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South Fork Wind Farm and South Fork Export Cable Project

Draft Environmental Impact Statement

January 2021

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Author:

Bureau of Ocean Energy Management

Office of Renewable Energy Programs

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ENVIRONMENTAL IMPACT STATEMENT
SOUTH FORK WIND FARM AND SOUTH FORK EXPORT CABLE PROJECT

Draft (X) Final ( )

Lead Agency:

U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM)

Cooperating Federal Agencies:

U.S. Department of Commerce, National Oceanic and Atmospheric Administration

National Marine Fisheries Service

U.S. Department of Defense, U.S. Army Corps of Engineers

U.S. Department of Homeland Security, U.S. Coast Guard

U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement

U.S. Environmental Protection Agency

Cooperating Tribal Nation:

None

Area:

Lease Area OCS-A 0517

Date for Comments:

February 22, 2021

Cooperating State and Local Agencies:

Commonwealth of Massachusetts Office of Coastal Zone Management

State of Rhode Island Coastal Resources Management Council

State of Rhode Island Department of Environmental Management

Town of East Hampton

Trustees of the Freeholders and Commonalty of the Town of East Hampton

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Abstract

The *South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement* (DEIS) assesses the reasonably foreseeable impacts to physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance, and conceptual decommissioning of a commercial-scale wind energy project, the South Fork Wind Farm and South Fork Export Cable Project (the Project), located in BOEM Renewable Energy Lease Number OCS-A 0517, approximately 19 miles southeast of Block Island, Rhode Island, and 35 miles east of Montauk Point, New York.

Deepwater Wind South Fork, LLC, is proposing the Project, which is designed to contribute to New York's renewable energy requirements, particularly, the state's goal of generating 9,000 megawatts of offshore wind energy by 2030. BOEM has prepared the DEIS following the requirements of the National Environmental Policy Act (42 United States Code [USC] 4321–4370f) and implementing regulations. Once finalized, the final environmental impact statement (FEIS) will inform BOEM in deciding whether to approve, approve with modifications, or disapprove the Project. Cooperating agencies would rely on the DEIS to support their decision making and to determine if the analysis is sufficient to support their decision. BOEM's action furthers United States policy to make the Outer Continental Shelf energy resources available for development in an expeditious and orderly manner, subject to environmental safeguards (43 USC 1332(3)), including consideration of natural resources and existing ocean uses.

EXECUTIVE SUMMARY

The *South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement* (DEIS) assesses the reasonably foreseeable impacts to physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of a commercial-scale offshore wind energy facility and transmission cable to shore known as the South Fork Wind Farm (SFWF) and South Fork Export Cable (SFEC) Project (Project). The Bureau of Ocean Energy Management (BOEM) has prepared the DEIS under the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321–4370f) and Executive Order 13807 (Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure).

Council on Environmental Quality (CEQ) NEPA regulations from 1978 were revised on July 26, 2020, and took effect on September 14, 2020. Because work on the DEIS began before September 14, 2020, BOEM has followed the 1978 CEQ NEPA regulations. All following citations to CEQ NEPA regulations refer to the regulations before they were revised on July 26, 2020 (see 40 Code of Federal Regulations (CFR) 1506.13 of the revised regulations). Once finalized, the final environmental impact statement (FEIS) will inform BOEM's decision on whether to approve, approve with modifications, or disapprove the Project's construction and operations plan (COP).

Purpose of and Need for the Proposed Action

On March 28, 2017, the President determined that it is "in the national interest to ensure that the Nation's electricity is affordable, reliable, safe, secure, and clean, and that it can be produced from domestic sources, including renewable sources" (Executive Order 13783:Section 1(b)).

Through a competitive leasing process under 30 CFR 585.211, Deepwater Wind New England, LLC was awarded Commercial Lease OCS-A 0486 for a leased area offshore Rhode Island. This lease area was later assigned to Deepwater Wind South Fork, LLC (DWSF) and segregated to Commercial Lease OCS-A 0517 (Lease). DWSF has the exclusive right to submit a COP for activities within the area of the Lease, and it has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of the Project.

The purpose of the Project is to develop a commercial-scale offshore wind energy facility in the area of the Lease with wind turbine generators (WTGs), an offshore substation, and one transmission cable making landfall in Suffolk County, New York. The Project would contribute to New York's renewable energy requirements, particularly the state's goal of 9,000 MW of offshore wind energy generation by 2030. In addition, DWSF's goal is to fulfill its contractual commitments to Long Island Power Authority (LIPA) pursuant to a power purchase agreement executed in 2017 resulting from LIPA's technology-neutral competitive bidding process.

The purpose of BOEM's action is to respond to and determine whether to approve, approve with modifications, or disapprove the COP to construct and install, operate and maintain, and decommission a commercial-scale offshore wind energy facility within the area of the Lease. BOEM's action is needed to further the United States' policy to make Outer Continental Shelf (OCS) energy resources available for expeditious and orderly development, subject to environmental safeguards (43 USC 1332(3)), including consideration of natural resources and existing ocean uses. In addition, other federal agencies may consider requests for authorizations related to the Project under applicable laws and regulations not administered by BOEM. These considerations differ from BOEM's consideration of the Proposed Action but they are related and constitute connected actions under 40 CFR 1508.25, with discrete purposes and needs based on their respective statutory and regulatory obligations. The purpose and need of other federal agencies' action is to evaluate the applicant's request pursuant to specific requirements of the statutes and implementing regulations administered by those agencies, considering impacts of the applicant's activities on relevant resources, and if appropriate, issue the permit or authorization.

Public Involvement

Before the preparation of the DEIS, BOEM conducted a 30-day public comment period and held three public scoping meetings near the Lease Area to solicit feedback and identify issues and potential alternatives for consideration. BOEM considered all scoping comments while preparing the DEIS; the topics most referenced in the comments include commercial fisheries and for-hire recreational fishing; finfish, invertebrates, and essential fish habitat; the NEPA process; socioeconomics; and alternatives. Additional public input occurred during the Project's planning and leasing phases between 2010 and 2018. Publication of the DEIS initiates a 45-day comment period open to all, after which BOEM will assess and consider all the comments received in preparation of a FEIS. See Appendix A for additional information on public involvement.

Alternatives

The DEIS analyzes in detail a No Action alternative and three action alternatives, as briefly described below. Chapter 2 provides detailed descriptions of the analyzed alternatives.

- No Action alternative: Under this alternative, BOEM would not approve the COP, and Project construction and installation, O&M, and conceptual decommissioning activities would not occur. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur.
- Proposed Action alternative: Under this alternative, the construction and installation, O&M, and conceptual decommissioning of up to 15 wind turbine generators (WTGs) in the 6- to 12-MW range and an offshore substation (OSS) within the Lease Area (including the expanded area) and associated export cables would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures. DWSF would space WTGs in a uniform east–west and north–south grid with 1 × 1–nautical-mile (nm) spacing between WTGs and diagonal transit lanes at least 0.6 nm wide. This configuration would still allow micrositing of WTGs to avoid sensitive cultural resources and marine habitats.
- Vessel Transit Lane alternative (Transit alternative): Under this alternative, BOEM evaluated a 4-nm-wide vessel transit lane[1] through the Lease Area where no surface occupancy would occur. BOEM developed this alternative in response to the January 3, 2020, Responsible Offshore Development Association (RODA) layout proposal (RODA 2020). The RODA proposal includes designated transit lanes, each at least 4 nm wide. Although the proposal includes six total transit lanes, only one lane intersects the Lease Area. The vessel transit lane is unique to this alternative and could facilitate transit of vessels through the Lease Area from southern New England and eastern Long Island ports to fishing areas in the region. WTGs located within the transit lane would be eliminated under this alternative. DWSF would develop the remaining WTGs with a 12-MW turbine capacity and would move the offshore substation north of the currently proposed location and install it in one of the remaining WTG locations. The Transit alternative is within the proposed design envelope of up to 15 turbines in the 6- to 12-MW range. This alternative would

[1] BOEM also evaluated a 2-nm and 3-nm transit lane alternative. However, these smaller lanes would result in the same impacts as the Proposed Action because the lane would not overlap any proposed WTGs or the OSS. Therefore, a smaller lane width was dismissed from further evaluation.

disclose the effect a transit lane could have on the expected effects from the other action alternatives analyzed in the DEIS.

- Fisheries Habitat Impact Minimization alternative (Habitat alternative): Under this alternative, the construction and installation, O&M, and conceptual decommissioning of WTGs and an OSS within the Lease Area and associated inter-array and export cables would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures. However, to reduce impacts to complex fisheries habitats as compared to the Proposed Action, BOEM would require DWSF to exclude certain WTGs and associated cable locations, if micrositing is not possible to maintain a uniform east–west and north–south grid of 1 × 1–nm spacing between WTGs with diagonal transit lanes of at least 0.6 nm wide. Under the Habitat alternative, BOEM may approve fewer WTG locations than proposed by DWSF.

Environmental Impacts

The DEIS uses a four-level classification scheme to characterize the potential adverse or beneficial impacts as negligible, minor, moderate, or major. Chapter 2, Section 2.3 provides a detailed comparison of impacts by alternative, whereas Table ES-1 provides a summary of key findings for the Proposed Action.

Impacts associated with the other action alternatives are generally similar to those described for the Proposed Action. See Section 3.1 for additional information on impact levels, and Sections 3.3 through 3.5 for detailed descriptions of the impacts for each resource under each alternative. CEQ NEPA implementing regulations (40 CFR 1502.16) require that an EIS evaluate the potential for unavoidable adverse impacts associated with a proposed action. The same regulations also require that an EIS review the potential impacts on irreversible or irretrievable commitments of resources resulting from implementation of a proposed action. Chapter 4 of the DEIS provides these disclosures.

Table ES-1. Key Environmental Impact Statement Findings for the Proposed Action

Resource	Proposed Action
Air quality	Minor to moderate temporary adverse impacts to air quality in the region due to construction and installation, O&M, and conceptual decommissioning, as well as minor beneficial, long-term air quality and reduced health event impacts. The overall cumulative impacts to air quality would be minor adverse and minor beneficial.
Water quality	Negligible to moderate impacts to onshore surface water and groundwater quality and offshore water quality from erosion, sediment resuspension and deposition and scouring, discharges, and inadvertent spills. Onshore and offshore, overall cumulative impacts to water quality would be minor.
Bats	Negligible to minor adverse impacts on bats and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.
Benthic habitat, essential fish habitat (EFH), invertebrates, and finfish	Project construction and installation and conceptual decommissioning would have a negligible to minor adverse effect on for benthic resources, minor for EFH, and negligible to minor for invertebrates and finfish due to noise, water quality–related effects, seabed disturbance, lighting, EMF, and vessel activity. Project O&M would cause fewer impacts to fish, invertebrates, benthic habitats, and EFH than Project construction. The foundation piles and associated scour protection would create an artificial reef effect, which could result in minor beneficial effects to species distribution, community composition, and predator-prey interactions in the vicinity. Overall cumulative effects to benthic habitat, EFH, invertebrates, and finfish within the Northeast Shelf Large Marine Ecosystem would be moderate.

Resource	Proposed Action
Birds	Negligible to minor impacts on birds and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor.
Marine mammals	Negligible to moderate impacts from construction and installation, O&M, and conceptual decommissioning activities. Although less likely, some individual whales or seals could suffer temporary or permanent hearing injury; these adverse effects would be moderate for affected individual marine mammals. Overall cumulative adverse impacts would be moderate.
Terrestrial and coastal habitats and fauna	Negligible to minor impacts to terrestrial and coastal habitats and fauna from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.
Sea turtles	Negligible to minor impacts from elevated underwater noise from construction, vessel traffic, and accidental discharges of spills or trash. Overall cumulative adverse impacts would be moderate adverse and moderate beneficial.
Wetlands and other waters of the United States (WOTUS)	Short- to long-term, negligible to minor, adverse impacts to wetlands and WOTUS from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.
Commercial fisheries and for-hire recreation fishing	Negligible to moderate adverse construction and installation, O&M, and conceptual decommissioning impacts to commercial fisheries and for-hire recreational fishing due to increased port congestion; changes to fishing access, primarily through reduced fishing opportunity when construction activities are occurring; damage to or loss of fishing gear; and impacts on the catch due to changes in target species abundance or availability during construction activities. The "reef effect" of WTG foundations and associated scour protection would have minor beneficial impacts to for-hire recreational fisheries, depending on the extent to which the foundations enhance fishing opportunities. Overall cumulative adverse impacts would be moderate.
Cultural resources	Negligible to major adverse impacts to marine and terrestrial archaeological resources and to historic visual resources from Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be negligible to moderate across marine, terrestrial and viewshed resources.
Demographics, employment, and economics	Negligible to minor adverse and minor to moderate beneficial impacts to the socioeconomic analysis area in terms of employment, federal revenue, and income. Overall cumulative impacts would be minor adverse and minor beneficial.
Environmental justice	Minor to moderate adverse impacts to minority or low-income populations and tribes from the Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be moderate.
Land use and coastal infrastructure	Minor beneficial impacts to land use due to increased compatible uses at ports, whereas construction or conceptual decommissioning of onshore components would have negligible to moderate, temporary adverse impacts due to disturbance associated with onshore construction, including traffic delays and re-routing. Overall cumulative adverse impacts would be minor adverse and minor beneficial.
Navigation and vessel traffic	Negligible to minor impacts on navigation and vessel traffic in the region from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate.
Other marine uses	Negligible to moderate impacts to mineral extraction, military use, air traffic, land-based radar services, cables and pipelines, and scientific surveys. Overall cumulative adverse impacts would be minor for most uses. However, the overall effect would be moderate adverse for military uses and major adverse for scientific research and protected species surveys.
Recreation and tourism	Negligible to minor impacts to recreation and tourism due to Project construction and conceptual decommissioning activities. O&M and conceptual decommissioning of offshore Project activities could elicit both beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. Overall cumulative adverse impacts would be minor adverse and minor beneficial.
Visual resources	Negligible to major, adverse impacts on non-historic visual resources from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate, as the viewshed would return to previous condition after conceptual decommissioning.

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ABBREVIATIONS

°F	degrees Fahrenheit
μPa	micropascal
AC	alternating current
ADLS	Aircraft Detection Lighting System
AIS	automatic identification system
APE	area of potential effects
ASMFC	Atlantic States Marine Fisheries Commission
AVERT	AVoided Emissions and geneRation Tool
BA	biological assessment
BIWF	Block Island Wind Farm
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CapEx	capital expenditures
CFR	Code of Federal Regulations
CH_4	methane
CMECS	Coastal and Marine Ecological Classification Standard
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COBRA	CO-Benefits Risk Assessment
COP	construction and operations plan
CPUE	catch per unit of fishing effort
CT	Connecticut
dB	decibel
dBA	A-weighted decibels
dB_{PEAK}	peak decibels
dB_{RMS}	root mean square decibels
dB_{SEL}	cumulative sound exposure level in decibels
DC	direct current
DEIS	*South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement*
DO	dissolved oxygen
DoD	U.S. Department of Defense
DWSF	Deepwater Wind South Fork, LLC
ECNYS	Ecological Communities of New York State
EFH	essential fish habitat
EIS	environmental impact statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency

EPMs	environmental protection measures
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	final environmental impact statement
FIMP Project	Fire Island Montauk Point Project
FMP	fishery management plan
FTE	full-time equivalent
G&G	geological and geophysical
GDP	gross domestic product
GHGs	greenhouse gases
HAPCs	habitat areas of particular concern
HDD	horizontal directional drilling
hp	horsepower
HUC	Hydrologic Unit Code
Hz	hertz
IPaC	Information for Planning and Conservation
IPF	impact-producing factors
kHz	kilohertz
kJ	kilojoule
km	kilometer
kV	kilovolt
L	liter
Lease	BOEM Renewable Energy Lease Number OCS-A 0517
Lease Area	Area of BOEM Renewable Energy Lease Number OCS-A 0517
LIPA	Long Island Power Authority
LIRR	Long Island Railroad
m	meter
MA	Massachusetts
MAFMC	Mid-Atlantic Fishery Management Council
MARCO	Mid-Atlantic Regional Council on the Ocean
MBTA	Migratory Bird Treaty Act of 1918
mG	milligauss
mg	milligram
MHWL	mean high-water level
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOU	memorandum of understanding
mT	millitesla
mV/m	millivolts per meter
MW	megawatts
MWA	maximum work area

N/A	not applicable
N_2O	nitrogen oxide
NAAQS	National Ambient Air Quality Standards
NARW	North Atlantic right whale
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLCD	U.S. Geological Survey National Land Cover Database
nm	nautical miles
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide (also written as NO_x)
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NSF	National Science Foundation
NY	New York
NYISO	New York Independent System Operator
NYNHP	New York Natural Heritage Program
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O&M	operations and maintenance
O_3	ozone
OCM	Office for Coastal Management
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act, 43 USC 1331 et seq.
OpEx	operating expenditures
OSS	offshore substation
PM_{10}	particulate matter smaller than 10 microns
$PM_{2.5}$	particulate matter smaller than 2.5 microns
ppb	parts per billion
Project	South Fork Wind Farm and South Fork Export Cable Project
PSO	protected species observer
PTS	permanent threshold shift
RI	Rhode Island
RI/MA WEA	Rhode Island/Massachusetts Wind Energy Area
RMS	root mean square
ROW	right-of-way
RSZ	rotor swept zone
SAR	Office of Search and Rescue
SAV	submerged aquatic vegetation
SEFSC	Southeast Fisheries Science Center

SEL	sound exposure level
SFEC	South Fork Export Cable
SFWF	South Fork Wind Farm
SIP	state implementation plan
SO_2	sulfur dioxide
SPCC	spill prevention control and countermeasures
SPL	sound pressure levels
SRHP	State Register of Historic Places
SWPP	storm water pollution prevention plan
tpy	tons per year
TSS	total suspended solids
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compounds
VTR	Vessel Trip Report
WEA	wind energy area
WOTUS	waters of the United States
WTGs	wind turbine generators

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND

This chapter introduces a proposed offshore wind energy project, the South Fork Wind Farm and South Fork Export Cable Project (the Project). On June 29, 2018, Deepwater Wind South Fork, LLC (DWSF)[2] submitted a Project construction and operations plan (COP) to BOEM (CH2M HILL Engineers, Inc. [CH2M HILL] 2018). After addressing BOEM's comments on this initial COP, DWSF resubmitted an updated COP on May 24, 2019 (Jacobs Engineering Group Inc. [Jacobs] 2019). DWSF submitted a second updated COP for the Project in February 2020 (Jacobs 2020a) and a third updated COP in July 2020 (Jacobs 2020b)[3]. Information regarding the planning and leasing process that occurred before the development of the initial COP is available on BOEM's website and in Section 2 of the COP.

The Project would be located in the area of BOEM's Renewable Energy Lease Number OCS-A 0517 (Lease Area) approximately 19 miles southeast of Block Island, Rhode Island, and 35 miles east of Montauk Point, New York (Figure 1.2.1-1) in the Atlantic Ocean. In this document, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (miles used specifically for marine navigation). Statute miles are more commonly used and are referred to simply as *miles*, whereas nautical miles are referred to by name or by their abbreviation *nm*.

The COP describes the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of the Project, which consists of the following components (see Project Operational Concept [Figure 1.1-1] in the COP):

- SFWF: This would include up to 15 wind turbine generators (WTGs or turbines), submarine cables between the WTGs (inter-array cables), and an offshore substation (OSS). The SFWF also includes an onshore O&M facility.
- SFEC: This would include an alternating current (AC) electric cable and an interconnection facility that connects the SFWF to the existing mainland electric grid in East Hampton, New York, and delivers power to the South Fork of Suffolk County, Long Island.

BOEM has prepared this draft environmental impact statement (DEIS) in accordance with the National Environmental Policy Act (NEPA) and Executive Order 13807 (Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure) to consider and disclose potential environmental impacts associated with the construction and installation, O&M, and conceptual decommissioning of the Project. The final environmental impact statement (FEIS) will inform BOEM in deciding whether to approve, approve with modifications, or disapprove the COP. Publication of the DEIS initiates a 45-day comment period. BOEM will assess and consider the comments received during the comment period in the preparation of the final EIS. The DEIS has eight appendices. Appendix A describes required environmental permits and consultations; Appendix B provides a list of preparers and reviewers, references cited, and glossary; Appendix C provides additional figures; Appendix D describes the Project design envelope and maximum-case scenario; Appendix E describes the cumulative activities scenario; Appendix F provides supplemental information to the DEIS; Appendix G describes environmental protection measures, mitigation, and monitoring; and Appendix H provides an assessment of resources with negligible to minor impacts from implementation of the Proposed Action and other considered alternatives.

[2] On November 7, 2018, Orsted completed an acquisition of all of the equity of Deepwater Wind. A new company, Orsted US Offshore Wind, combines the personnel and assets of the two North American offshore wind developers. Orsted also subsequently renamed the subsidiary as South Fork Wind. However, Deepwater Wind New England, LLC (later assigned to DWSF as Lease OCS-A 0517) submitted their COP prior to this ownership and name change. Therefore, the EIS refers to DWSF throughout.

[3] The updated COP—*South Fork Wind Farm and South Fork Export Cable Construction and Operations Plan*— is referred to frequently throughout the EIS, and therefore the author-date citation is provided here at first mention only.

1.2 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

On March 28, 2017, the President determined that it is “in the national interest to ensure that the Nation's electricity is affordable, reliable, safe, secure, and clean, and that it can be produced from domestic sources, including renewable sources” (Executive Order 13783:Section 1(b)).

Through a competitive leasing process under 30 CFR 585.211, Deepwater Wind New England, LLC was awarded Commercial Lease OCS-A 0486 for a leased area offshore Rhode Island. This lease area was later assigned to DWSF and segregated to Commercial Lease OCS-A 0517 (Lease). DWSF has the exclusive right to submit a COP for activities within the area of the Lease, and it has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of the Project.

The purpose of the Project is to develop a commercial-scale offshore wind energy facility in the area of the Lease with WTGs, an offshore substation, and one transmission cable making landfall in Suffolk County, New York. The Project would contribute to New York’s renewable energy requirements, particularly the state’s goal of 9,000 MW of offshore wind energy generation by 2030. In addition, DWSF’s goal is to fulfill its contractual commitments to Long Island Power Authority (LIPA) pursuant to a power purchase agreement executed in 2017 resulting from LIPA’s technology-neutral competitive bidding process.

The purpose of BOEM’s action is to respond to and determine whether to approve, approve with modifications, or disapprove the COP to construct and install, operate and maintain, and decommission a commercial-scale offshore wind energy facility within the area of the Lease. BOEM’s action is needed to further the United States’ policy to make Outer Continental Shelf (OCS) energy resources available for expeditious and orderly development, subject to environmental safeguards (43 USC 1332(3)), including consideration of natural resources and existing ocean uses. In addition, other federal agencies may consider requests for authorizations related to the Project under applicable laws and regulations not administered by BOEM. These considerations differ from BOEM’s consideration of the Proposed Action but they are related and constitute connected actions under 40 CFR 1508.25, with discrete purposes and needs based on their respective statutory and regulatory obligations. The purpose and need of other federal agencies' action is to evaluate the applicant’s request pursuant to specific requirements of the statutes and implementing regulations administered by those agencies, considering impacts of the applicant’s activities on relevant resources, and if appropriate, issue the permit or authorization.

In addition, other federal agencies may consider requests for authorizations related to the Project under applicable laws and regulations not administered by BOEM. These considerations differ from BOEM’s consideration of the Proposed Action but they are related and constitute connected actions per 40 CFR 1508.25, with discrete purposes and needs based on their respective statutory and regulatory obligations. The purpose and need of other federal agencies' action is to evaluate the applicant’s request pursuant to specific requirements of the statutes and implementing regulations administered by those agencies considering the impacts of the applicant’s activities on relevant resources, and if appropriate, issue the permit or authorization.

1.2.1 Project Location Map

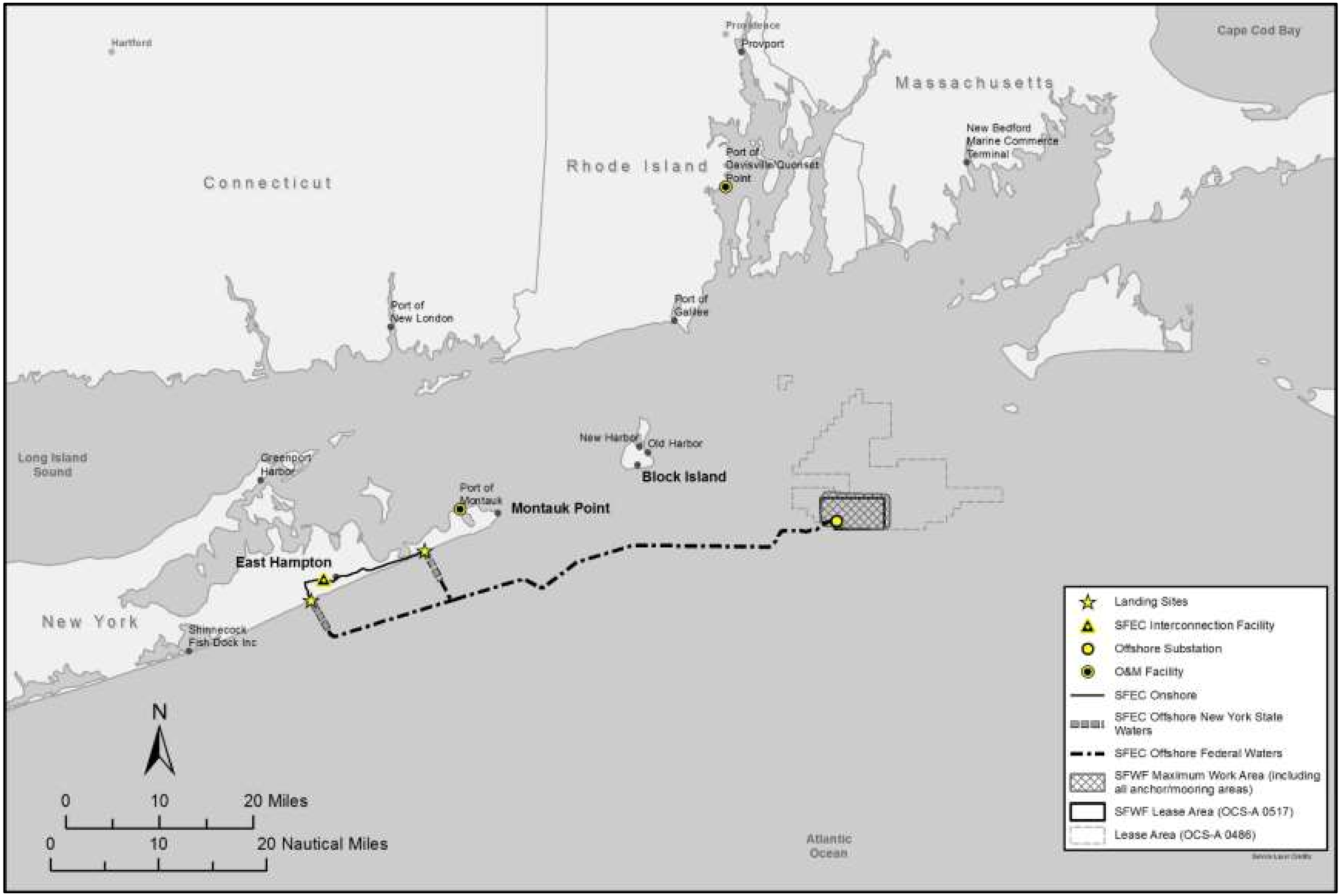

Figure 1.2.1-1. Project location

1.3 REGULATORY FRAMEWORK

Section 8(p)(1)(C) of the Outer Continental Shelf Lands Act (OCSLA) authorizes the Secretary of the Interior to issue leases, easements, or rights-of-way (ROWs) on the OCS for the purpose of wind energy development (OCSLA, 43 USC 1337(p)(1)(C)). Section 8(p)(4) (43 USC § 1337(p)(4)), specifies requirements applicable to any activity carried out under Section 8(p). These requirements include, for example, that the "Secretary shall ensure that any activity under this subsection [8(p)] is carried out in a manner that provides for…prevention of interference with reasonable uses (as determined by the Secretary) of the exclusive economic zone, the high seas, and the territorial seas…[and] consideration of…any other use of the sea or seabed, including use for a fishery, a sealane, a potential site of a deepwater port, or navigation[.]" (Section 8[p][4][I] and [J]).

Final regulations implementing the authority for renewable energy leasing under OCSLA (30 CFR Part 585) were promulgated on April 22, 2009[4]. These regulations prescribe BOEM's responsibility for determining whether to approve, approve with modifications, or disapprove the proposed COP (30 CFR § 585.628). 30 CFR Part 585 has several provisions that are applicable to a decision on a COP, including 30 CFR § 585.102 and "Subpart F—Plans and Information Requirements." Specifically, 30 CFR § 585.102 provides in part that "BOEM will ensure that any activities authorized in this part are carried out in a manner that provides for:...[p]rotection of the rights of other authorized users of the OCS; ... [and] [p]revention of interference with reasonable uses (as determined by the Secretary or Director) of the exclusive economic zone, the high seas, and the territorial seas" (30 CFR. § 585.102[a][7] and [a][9]). In addition, 30 CFR § 585.621 provides that a "COP must demonstrate that [the lessee has] planned and [is] prepared to conduct the proposed activities in a manner that conforms to your responsibilities listed in § 585.105(a) and: (a) conforms to all applicable laws, implementing regulations, lease provisions, and stipulations or conditions of your commercial lease; (b) is safe; (c) does not unreasonably interfere with other uses of the OCS, including those involved with national security or defense; (d) does not cause undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance; (e) uses best available and safest technology; (f) uses best management practices; and (g) uses properly trained personnel."

Consistent with the requirements of OCSLA and applicable regulations, Section 2 of the Lease provides the Lessee with the right to submit a COP to BOEM for approval. Section 3 provides that BOEM will decide whether to approve a COP in accordance with applicable regulations in 30 CFR Part 585; BOEM retains the right to disapprove a COP based on its determination that the proposed activities would have unacceptable environmental consequences, would conflict with one or more of the requirements set forth in 43 USC. § 1337(p)(4), or for other reasons provided by BOEM pursuant to § 585.613(e)(2) or § 585.628(f); BOEM reserves the right to approve a COP with modifications; and BOEM reserves the right to authorize other uses within the leased area and project easement that will not unreasonably interfere with activities described in an approved COP pursuant to the lease. Section 7 of the Lease provides that "no activities authorized [under it] will be carried out in a manner that: (a) could unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the Act, or under any other license or approval from any Federal agency; (b) could cause any undue harm or damage to the environment; (c) could create hazardous or unsafe conditions; or (d) could adversely affect sites, structures, or objects of historical, cultural, or archaeological significance, without notice to and direction from the Lessor on how to proceed." Addendum C provides additional lease-specific terms, conditions, and stipulations that BOEM must consider when reviewing a COP.

[4] Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19638

In accordance with the "One Federal Decision" mandate of Executive Order 13807, this document will serve as the sole EIS for all relevant federal authorization decisions to be made for the Project (such as NOAA's Incidental Harassment Authorization). Appendix A (Consultation and Coordination) provides further discussion of this executive order as well as a discussion of other federal and state reviews required, including legal authority, jurisdiction of the agency, and the regulatory process involved. DWSF would be required to construct, operate and maintain, and decommission the Project in compliance with the terms and conditions of all required permits and approvals. Appendix A also provides a description of BOEM's other consultation efforts in the development of the DEIS.

On July 16, 2020, CEQ, which is responsible for federal agency implementation of NEPA, revised the regulations for implementing the procedural provisions of NEPA (85 CFR 43304-43376). Since publication of the notice of intent to prepare an EIS and BOEM's NEPA review of the Project began prior to the September 14, 2020, effective date of the updated regulations, the DEIS was prepared under the previous version of the regulations (1978, as amended in 1986 and 2005). However, much of CEQ's updated regulations is an incorporation of the interagency coordination, timing, and page limit elements of the One Federal Decision policy and the Interior Secretary's Order 3355, which were already applicable to this EIS process.

In summary, BOEM can only approve DWSF's COP after determining that the activities included in the COP, as it may be modified or conditioned by BOEM on approval, are consistent with all requirements of Section 8(p)(4), 30 CFR 585.628(f)(2), and all terms of the Lease, including the prevention of interference with other reasonable uses of the exclusive economic zone (U.S. Department of the Interior 2020). This determination is made at the ROD stage. If BOEM disapproves the DWSF COP, per 30 CFR 585.628(f)(2), BOEM will inform DWSF of the reasons and allow DWSF an opportunity to resubmit a revised plan addressing the concerns identified. BOEM may suspend the term of the Lease to facilitate resubmittal.

1.4 RELEVANT EXISTING NATIONAL ENVIRONMENTAL POLICY ACT AND CONSULTING DOCUMENTS

BOEM has conducted several other environmental analyses that were used to inform the DEIS, consistent with the Council on Environmental Quality (CEQ) directive "Incorporation by reference" (40 CFR 1502.21).

1.5 INCOMPLETE AND UNAVAILABLE INFORMATION

Under 40 CFR 1502.22, BOEM is required to identify any incomplete or unavailable information that is relevant to the evaluation of potential Project impacts. At the time of this publication, BOEM has not identified any incomplete or unavailable information that is essential to a reasoned choice among alternatives.

1.6 METHODOLOGY FOR ASSESSING THE DESIGN ENVELOPE

The Project is being developed based on an envelope approach, consistent with BOEM's *Draft Guidance Regarding the Use of a Project Design Envelope in a Construction and Operations Plan* (BOEM 2018). This approach is intended to provide flexibility for lessees and minimize the need for subsequent NEPA reviews as the Project design is refined.

The DEIS assesses the impacts of a range of characteristics and locations for components that would be considered as part of the Proposed Action and other action alternatives using a "maximum-case scenario" process. Through the maximum-case scenario process, BOEM analyzes the aspects of each design parameter or combination of parameters that would result in the greatest impact for each physical, biological, socioeconomic, and cultural resource (see Appendix D for list of parameter specifications). Through consultation with its own engineers and outside industry experts, BOEM verified that the maximum-case scenario analyzed in the DEIS could reasonably occur.

1.7 METHODOLOGY FOR ASSESSING CUMULATIVE IMPACTS

Cumulative impacts are the incremental effects of the Proposed Action on the environment when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes the actions (see 40 CFR 1508.7). Appendix E provides a description of the resource-specific geographic analysis areas and analyzes the impacts of the types of actions (including the future action of approving wind farm development activities other than the Project) that BOEM has identified as potentially contributing to cumulative impacts when combined with impacts from the Proposed Action and other alternatives over the geography and time scale identified.

In 2019, BOEM released a study of impact-producing factors (IPFs) from renewable energy projects on the North Atlantic OCS (BOEM 2019). As noted, in addition to the general cumulative analysis associated with onshore and offshore non-wind activities, the DEIS specifically discloses the cumulative impacts of relevant IPFs from offshore wind by resource. Where possible, BOEM provides a quantitative estimate of these offshore wind impacts. However, readers of the DEIS should not consider these results as absolute values or predictions of actual future conditions. Although BOEM estimates represent the best tool currently available to inform the impact analysis in the DEIS, it is not possible to precisely predict future conditions. Correspondingly, estimates are based on past experience and trends and represent reasonable assumptions about future behaviors.

CHAPTER 2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 ALTERNATIVES

This chapter describes in detail three action alternatives and a No Action alternative for the Project. Chapter 2, Section 2.1.5 provides a discussion of the alternative development process and alternatives not carried forward for analysis, whereas Chapter 2, Section 2.3 provides a summary and comparison of impacts by alternative.

2.1.1 Proposed Action Alternative

The SFWF and SFEC are the two primary components of the Project (see Figure 1.2.1-1). The Project uses a design envelope approach, consistent with BOEM's *Draft Guidance Regarding the Use of a Project Design Envelope in a Construction and Operations Plan* (BOEM 2018). This approach results in a range of characteristics and locations for some components of the Proposed Action. Chapter 1, Section 1.6 and Appendix D provide additional information on the Project design envelope approach. The proposed SFWF maximum work area (MWA) used during construction and installation would encompass the entire Lease Area. However, only a small portion of the Lease Area would be permanently developed and occupied by Project components (see Table 2.1.1-1).

2.1.1.1 South Fork Wind Farm Component

SFWF would be located within federal waters (Atlantic Ocean) on the OCS, specifically in the Lease Area, approximately 16.6 nm (19 miles) southeast of Block Island, Rhode Island, and 30.4 nm (35 miles) east of Montauk Point, New York. Table 2.1.1-1 summarizes the SFWF components. The sections that follow Table 2.1.1-1, Section 3.1 of the COP, and Appendix D provide additional details.

Table 2.1.1-1. South Fork Wind Farm Components and Footprint

Project Component	Location	Project Envelope Characteristic	Construction and Installation Footprint (temporary)	Operation Footprint (permanent)
WTGs	Offshore	Up to 15 WTGs; 6 to 12 MW each; sited in a grid with a spacing of approximately 1.0 nm (1.9 km, 1.15 miles) × 1.0 nm (1.9 km, 1.15 miles) that aligns with other proposed adjacent offshore wind projects in the Rhode Island/ Massachusetts Wind Energy Area	17,202 acres (MWA)	840 feet, measured from mean lower water level to the tip of the blade
Foundations	Offshore	Monopile with piles up to 11 meters in diameter	14.8 acres	14.6 acres
		Foundation cable protection	Not applicable (N/A)	7.5 acres
Inter-array cable	Offshore	34.5-kilovolt (kV) or 66-kV cable	340 acres	2.5 acres
		Cable protection	N/A	10.2 acres

Project Component	Location	Project Envelope Characteristic	Construction and Installation Footprint (temporary)	Operation Footprint (permanent)
OSS	Offshore	Mounted on a dedicated framework or co-located with a WTG	Same as foundations (see above)	If on dedicated framework: 150 to 200 feet, measured from mean sea level to the top of the substation. If collocated with a WTG: total maximum height of the OSS plus WTG would not exceed the height of other WTGs.
Vessel anchoring / mooring	Offshore	Six vessels used during anchoring/mooring	821 acres	N/A
O&M facility	Onshore	Located in Montauk, New York, or Quonset Point, Rhode Island	Montauk: dredge footprint of up to 37,350 square feet	7,600 to 12,000 square feet of office and storage space (all locations)
Port facilities	Onshore	Located in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, or Virginia	N/A (the SFWF would use existing facilities only.)	N/A (the SFWF would use existing facilities only.)

Source: Jacobs (2020).

Note: Table 3.1-1 in the COP provides a detailed description of assumptions used to develop the footprint estimates.

2.1.1.1.1 WIND TURBINE GENERATORS

The SFWF would consist of up to 15 WTGs. DWSF has committed to an indicative layout with WTGs sited in a grid with a spacing of approximately 1.0 nm (1.9 kilometers [km], 1.15 miles) × 1.0 nm (1.9 km, 1.15 miles) that aligns with other proposed adjacent offshore wind projects in the Rhode Island/Massachusetts Wind Energy Areas (RI-MA WEAs). Each WTG would comprise the following major components: a tower, nacelle (a cover housing the generator, gear box, drive train, and brake assembly), and rotor that includes the blades. Figure 3-1.3 in the COP provides typical dimensions for different WTG size classes that could be used for the Project. Control, lighting, marking, and safety systems would be installed on each WTG. Each WTG would also contain small amounts of lubrication, grease, oil and cooling fluids, as well as heating, ventilation, and air conditioning for climate control. If needed, a small, temporary diesel generator could also be placed at each WTG on the work deck of the foundation, with a maximum power of 200 horsepower (hp) and up to a 50-gallon diesel tank with secondary containment. Each WTG would also have helicopter access by means of winching personnel onto and/or from a landing area. Fugro (2018), SFWF (2017, 2018a, 2018b), and Jacobs (2020) provide additional design details.

2.1.1.1.2 FOUNDATIONS

Each WTG would be supported by one steel monopile foundation installed into the seabed, as shown in COP Figure 3.1-2. Fugro (2018), SFWF (2017, 2018a, 2018b), and Jacobs (2020) provide additional design details.

2.1.1.1.3 INTER-ARRAY CABLE

Inter-array cables would connect individual WTGs and transfer power between the WTGs and the OSS. The inter-array cable would either be a 34.5-kilovolt (kV) or a 66-kV three-phase, AC, 6- to 12-inch-diameter cable. The cables would contain three conductors, screens, insulators, fillers, sheathing, armor, and fiber optic cables; they would not contain lubricants, liquids, oils, or insulating fluids. The cables would be buried in a seabed trench to a target depth of 4 to 6 feet, for a total estimated maximum distance of 21.4 miles long. Where the inter-array cable emerges from the trench and is attached to the foundation, cable protection (rock or engineered concrete mattresses) would be used. Similarly, additional cable protection would be used to protect portions of the inter-array cable that did not achieve the target burial depth (see Table 3.1-4 in the COP and Fugro [2019] for details).

Fugro (2018), SFWF (2017, 2018a, 2018b), and Jacobs (2020) provide additional design details.

2.1.1.1.4 OFFSHORE SUBSTATION

The OSS would collect electric energy generated by the WTGs through the inter-array cables. The OSS would also house the supervisory control and data acquisition system that serves as the means for wind farm monitoring and control between the WTGs, substation, and onshore O&M facility. The OSS would consist of a high and secondary medium-voltage power transformer, a reactor, and switchgears along with utility equipment and a small permanent diesel generator. The OSS could also include boat landing and helicopter access (i.e., helideck) for emergency transport and limited maintenance activities, including transport of crew and supplies. The OSS would be either 1) located above water on a platform supported by a foundation similar to those used for the WTGs and would be in line with the WTG's east–west and north–south grid of 1 × 1–nm spacing, or 2) collocated on a foundation with a WTG (see Figure 3.1-4 of the COP).

2.1.1.1.5 OPERATIONS AND MAINTENANCE FACILITY

The O&M facility would include potential construction of a building, stationary crane, and up to three docks for crew transfer vessels at a nearby port in one location at Montauk in East Hampton, New York, or at one of two potential locations at Quonset Point in North Kingstown, Rhode Island, so that O&M staff could prepare and mobilize for offshore maintenance activities. The facility would also include office and storage space for spare parts and other equipment. If the Port of Montauk is selected, port modification could be required, including reinforcement or rehabilitation of the quayside(s) and both initial and maintenance dredging to support the crew transfer vessels (Stantec 2020). To allow for suitable depths for navigation and berthing, a dredge footprint of up to 37,350 square feet (3,500 square meters) could be required. Dredged materials would be loaded onto land-based dump trucks and transported to adjacent beaches for placement as nourishment material. In addition to dredging, other potential in-water work could include replacement of the quayside bulkhead as well as potential bank stabilization. Fixed and floating docks could also be installed to support the vessel berths, which could include pile installation. Additional piles could be necessary to provide safe berthing conditions (i.e., mooring dolphin).

2.1.1.1.6 PORT FACILITIES

The Project would use existing port facilities located in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, or Virginia for offshore construction, staging and fabrication, and crew transfer and logistics support. Modifications of these ports specifically for the Project are not anticipated. Final port selection has not been determined at this time; Table 3.1-5 of the COP provides a summary of potential ports that could be used to support the Project.

2.1.1.2 South Fork Export Cable Component

SFEC is an AC electric cable and interconnection facility that would connect the SFWF to the existing mainland electric grid in East Hampton, New York, and deliver power to the South Fork of Suffolk County, Long Island. The SFEC would be located offshore, in both federal waters and New York State territorial waters, and onshore in East Hampton, New York (see COP Figure 1.1-2). Table 2.1.1-2 summarizes the distances for each segment of the SFEC by landing site. Additional details on these segments and the SFEC components follow the table.

Table 2.1.1-2. Distances for Each Segment of the South Fork Export Cable by Landing Site

SFEC Segment	Landing Site	
	Beach Lane (miles)	Hither Hills (miles)
Offshore federal waters	58.3	46.0
Offshore New York State waters	3.5	3.5
Onshore	4.1	11.5

2.1.1.2.1 OFFSHORE SEGMENTS

The SFEC would extend westward through federal waters from the OSS, pass south of Block Island, and cross into state waters 3 nm offshore New York State. The SFEC would consist of a buried 138-kV submarine power cable, with one segment of single three-core conductor and fiber optic cable for communication and control. The SFEC would be approximately 8 to 12 inches in diameter and installed to a target burial depth of 4 to 6 feet. Additional cable protection or armoring would be installed in locations where the target burial depth is not achieved (see Tables 3.2-2 and 3.2-3 in the COP for details).

2.1.1.2.2 ONSHORE SEGMENT

The onshore SFEC would begin at the transition vault located at the landing site and end at the interconnection facility. The onshore SFEC would consist of a 138-kV underground power cable installed within a new underground electrical duct bank. The duct bank would comprise a conduit surrounded by concrete through which the SFEC would be run, and it would be located underground within public ROWs and alongside the tracks within the Long Island Railroad (LIRR) ROW. No overhead lines would be constructed. The specific configuration of the duct bank is not yet determined; however, the ducts would be placed within a 4 × 8–foot trench along the onshore route.

DWSF initially considered five landing sites for the SFEC (see Section 2.2.2 in the COP for details). Of these five initial sites, BOEM carried two potential cable landing sites forward for analysis (see COP Figure 3.2-3): Beach Lane and Hither Hills. The Beach Lane onshore SFEC route would primarily follow the Town of East Hampton Road and LIRR ROWs. The route would travel northwest along Beach Lane to Wainscott Main Street, then northeast on Wainscott Main Street, and then northwest onto Sayre’s Path. The route would continue north onto Wainscott Stone Road and then northwest on Wainscott Northwest Road, crossing Montauk Highway/State Route 27 (state-owned), to get to the LIRR where it would route along the LIRR to the interconnection facility. The Hither Hills onshore SFEC route would transition from the Hither Hills State Park parking lot to the Old Montauk Highway, which it would follow southwesterly to its intersection with the Montauk Highway. The SFEC would then follow the Montauk Highway westward to Main Street and then Buell Lane, which it would follow until its intersection with the LIRR. The route would follow the LIRR westward to the interconnection facility.

2.1.1.2.3 SEA-TO-SHORE TRANSITION

The sea-to-shore transition is the point at which the offshore and onshore cables are spliced together. Using horizontal directional drilling (HDD), the offshore cable would be installed at least 30 feet below the current beach profile. The cable would connect to a new onshore underground transition vault, constructed approximately 650 to 800 feet from the mean high-water level (MHWL). Pedestrian and vehicle access would be maintained throughout installation. If a temporary offshore cofferdam is required, it would be installed using a sheet pile or gravity cell. See COP Figure 3.2-2 and COP Section 3.2.2.2 for additional details.

2.1.1.2.4 INTERCONNECTION FACILITY

DWSF would construct the interconnection facility to connect the SFEC with the existing 69-kV LIPA substation, located off Cove Hollow Road in East Hampton, New York. DWSF would locate the facility adjacent to the existing LIPA substation (see COP Figure 3.2-4) and would include all equipment necessary to safely connect to the New York Independent System Operator (NYISO) transmission system.

Table 2.1.1-3 provides a summary of SFEC components and the Project footprint. Additional information is provided in Appendix D.

Table 2.1.1-3. South Fork Export Cable Components and Footprint

Project Component	Location	Project Envelope Characteristic	Construction and Installation Footprint (temporary)	Operation Footprint (permanent)
SFEC	Offshore	138 kV; target burial depth of 4 to 6 feet	573.3 acres	7.4 acres
		Cable protection	Not applicable (N/A)	7.9 acres
SFEC	Onshore	Onshore duct bank within existing paved road and railroad ROWs, target burial of 8 feet	2.6 to 6.3 acres (depending on route)	2.4 acres
Sea-to-shore transition	Offshore–onshore	Landing site at either Beach Lane or Hither Hills Installed using HDD between onshore underground cable transition vault and the offshore HDD exit location Offshore sheet pile cofferdam*, gravity cell cofferdam, or no cofferdam at the HDD exit location	850 square yards (cofferdam)	N/A
Interconnection facility	Onshore	Newly constructed, air-insulated facility adjacent to the East Hampton substation	2.7-acre parcel	Approximately 71,000 square feet with maximum equipment height of approximately 43 feet
Port facilities	Onshore	Located in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, or Virginia	N/A (the SFWF would use existing facilities only.)	N/A (the SFWF would use existing facilities only.)

Source: Jacobs (2020).

Note: For a detailed description of assumptions used to develop the footprint estimates, see Tables 3.2-2 and 3.2-3 in the COP.

* A cofferdam is a watertight enclosure pumped dry to permit construction work below the waterline.

2.1.1.3 Construction and Installation

Construction and installation of the SFWF and SFEC are scheduled to take place over 2 years within applicable seasonal work windows and would include transportation and installation of foundations, installation of cable systems, installation of WTGs, and installation of the OSS. Table 1.5-1 in the COP provides a construction and installation schedule for all Project components.

2.1.1.3.1 TRANSPORTATION AND INSTALLATION OF FOUNDATIONS

DWSF would transport WTGs and other components to area ports for staging prior to installation. During installation, transportation barges and material barges would transport components and equipment to the Lease Area (as described in Section 3.1.3.1 of the COP). Foundation installation steps would include preparing the seafloor (if necessary); installing foundations and commissioning the platform, which includes installation of marking and lighting for Private Aids to Navigation required by the U.S. Coast Guard (USCG); and conducting inspection and quality control checks. Section 3.1.3.2 of the COP provides details on foundation installation.

To allow for site-specific micrositing, DWSF would install each foundation within a 500-foot radius of the proposed locations (in accordance with 30 CFR 585.634) shown on COP Figures 3.1-1 and 3.1-2 (Jacobs 2020) while maintaining the 0.6-nm-wide northwest–southeast transit lanes as recommended by the USCG. The COP assumes that each monopile foundation would require a total of 2 to 4 days for construction but would be driven into the seabed in a single day. Board and lodging for the construction crew and other personnel would be provided on large vessels; crew transfers would be provided via crew transport vessels or during port visits for provisioning and material transport.

2.1.1.3.2 INSTALLATION OF CABLE SYSTEMS

South Fork Wind Farm: Inter-Array Cables

Prior to installation, DWSF would ensure all possible obstructions and debris are removed from the cable route. Inter-array cables would then be installed using a mechanical cutter, mechanical plow, and/or jet-plow to a target burial depth of 4 to 6 feet (see Section 3.1.3.3 of the COP for construction details). Cable installation would occur out to approximately 300 feet from each WTG foundation, at which point the cable would be laid out and cut. At that point, a pulling head would be put on the cable end to allow the cable to be pulled into the foundation. After cable installation, scour protection would be installed, as applicable.

If seabed conditions do not permit cable burial, DWSF would employ other methods of cable protection (fronded mattresses, rock bags, rock, or engineered concrete mattresses) (see Table 3.1-1 of the COP for details). A cable inspection program would be developed to confirm the cable burial depth along the route and to identify any further remedial burial activities and/or secondary cable protection.

South Fork Export Cable: Offshore

Construction staging and installation for the offshore SFEC would generally be as described for the inter-array cables. Cable lay and burial would be conducted for the entire SFEC route, up to approximately 300 feet from the OSS. At that point, the cable would be attached to the OSS in the same process as described for connecting inter-array cables to WTGs. If seabed conditions do not permit cable burial, remedial burial could occur using a controlled flow excavator or other methods of cable protection (e.g., rock or engineered concrete mattresses) would be employed. DWSF would cross other existing telecommunication cables using industry standards, including cable protection and clearing of inactive cables from the burial route, where applicable (see Tables 3.2-2 and 3.2-3 in the COP for details regarding cable protection at crossings).

South Fork Export Cable: Sea-to-Shore Transition

DWSF would locate the work area and drill entry point for installation of the sea-to-shore transition onshore at least 650 feet from the MHWL and would end offshore at least 1,750 feet from the MHWL. If necessary, a temporary 75 × 25–foot cofferdam would be installed at the offshore end of the HDD to contain drilling returns. The cofferdam would be constructed using either sheet pile or gravity cell construction (see Section 3.2.3.4 of the COP for details) and would be clearly marked to indicate presence to vessels. A drill and drilling fluid would be used to construct a 32-inch-diameter borehole under the beach and intertidal zone. A 24-inch-diameter conduit (high-density polyethylene pipe) would be inserted through the entire length of the borehole, through which the cable would be installed. After installation, a transition vault would be installed onshore around the drill pit; the offshore and onshore cables would be spliced together; and the transition vault would then be sealed, covered, and repaved with manhole covers at the surface. The cofferdam would be removed; excavated sediments placed in the immediate vicinity of the cofferdam would be allowed to disperse naturally.

HDD installation is estimated to take 10 to 16 weeks, including equipment mobilization and breakdown. Work would typically be completed outside the summer season using 12-hour work windows in residential areas, barring any extenuating circumstances.

South Fork Export Cable: Onshore

DWSF would install the onshore SFEC cable in an underground duct bank consisting of concrete-encased conduits within the ROW of existing roads or within the LIRR ROW. Existing pavement, gravel, or dirt would be removed, along with vegetation clearing as needed, and a trench of up to 4 feet wide and 8 feet deep would be excavated. As needed, DWSF could also use HDD to cross under existing infrastructure. The conduits would be assembled and then lowered. The area around the conduits would be filled with concrete. Once the conduit is installed, the trench would be backfilled with compacted soil. Temporary pavement would be applied followed by full pavement of the affected lane or the road, as appropriate. After duct bank installation is complete, the onshore SFEC would be installed by pulling the cable from manhole to manhole, with cables spliced at each manhole.

Construction of the interconnection facility would include site preparation, excavation, and grading; construction of foundations for control building, transformer, reactors, and switchgear; construction of electrical grounding, duct banks, and underground conduits; installation of drainage systems and station service; and installation of aboveground structures. Any temporary staging areas required during construction would be located within, or adjacent to, the proposed facility. Onshore construction is estimated to take 9 to 12 months; however, the construction schedule would be designed to minimize impacts during the summer tourist season (see Section 4.6.1.3 of the COP).

2.1.1.3.3 INSTALLATION OF WIND TURBINE GENERATORS

After installation of the foundation and the inter-array cables, DWSF would transport WTGs from onshore staging facilities by barge or other vessel to the offshore installation site. A jack-up vessel would be located next to each foundation and would individually lift and set the tower, either in sections or as a single piece (see COP Figure 3.1-6). The nacelle would then be lifted and connected to the tower, followed by installation of each blade to the hub. Once the components are installed, workers would finalize securing each WTG component. Installation of each WTG would require up to 3 days, assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances.

2.1.1.3.4 INSTALLATION OF OFFSHORE SUBSTATION

The installation process for the OSS would be similar to that described for WTGs. The substation would be brought to a foundation on a transportation barge and lifted into place by a jack-up lift barge or a derrick barge.

2.1.1.4 Operations and Maintenance

DWSF would provide O&M for the duration of the Project. The SFWF would operate at maximum capacity while complying with all electric grid requirements from LIPA and NYISO. The SFWF and SFEC would be monitored 24 hours a day and 365 days a year from a remote facility. The anticipated vessels and support vehicles to be used during operations are described in Section 3.1.3.1 and Table 3.1-6 of the COP. WTGs and the OSS would be maintained and equipped with safety devices and Federal Aviation Administration (FAA) and USCG-recommended marking and lighting. The OSS and interconnection facility would also contain a utility generator in the case of emergency events. For planned maintenance activities, personnel access would be provided using crew transfer vessels during low wind periods. DWSF would also conduct routine foundation inspections. Unscheduled maintenance, including major repairs, could require the use of jack-up or crane barges if repairs to equipment such as power transformers, reactors, or switchgear are necessary.

Inter-array cables and the SFEC are not expected to require planned maintenance; however, DWSF would develop a cable inspection program prior to Project commissioning; regular monitoring and inspections would be based on manufacturer-suggested methods.

2.1.1.5 Conceptual Decommissioning

In accordance with applicable regulations and a BOEM-approved conceptual decommissioning plan, DWSF would have up to 2 years to decommission the Project after the 25-year lease ends (approximately 2052), unless the Lease is extended. WTG components and the OSS would be disconnected and would be removed using a jack-up lift vessel or a derrick barge. Cables would be removed, in accordance with BOEM regulations (30 CFR 585, Subpart I). A material barge would transport components to a recycling yard where the components would be disassembled and prepared for re-use and/or recycling for scrap metal and other materials. The foundations would be cut by an internal abrasive water jet cutting tool at 15 feet below the seabed and returned to shore for recycling in the same manner described for the WTG components and the OSS. DWSF would clear the area after all components have been decommissioned to ensure that no unauthorized debris remains on the seabed. Onshore conceptual decommissioning requirements would be subject to state/local authorizations and permits. DWSF would be required to complete conceptual decommissioning within 2 years of the termination of its lease. DWSF would submit a decommissioning application prior to any conceptual decommissioning activities. BOEM would conduct a NEPA assessment at that time, which could result in the preparation of a NEPA document. Decommissioning may not occur for all Project components. However, for the purposes of the DEIS, all analyses assume that conceptual decommissioning would occur as described in this section.

2.1.1.6 Environmental Protection Measures and Additional Authorizations

DWSF has committed to environmental protection measures (EPMs) as part of its Project to avoid or minimize impacts to physical, biological, socioeconomic, and cultural resources. These measures are described in Table G-1 in Appendix G and are incorporated as part of the Proposed Action in the DEIS. As noted in Section 1.3, DWSF would also obtain all other necessary state and federal permits and authorizations under applicable statutes prior to Project construction.

2.1.2 Vessel Transit Lane Alternative

Under the Vessel Transit Lane alternative (hereafter the Transit alternative), BOEM evaluated a 4-nm-wide vessel transit lane[5] through the Lease Area where no surface occupancy would occur. BOEM developed this alternative in response to the January 3, 2020, Responsible Offshore Development Association (RODA) layout proposal (RODA 2020). The RODA proposal includes designated transit lanes, each at least 4 nm wide. Although the proposal includes six total transit lanes, only one lane intersects the Lease Area. The vessel transit lane is unique to this alternative and could facilitate transit of vessels through the Lease Area from southern New England and eastern Long Island ports to fishing areas in the region (Figure 2.1.3-1).

WTGs located within the transit lane would be eliminated under this alternative. DWSF would develop the remaining WTGs with a 12-MW turbine capacity and would move the offshore substation north of the currently proposed location and install it in one of the remaining WTG locations. The Transit alternative is within the proposed design envelope of up to 15 turbines in the 6- to 12-MW range.

[5] BOEM also evaluated a 2-nm and 3-nm-wide transit lane alternative. However, these smaller lanes would result in the same impacts as the Proposed Action because the lane would not overlap any proposed WTGs or the OSS. Therefore, a smaller lane width was dismissed from further evaluation.

All other Project components and construction and installation, O&M, and conceptual decommissioning would be identical to the Proposed Action. The Transit alternative discloses the effect a vessel transit lane could have on resources analyzed in the DEIS. The DEIS also considers the five other transit lanes that could intersect the other reasonably foreseeable projects to the extent that the impacts of those additional lanes would contribute to cumulative impacts in the analysis area considered for each resource area (see Figure 2.1.3-1).

2.1.3 Fisheries Habitat Impact Minimization Alternative

Under the Fisheries Habitat Impact Minimization alternative (hereafter the Habitat alternative), the construction and installation, O&M, and conceptual decommissioning of WTGs and an OSS within the Lease Area and associated inter-array and export cables would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures. However, to reduce impacts to complex fisheries habitats as compared to the Proposed Action, BOEM would require DWSF to exclude certain WTGs and associated cable locations within complex fisheries habitats should micrositing not be possible to maintain a uniform east–west and north–south grid of 1 × 1–nm spacing between WTGs with diagonal transit lanes of at least 0.6 nm wide.

Under this alternative, BOEM may approve fewer WTG locations than proposed by DWSF. However, this alternative is still within the proposed design envelope of up to 15 turbines and the 6- to 12-MW range. All other Project components and construction and installation, O&M, and conceptual decommissioning would be identical to the Proposed Action.

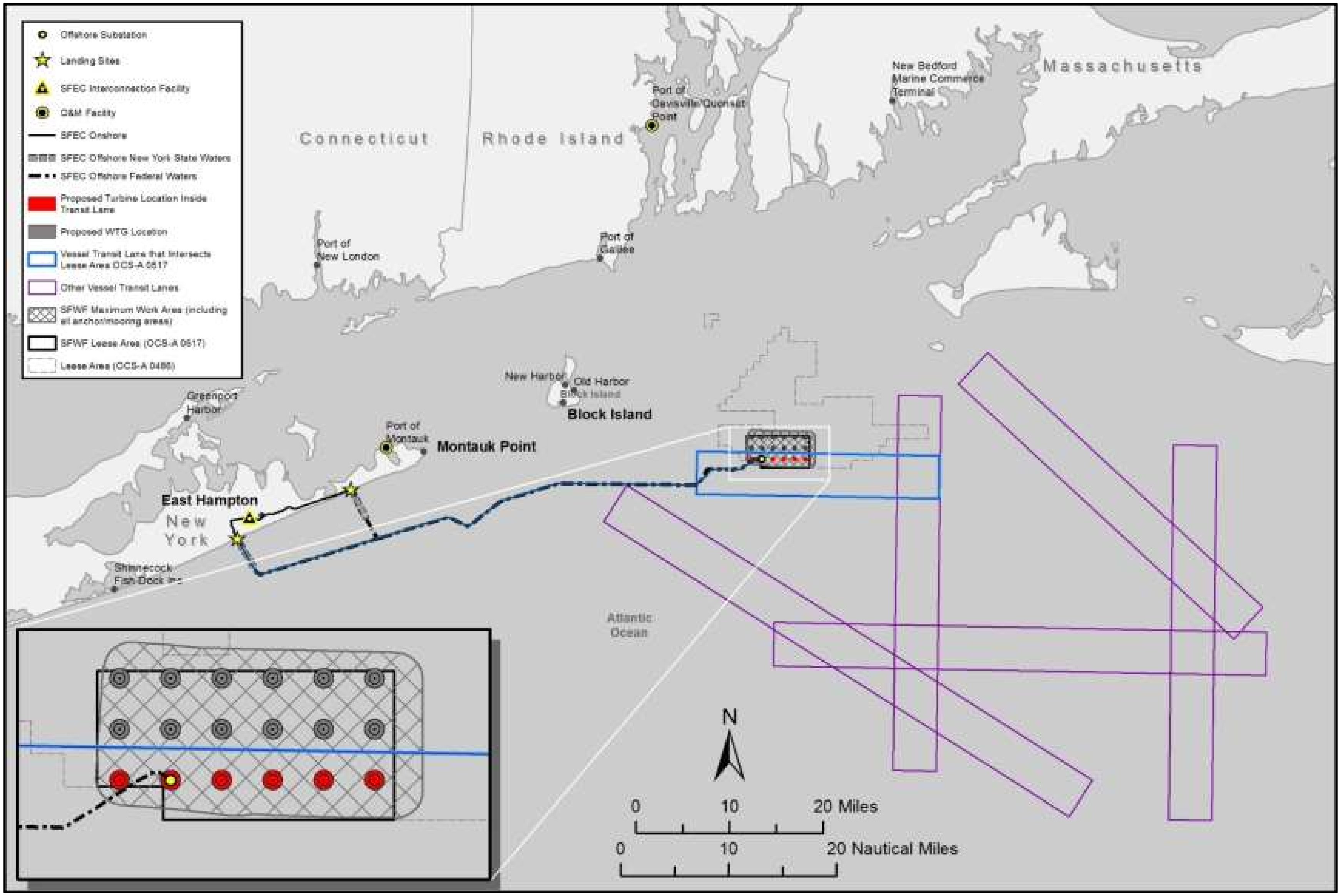

Figure 2.1.3-1. Transit alternative layout.

2.1.4 No Action Alternative

Under the No Action alternative, BOEM would not approve the COP, and the Project construction and installation, O&M, and conceptual decommissioning activities would not occur. Likewise, no additional permits or authorizations would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. However, all other existing or other reasonably foreseeable future impact-producing activities would persist in the Lease Area. Table 2.3.1-1 includes an impact assessment of the No Action alternative for each resource, including an assessment for cumulative effects. The No Action alternative cumulative effects assessment provides an assessment for impacts with and without approval of additional wind farms in BOEM lease areas. Through these assessments, the No Action alternative provides a baseline against which all action alternatives are evaluated.

2.1.5 Alternatives Considered but Dismissed from Detailed Analysis

BOEM considered a range of alternatives during the DEIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. To be carried forward for analysis, all considered alternatives were required to meet the following screening criteria: 1) meet the purpose of and need for the Proposed Action; 2) be operationally, technically, and economically feasible and implementable; 3) be consistent with other local, state, or federal plans, permits, and regulations; 4) further reduce or avoid impacts as compared to the Proposed Action; and 5) not be substantially the same as another alternative. Table 2.1.5-1 summarizes the alternatives considered but dismissed from detailed analysis along with detailed rationale for elimination.

Table 2.1.5-1. Alternatives Considered but Dismissed from Detailed Analysis

Alternative	Objective	Rationale for Dismissal
Minimizing the number of turbines/maximizing power output of individual turbines	Reduce impacts to benthic and marine species	The design envelope considered under the other action alternatives includes a range of turbine and WTG power outputs, including options to reduce the number of turbines and increase power outage. The Proposed Action considers one of the highest potential WTG power outputs currently available in the market. Therefore, this alternative was not carried forward for separate analysis but is addressed within the DEIS analysis of the Proposed Action and other action alternatives.
Alternative location in the Lease Area 0486	Reduce impacts to Cox Ledge resources	On January 16, 2020, Deepwater Wind New England, LLC requested that a portion of Lease OCS-A 0486, which corresponds to the defined geographic area identified in the COP, be assigned to a different entity, DWSF. Under BOEM's regulations, an assignment request can only be denied if the applicants fail to comply with the regulatory requirements applicable to assignments. Essentially, those requirements are limited to the technical, financial, and legal qualifications and capabilities of the assignee to comply with the obligations under the lease being assigned. Absent any deficiency in the technical, financial, and legal qualifications and capabilities of the assignee, BOEM is required to approve the assignment because denial or delay in approving the assignment for reasons other than those contemplated in the regulations cannot be legally justified. BOEM reviewed the assignment application submitted by DWSF and determined that it complied with the technical, financial, and legal requirements for approval under BOEM's regulations. The assignment was approved by BOEM on March 23, 2020, and had the effect of segregating the area assigned from Lease OCS-A 0486 and created a new lese (i.e., OCS-A 0517). The assignment also had the effect of rendering the "Alternate Location within the Lease Area Alternative" no longer viable because its selection would mean that BOEM would be requiring the lessee to develop the Project in a lease held by a different legal entity and for which another proposal is currently pending evaluation by BOEM (i.e., the Revolution Wind Project proposed by DWW Rev I, LLC). The Revolution Wind Project is intended to satisfy energy demands agreed to under power purchase agreements executed with the States of Connecticut and Rhode Island. BOEM selecting an alternative that would approve the Project in a lease held by another legal entity, and for which there is a project proposal intended to satisfy contractual commitments different than those intended to be satisfied by the SFWF, is the equivalent of choosing the No Action alternative because it is not a viable alternative that can be implemented by DWSF. Analysis and selection of the "Alternate Location within the Lease Area Alternative" would not result in developing the Project in that other location. Instead, it would result in deciding not to develop the Project in the defined geographic area where it was proposed because developing the Project in another location would have been preferable. The No Action alternative and the action alternatives currently being analyzed in detail allow the Secretary to understand the impacts that would be avoided or caused if the Project is developed or not in the defined geographic area where it is proposed. The alternatives being analyzed in detail would also allow the Secretary to determine whether the activities proposed in Lease OCS-A-0517 would, among others, cause "undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance" 30 CFR 585.621(d). Based on the above, BOEM finds that the selection and implementation of the "Alternate Location within the Lease Area Alternative" is no longer viable and analyzing such alternative in detail would not contribute to the Secretary's determination on whether the Project should be denied in the location where it is currently proposed. Said differently, the Secretary does not need to analyze the impacts the Project would have in other locations to determine whether the activities proposed in the defined geographic area would, among others, cause "undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance." 30 CFR 585.621(d). This alternative emerged because of concerns related to Cox Ledge; these concerns are addressed through the Habitat alternative, which avoids sensitive habitat in that area.

Alternative	Objective	Rationale for Dismissal
Using a 1 × 1–nm wind turbine layout	Reduce impacts to fisheries and navigation	DWSF has committed to an indicative layout with WTGs sited in a grid with a spacing of approximately 1.0 nm (1.9 km, 1.15 miles) × 1.0 nm (1.9 km, 1.15 miles) that aligns with other proposed adjacent offshore wind projects in the RI-MA WEAs. Therefore, this alternative is already considered under the Proposed Action alternative and was dismissed from further consideration.
Reducing the permitted operating life of the facility	Reduce impacts to all resources	The lease allows for 25 years of operations (plus up to an additional 2 years for conceptual decommissioning). Reducing the permitted operating life would violate the lease.
Using the LIPA 138-kV land-based transmission cable project or the East End – Battery large-scale facility to meet energy demand.	Reduce impacts to all marine resources	Not responsive to the purpose and need. May be considered as the No Action alternative where power generation would come from alternate sources.
Alternatives for cable construction methods and protection (e.g., natural materials vs. artificial materials), including using smaller cable, burying the cable deeper, alternatives to side-casting spoils, route alternatives that allow for full cable burial, and using better shielding materials	Reduce impacts to benthic and marine resources	No cable construction alternatives were identified during Project development that would further reduce or avoid marine impacts (see New York Article VII submitted by DWSF and Section 2.3.2 of the COP). Project impacts associated with cable construction methods and protection are disclosed in Chapter 3 of the DEIS for relevant affected resources. As applicable, BOEM could also choose to implement additional mitigation measures to further reduce or avoid impacts. The habitat alternative evaluated in the DEIS also considers ways to minimize certain habitat impacts. Therefore, this alternative was not carried forward for separate analysis because it would not provide a substantially different analysis than that provided with the analysis of the Proposed Action and other action alternatives, and because of the mitigation measures identified and considered in the DEIS.
Alternatives to cable routes that minimized impacts to sensitive biotic/benthic habitats	Reduce impacts to benthic resources	DWSF identified an alternative SFEC cable route that ran southwest from the SFWF, passing north of Montauk Point and into Napeague Bay on the north shore of the South Fork in the town of Easthampton, New York. However, this route was rejected because of commercial fishing concerns expressed by stakeholders. No other feasible route alternatives were identified during Project development or scoping that would allow DWSF to meet its power purchase agreement. Therefore, this alternative was not carried forward for analysis.
Alternatives to cofferdam excavation	Reduce impacts to water quality and marine resources	The DEIS considers scenarios where cofferdam excavation may or may not be needed as part of the Project design envelope. A cofferdam would only be used if needed to contain HDD drilling returns. Alternatives to cofferdam excavation, such as inflatable dams, would not provide a substantially different analysis than that provided with the analysis of the Proposed Action. As applicable, BOEM could also choose to implement additional mitigation measures to further reduce or avoid impacts. Therefore, this alternative was not carried forward as a separate alternative.
Alternatives to cable decommissioning that remove all cables, etc. rather than burying cables in place	Reduce impacts to benthic and marine resources	BOEM regulations (30 CFR 585, Subpart I) currently require the removal of the cables, and the Proposed Action addresses the removal of cables.

Alternative	Objective	Rationale for Dismissal
Alternative renewable energy technology such as solar or wave devices rather than wind	Reduce impacts to all resources	Alternative technologies such as solar and wave devices that would meet renewable energy goals are not technologically and commercially feasible at this time. Additionally, this alternative is not responsive to the purpose and need to respond to the Project COP and determine whether to approve, approve with modifications, or disapprove the COP to construct, operate, and conceptually decommission a commercial-scale wind energy facility within Lease Area OCS-A 0517.
Alternate locations for turbines including an upland site near East Hampton that would involve no discharge of dredged or fill material in wetlands and other waters of the United States	Reduce impacts to all resources	Evaluating an alternate location outside of Lease Area OCS-A 486 would constitute a new Proposed Action and would not meet BOEM's purpose and need to respond to the Project COP and determine whether to approve, approve with modifications, or disapprove the COP to construct, operate, and conceptually decommission a commercial-scale wind energy facility within Lease Area OCS-A 0517. BOEM's regulations require BOEM to analyze DWSF's proposal to build a commercial wind energy facility on Lease OCS-A 0517. BOEM would consider proposals on other existing leases through a separate regulatory process. Other potential lease areas may be considered at a later date, either through a competitive lease sale process if multiple companies wish to bid, or through a non-competitive process if no competitive interest exists. This alternative would therefore not meet the purpose and need of the Project, and would effectively be the same as selecting the No Action alternative.
Alternate location closer to shore or within state waters		
Alternate location for the wind energy facility outside of Lease Area OCS-A 0486		
Alternative wind turbine foundations	Reduce impacts to benthic and marine resources	BOEM received comments suggesting the use of alternative foundation types, including suction bucket foundations and floating wind turbine foundation types to reduce impacts on marine mammals, sea turtles, and fish from pile driving associated with monopile and jacket foundations. These foundation types are not feasible within the Lease Area because of the following: The dense soils beneath an upper loose surficial layer of sand may prevent the full penetration required for stability of suction bucket foundations. The loose upper layer of sandy sediment also presents a settlement risk for gravity-based foundations. The water depths are too shallow in portions of the Lease Area for floating foundations, which is a technology that is unproven for a project the size of what is proposed by DWSF. Although these foundation types would not require pile driving, the larger footprint of suction bucket foundations would increase seabed disturbance; additionally, all foundation types would create less room for fishing activities between turbines when compared to monopile foundations. The cables associated with floating wind turbines would also increase the risk of entanglement for marine mammals. Overall, these alternative foundation types are not feasible in the Lease Area and may increase long-term environmental impacts to some resources over those from monopile foundations within the Lease Area.
Alternatives to cable landing site options	Reduce socioeconomic and human health impacts	DWSF evaluated a total of five landing sites. Two of these sites were located in Napeague Bay, which required a cable route that was eliminated because of commercial fishing concerns. Of the three remaining sites, only Beach Lane and Hither Hills were considered feasible from an engineering and environmental perspective. No other cable landing site alternatives were identified during Project development or scoping that would further reduce or avoid social or environmental impacts (see New York Article VII submitted by DWSF). Based on this process, and because the DEIS already considers an alternative cable landing location as part of the Project design envelope, there is no need to consider it as a separate alternative.

Alternative	Objective	Rationale for Dismissal
Eliminating Beach Lane landing site	Reduce socioeconomic impacts	The DEIS evaluates and discloses the impacts of both the Beach Lane and Hither Hills landing site as part of the Project design envelope. Therefore, this alternative was not carried forward. BOEM would use the information disclosed in the DEIS to evaluate landing sites and may choose to identify a specific landing site as part of their preferred alternative.
Transit lane alternative with widths greater than 4 nm	Reduce navigation impacts	BOEM's subject matter experts believe that an analysis of additional transit lane widths would not provide the U.S. Secretary of the Interior significantly different information regarding impacts on affected resources when compared to the 4-nm alternative analyzed in the DEIS. Although BOEM is aware of a desire for vessel transit lanes with widths in excess of 4 nm, BOEM is unaware of any studies justifying that width. The closest metric that BOEM has seen (from U.K. Maritime Guidance MGN 543) is that routes should be wide enough to allow for a 20 degree course variation in rough conditions. For the 15-nm-long diagonal transit lane through the RI and MA Lease Areas, this would be a lane of 5.5 nm. However, MGN 543 indicates that this metric is intended for larger commercial vessels with less responsive steering and that are more heavily impacted by wind, such as the vessels moving through New York Harbor that are in excess of 800 feet. Conversely, the fishing vessels transiting the RI and MA Lease Areas are much smaller, with the largest licensed fishing vessel in the area being 138 feet (42.1 meters). Nearby lanes intended for deep-draft traffic include the Traffic Separation Schemes for Narragansett Bay (11.5 nm long and 4 nm wide) and Boston (127.5 nm long and 4 nm wide). These Traffic Separation Schemes see both a larger traffic volume and larger individual vessel size than the entirety of the RI and MA Lease Areas, and include a separation zone of 1 to 2 nm in the middle of the lane. Additionally, BOEM expects that transit lanes greater than 4 nm wide would be equivalent to the No Action alternative because additional WTGs would be removed, and remaining WTGs would be insufficient to meet DWSF's power purchase agreement.
Atlantic Avenue landing site	Reduce socioeconomic and human health impacts	DWSF considered the Atlantic Avenue landing site during initial screening but did not include the site in permitting documents because it was determined, based on discussions with local government, that securing property rights for routing of the cable was not possible.

2.2 NON-ROUTINE ACTIVITIES AND LOW-PROBABILITY EVENTS

Non-routine activities and low-probability events associated with the Project could occur during construction and installation, O&M, or conceptual decommissioning. Although these activities or events are impossible to predict with certainty, examples of such activities and events and potential for Project impacts are briefly summarized below. Impacts from these activities would be as described for the Proposed Action (described in Chapter 3).

- Corrective maintenance activities: These activities could be required as a result of other low-probability events, or as a result of unanticipated equipment wear or malfunctions. DWSF would stock spare parts and have sufficient workforce available to conduct corrective maintenance activities, if required.
- Collisions and allisions: These activities could result in spills (described below) or injuries or fatalities to humans and/or wildlife (addressed in Chapter 3). Collisions and allisions would be minimized through USCG's requirement for lighting on vessels, temporary safety zones anticipated to be implemented by DWSF during construction, the implementation of National Oceanic and Atmospheric Administration (NOAA) vessel-strike guidance, proposed spacing between WTGs and other facility components, and inclusion of Project components on nautical charts.
- Cable displacement or damage by vessel anchors or fishing gear: This could result in safety concerns and economic damages to vessel operators. However, such incidents would be minimized by inclusion of Project components on nautical charts and the cable burial or other protection measures.
- Chemical spills or releases: For offshore activities, these would include inadvertent releases from refueling vessels, spills from routine maintenance activities, and any more significant spills as a result of a catastrophic event. DWSF would comply with USCG and Bureau of Safety and Environmental Enforcement regulations relating to prevention and control of oil spills. Onshore, releases could occur from construction equipment and/or HDD activities. DWSF would prepare a construction spill prevention, control, and countermeasure plan in accordance with applicable requirements, and would outline spill prevention plans and measures to take to contain and clean up spills that may occur.
- Severe weather and natural events: DWSF designed the Project components to withstand severe weather events. However, severe flooding or coastal erosion could require repairs during construction and installation activities. Although highly unlikely, structural failure of a WTG (i.e., loss of a blade or tower collapse) would result in temporary hazards to navigation for all vessels.
- Terrorist attacks: Impacts from terrorist attacks could greatly vary in magnitude and extent and, therefore, their analysis would be highly speculative. BOEM also considers terrorist attacks unlikely and therefore does not analyze them further in the DEIS.

2.3 SUMMARY AND COMPARISON OF IMPACTS BY ALTERNATIVE

2.3.1 Comparison of Impacts by Alternative

Table 2.3.1-1 summarizes and compares the impacts from Chapter 3 by environmental resource and alternative.

Table 2.3.1-1. Comparison of Impacts by Alternative

Resource	No Action	Proposed Action	Vessel Transit Lane Alternative	Fisheries Habitat Impact Minimization Alternative
Air quality	Continuation of existing air quality trends and sources of air pollution. Negligible to moderate adverse effects if no other wind farms are authorized and negligible to moderate adverse effects if they are authorized.	Minor to moderate temporary adverse impacts to air quality in the region due to construction and installation, O&M, and conceptual decommissioning, as well as minor beneficial, long-term air quality and reduced health event impacts. The overall cumulative impacts to air quality would be minor adverse and minor beneficial.	Minor to moderate temporary adverse impacts to air quality in the region due to construction and installation, O&M, and conceptual decommissioning, as well as minor beneficial long-term air quality and reduced health event impacts. The overall cumulative impacts to air quality would be minor adverse and minor beneficial. When compared to the Proposed Action, air quality impacts could slightly decrease depending on final design.	Minor to moderate temporary adverse impacts to air quality in the region due to construction and installation, O&M, and conceptual decommissioning, as well as minor beneficial, long-term air quality and reduced health event impacts. The overall cumulative impacts to air quality would be minor adverse and minor beneficial. When compared to the Proposed Action, air quality impacts could slightly decrease depending on final design.
Water quality	Continuation of existing water quality trends. Minor to moderate adverse effects if no other wind farms are authorized and minor to moderate adverse effects and minor beneficial effects if they are authorized.	Negligible to moderate impacts on onshore surface water and offshore water quality from erosion, sediment resuspension and deposition and scouring, discharges, and inadvertent spills. Onshore and offshore, overall cumulative impacts to water quality would be minor.	Negligible to moderate impacts on onshore surface water and offshore water quality from erosion, sediment resuspension and deposition and scouring, discharges, and inadvertent spills. Onshore and offshore, overall cumulative impacts to water quality would be minor. When compared to the Proposed Action, offshore water quality impacts could slightly decrease depending on final design.	Negligible to moderate impacts on onshore surface water and offshore water quality from erosion, sediment resuspension and deposition and scouring, discharges, and inadvertent spills. Onshore and offshore, overall cumulative impacts to water quality would be minor. When compared to the Proposed Action, offshore water quality impacts could slightly decrease depending on final design.
Bats	Continuation of population trends and continuation of effects to species from natural and human-caused stressors. Minor adverse effects if no other wind farms are authorized and minor adverse effects if they are authorized.	Negligible to minor adverse impacts on bats and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.	Negligible to minor adverse impacts on bats and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor. When compared to the Proposed Action, collision risk could slightly decrease depending on final design.	Negligible to minor adverse impacts on bats and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor. When compared to the Proposed Action, collision risk could slightly decrease depending on final design.
Benthic habitat, essential fish habitat (EFH), invertebrates, and finfish	Continuation of population trends. Continuation of effects to species from natural and human-caused stressors. Negligible to moderate adverse effects if no other wind farms are authorized and negligible to moderate adverse effects if they are authorized.	Project construction and conceptual decommissioning would have a negligible to minor adverse effect for benthic resources, minor for EFH, and negligible to minor for invertebrates and finfish due to noise, water quality related effects, seabed disturbance, lighting, EMF, and vessel activity. Project O&M would cause fewer impacts to fish, invertebrates, benthic habitats, and EFH than Project construction and installation. The foundation piles and associated scour protection would create an artificial reef effect, which could result in minor beneficial effects to species distribution, community composition, and predator-prey interactions in the vicinity. Overall cumulative effects to benthic habitat, EFH, invertebrates, and finfish within the Northeast Shelf Large Marine Ecosystem would be moderate.	Project construction and conceptual decommissioning would have a negligible to minor adverse effect for benthic resources, minor for EFH, and negligible to minor for invertebrates and finfish due to noise, water quality–related effects, seabed disturbance, lighting, EMF, and vessel activity. Project O&M would cause fewer impacts to fish, invertebrates, benthic habitats, and EFH than Project construction and installation. The foundation piles and associated scour protection would create an artificial reef effect, which could result in minor beneficial effects to species distribution, community composition, and predator-prey interactions in the vicinity. Overall cumulative effects to benthic habitat, EFH, invertebrates, and finfish within the Northeast Shelf Large Marine Ecosystem would be moderate. When compared to the Proposed Action, reduced WTG and cable installation could slightly decrease impacts depending on final design.	Project construction and conceptual decommissioning would have a negligible to minor adverse effect for benthic resources, minor for EFH, and negligible to minor for invertebrates and finfish due to noise, water quality–related effects, seabed disturbance, lighting, EMF, and vessel activity. Project O&M would cause fewer impacts to fish, invertebrates, benthic habitats, and EFH than Project construction and installation. The foundation piles and associated scour protection would create an artificial reef effect, which could result in minor beneficial effects to species distribution, community composition, and predator-prey interactions in the vicinity. Overall cumulative effects to benthic habitat, EFH, invertebrates, and finfish within the Northeast Shelf Large Marine Ecosystem would be moderate. When compared to the Proposed Action, impacts to complex habitat would be reduced. Reduced WTG and cable installation, as well as micrositing of these components, could slightly decrease other Project-related impacts depending on final design.
Birds	Continuation of population trends. Continuation of effects to species from natural and human-caused stressors. Minor adverse effects if no other wind farms are authorized and negligible to minor adverse and minor beneficial effects if they are authorized.	Negligible to minor impacts on birds and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor.	Negligible to minor impacts on birds and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor. When compared to the Proposed Action, collision risk could slightly decrease depending on final design.	Negligible to minor impacts on birds and suitable habitat from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor. When compared to the Proposed Action, collision risk could slightly decrease depending on final design.
Marine mammals	Continuation of population trends and continuation of effects to species from natural and human-caused stressors. Negligible to moderate adverse effects if no other wind farms are authorized and negligible to moderate effects if they are authorized.	Negligible to moderate impacts from construction and installation, O&M, and conceptual decommissioning activities. Although less likely, some individual whales or seals could suffer temporary or permanent hearing injury; these adverse effects would be moderate for affected individual marine mammals. Overall cumulative adverse impacts would be moderate.	Negligible to moderate impacts from construction and installation, O&M, and conceptual decommissioning activities. Although less likely, some individual whales or seals could suffer temporary or permanent hearing injury; these adverse effects would be moderate for affected individual marine mammals. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, reduced WTG and cable installation could slightly decrease noise, turbidity, and collision impacts depending on final design.	Negligible to moderate impacts from construction and installation, O&M, and conceptual decommissioning activities. Although less likely, some individual whales or seals could suffer temporary or permanent hearing injury; these adverse effects would be moderate for affected individual marine mammals. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, reduced WTG and cable installation could slightly decrease noise, turbidity, and collision impacts depending on final design.
Other terrestrial and coastal habitats and fauna	Continuation of population trends and continuation of effects to species from natural and human-caused stressors. Minor adverse effects if no other wind farms are authorized and negligible to minor adverse effects if they are authorized.	Negligible to minor impacts to terrestrial and coastal habitats and fauna from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.	Negligible to minor impacts to terrestrial and coastal habitats and fauna from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.	Negligible to minor impacts to terrestrial and coastal habitats and fauna from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor.

Resource	No Action	Proposed Action	Vessel Transit Lane Alternative	Fisheries Habitat Impact Minimization Alternative
Sea turtles	Continuation of population trends and continuation of effects to species from natural and human-caused stressors. Minor to moderate adverse effects if no other wind farms are authorized and negligible to moderate adverse effects if they are authorized.	Negligible to minor impacts from elevated underwater noise from Project construction and vessel traffic and accidental discharges of spills or trash from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate adverse and moderate beneficial.	Negligible to minor impacts from elevated underwater noise from Project construction, and vessel traffic and accidental discharges of spills or trash from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate adverse and moderate beneficial. When compared to the Proposed Action, reduced WTG and cable installation could slightly decrease noise, turbidity, and collision impacts depending on final design.	Negligible to minor impacts from elevated underwater noise from Project construction, and vessel traffic and accidental discharges of spills or trash from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate adverse and moderate beneficial. When compared to the Proposed Action, reduced WTG and cable installation could slightly decrease noise, turbidity, and collision impacts depending on final design.
Wetlands and WOTUS	Continuation of existing trends/issues for wetland resource. Minor adverse effects if no other wind farms are authorized and minor adverse effects if they are authorized.	Short- to long-term, negligible to minor, adverse impacts to wetlands and WOTUS from Project construction and installation, and conceptual decommissioning. No O&M impacts are anticipated. Overall cumulative adverse impacts would be minor.	Short- to long-term, negligible to minor, adverse impacts to wetlands and WOTUS from Project construction and installation, and conceptual decommissioning. No O&M impacts are anticipated. Overall cumulative adverse impacts would be minor.	Short- to long-term, negligible to minor, adverse impacts to wetlands and WOTUS from Project construction and installation, and conceptual decommissioning. No O&M impacts are anticipated. Overall cumulative adverse impacts would be minor.
Commercial fisheries and for-hire recreation fishing	Continuation of current trends. Negligible to moderate adverse effects if no other wind farms are authorized and negligible to moderate effects if they are authorized.	Negligible to moderate adverse construction and installation, O&M, and conceptual decommissioning impacts to commercial fisheries and for-hire recreational fishing due to increased port congestion; changes to fishing access, primarily through reduced fishing opportunity when construction activities are occurring; damage to or loss of fishing gear; and impacts on the catch due to changes in target species abundance or availability during construction activities. The reef effect of WTG foundations and associated scour protection is expected to have negligible to minor beneficial impacts to for-hire recreational fisheries, depending on the extent to which the foundations enhance fishing opportunities. Overall cumulative adverse impacts would be moderate.	Negligible to moderate adverse construction and installation, O&M, and conceptual decommissioning impacts to commercial fisheries and for-hire recreational fishing due to increased port congestion; changes to fishing access, primarily through reduced fishing opportunity when construction activities are occurring; damage to or loss of fishing gear; and impacts on the catch due to changes in target species abundance or availability during construction activities. The reef effect of WTG foundations and associated scour protection is expected to have negligible to minor beneficial impacts to for-hire recreational fisheries, depending on the extent to which the foundations enhance fishing opportunities. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, the transit corridor could facilitate or hinder vessel transit, depending on the type of vessel. The transit corridor could increase the potential for allision, collision, and other navigation conflicts as compared to the Proposed Action.	Negligible to moderate adverse construction and installation, O&M, and conceptual decommissioning impacts to commercial fisheries and for-hire recreational fishing due to increased port congestion; changes to fishing access, primarily through reduced fishing opportunity when construction activities are occurring; damage to or loss of fishing gear; and impacts on the catch due to changes in target species abundance or availability during construction activities. The reef effect of WTG foundations and associated scour protection is expected to have negligible to minor beneficial impacts to for-hire recreational fisheries, depending on the extent to which the foundations enhance fishing opportunities. Overall cumulative adverse impacts would be moderate.
Cultural, resources	Continuation of existing trends/issues. Negligible to major adverse effects if no other wind farms are authorized and negligible to major effects if they are authorized.	Negligible to major adverse impacts to marine and terrestrial archaeological resources and to historic visual resources from Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be negligible to moderate across marine, terrestrial and viewshed resources, because the overall effect to cultural resources could be mitigated through the Section 106 process.	Negligible to major adverse impacts to marine and terrestrial archaeological resources and to historic visual resources from Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be negligible to moderate across marine, terrestrial and viewshed resources, because the overall effect to cultural resources could be mitigated through the Section 106 process. When compared to the Proposed Action, could decrease viewshed impacts and the risk of marine resource damage or destruction to unknown submerged cultural resources based on final design.	Negligible to major adverse impacts to marine and terrestrial archaeological resources and to historic visual resources from Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be negligible to moderate across marine, terrestrial and viewshed resources, because the overall effect to cultural resources could be mitigated through the Section 106 process. When compared to the Proposed Action, could decrease viewshed impacts and the risk of marine resource damage or destruction to unknown submerged cultural resources based on final design.
Demographics, employment, and economics	Continuation of existing trends for population and employment. Minor adverse to minor beneficial effects if no other wind farms are authorized and negligible to minor adverse and minor beneficial effects if they are authorized.	Negligible to minor adverse and minor to moderate beneficial impacts to the socioeconomic analysis area in terms of employment, federal revenue, and income from construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor adverse and minor beneficial.	Negligible to minor adverse and minor to moderate beneficial impacts to the socioeconomic analysis area in terms of employment, federal revenue, and income from construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor adverse and minor beneficial. When compared to the Proposed Action, slightly reduced, beneficial and adverse economic impact.	Negligible to minor adverse and minor to moderate beneficial impacts to the socioeconomic analysis area in terms of employment, federal revenue, and income from construction and installation, O&M, and conceptual decommissioning. Overall cumulative impacts would be minor adverse and minor beneficial. When compared to the Proposed Action, slightly reduced, beneficial and adverse economic impact.
Environmental justice	Continuation of current demographic trends. Minor adverse effects if other wind farms are not authorized and negligible to moderate effects if they are authorized.	Minor to moderate adverse impacts to minority or low-income populations and tribes from the Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be moderate.	Minor to moderate adverse impacts to minority or low-income populations and tribes from the Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, air, water quality, and commercial fishing impacts could slightly decrease depending on final design.	Minor to moderate adverse impacts to minority or low-income populations and tribes from the Project construction and installation, O&M, and conceptual decommissioning activities. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, air, water quality, and commercial fishing impacts could slightly decrease depending on final design.
Land use and coastal infrastructure	Continued activity in accordance with established land use patterns and regulations. Minor adverse effects if other wind farms are not authorized and negligible to minor effects if they are authorized.	Minor, beneficial impacts to land use due to increased compatible uses at ports, whereas construction or conceptual decommissioning of onshore components would have negligible to moderate, temporary adverse impacts due to disturbance associated with onshore construction, including traffic delays and re-routing. Overall cumulative impacts would be minor adverse and minor beneficial.	Minor, beneficial impacts to land use due to increased compatible uses at ports, whereas construction or conceptual decommissioning of onshore components would have negligible to moderate, temporary adverse impacts due to disturbance associated with onshore construction, including traffic delays and re-routing. Overall cumulative impacts would be minor adverse and minor beneficial.	Minor, beneficial impacts to land use due to increased compatible uses at ports, whereas construction or conceptual decommissioning of onshore components would have negligible to moderate, temporary adverse impacts due to disturbance associated with onshore construction, including traffic delays and re-routing. Overall cumulative impacts would be minor adverse and minor beneficial.

Resource	No Action	Proposed Action	Vessel Transit Lane Alternative	Fisheries Habitat Impact Minimization Alternative
Navigation and vessel traffic	Current navigation trends would continue. Minor to moderate adverse effects if other wind farms are not authorized and minor to moderate adverse effects if they are authorized.	Negligible to minor impacts on navigation and vessel traffic in the region from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate.	Negligible to minor impacts on navigation and vessel traffic in the region from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, navigation impacts could slightly increase or decrease depending on final design.	Negligible to minor impacts on navigation and vessel traffic in the region from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate. When compared to the Proposed Action, navigation impacts could slightly decrease depending on final design.
Other marine uses	No new impacts to marine uses and continuation of existing uses. Negligible to minor adverse effects if no other wind farms are authorized and negligible to minor (most uses) to moderate (military uses) to major (scientific research surveys) effects if they are authorized.	Negligible to moderate impacts to mineral extraction, military use, air traffic, land-based radar services, cables and pipelines, and scientific surveys from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor for most uses. However, the overall effect would be moderate adverse for military uses and major adverse for scientific research and protected species surveys.	Negligible to moderate impacts to mineral extraction, military use, air traffic, land-based radar services, cables and pipelines, and scientific surveys from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor for most uses. However, the overall effect would be moderate adverse for military uses and major adverse for scientific research and protected species surveys.	Negligible to moderate impacts to mineral extraction, military use, air traffic, land-based radar services, cables and pipelines, and scientific surveys from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be minor for most uses. However, the overall effect would be moderate adverse for military uses and major adverse for scientific research and protected species surveys.
Recreation and tourism	Continuation of existing trends and no beneficial impacts from Proposed Action. Minor to moderate adverse effects if no other wind farms are authorized and minor to moderate adverse and minor beneficial effects if they are authorized.	Negligible to minor short- to long-term impacts to recreation and tourism due to Project construction and conceptual decommissioning activities. O&M of offshore Project activities could elicit both beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. Overall cumulative adverse impacts would be minor adverse and minor beneficial.	Negligible to minor short- to long-term impacts to recreation and tourism due to Project construction and conceptual decommissioning activities. O&M of offshore Project activities could elicit both beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. Overall cumulative adverse impacts would be minor adverse and minor beneficial. When compared to the Proposed Action, recreation impacts could slightly increase or decrease depending on final design.	Negligible to minor short- to long-term impacts to recreation and tourism due to Project construction and conceptual decommissioning activities. O&M of offshore Project activities could elicit both beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. Overall cumulative adverse impacts would be minor adverse and minor beneficial. When compared to the Proposed Action, recreation impacts could slightly increase or decrease depending on final design.
Visual resources	Continuation of impacts to viewshed from past and current activities. Minor to major adverse effects if no other wind farms are authorized and negligible to major adverse effects if they are authorized.	Negligible to major short- to long-term impacts on non-historic visual resources from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate, as the viewshed would return to previous condition after conceptual decommissioning.	Negligible to major short- to long-term impacts on non-historic visual resources from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate, as the viewshed would return to previous condition after conceptual decommissioning. When compared to the Proposed Action, visual impacts from nighttime lighting and structures could slightly decrease depending on final design.	Negligible to major short- to long-term impacts on non-historic visual resources from Project construction and installation, O&M, and conceptual decommissioning. Overall cumulative adverse impacts would be moderate, as the viewshed would return to previous condition after conceptual decommissioning. When compared to the Proposed Action, visual impacts from nighttime lighting and structures could slightly decrease depending on final design.

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CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 ANALYSIS APPROACH

Based on previous environmental reviews, subject-matter expert input, consultation efforts, and public involvement to date, BOEM identified the resources addressed in Section 3.3 Physical Resources, 3.4 Biological Resources, and 3.5 Socioeconomic and Cultural Resources as potentially affected by the Project. Each resource section identifies a unique geographic analysis area. Geographic analysis area descriptions and maps are provided in Appendix E.

With regard to temporal extent, the DEIS assumes that potential construction effects generally diminish once construction ends; however, ongoing O&M activities could result in additional impacts for the 25-year life of the Project. Additionally, DWSF would have up to an additional 2 years to complete conceptual decommissioning activities. Therefore, the DEIS considers the time frame beginning with construction and ending when the Project's conceptual decommissioning is complete, unless otherwise noted. DEIS figures called out in Chapter 3 are available in Appendix C (Figures C-1 through C-31), Appendix E (Figures E-1 through E-17), and Appendix F (Figures F-1 through F-7) unless otherwise noted.

The DEIS uses the following duration terms:

- Long-term effects: Effects that last for a long period of time (e.g., years, decades, or longer). An example would be the loss of habitat where a foundation has been installed.
- Short-term effects: Effects that extend beyond construction but that are not long term. An example would be clearing of onshore shrubland vegetation during construction; the area would be revegetated when construction is complete, and once revegetation is successful, this effect would end.
- Temporary effects: Effects that end as soon as the activity ceases. An example would be the displacement of wildlife caused by construction noise. Once construction noise stopped, the effect would end.

In accordance with previous 1978 NEPA regulations (40 CFR 1508.27), the DEIS evaluates Project impacts based on the criteria of context and intensity. Impact levels described in BOEM's 2007 *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS 2007) were used as the initial basis for establishing adverse impacts specific to each resource. These resource-specific adverse impact levels were then further refined based on scientific literature and best professional judgment and are presented by resource in Sections 3.3 to 3.5.

When evaluating beneficial impacts and assigning an overall impact to each resource and when considering all evaluated factors, BOEM used a more general impact definition. Table 3.1.1-1 and Table 3.1.1-2 provide the definitions of potential adverse impact levels and potential beneficial impact levels, respectively, that are used for overall impact determinations across all resources in the DEIS. Where directionality (e.g., adverse or beneficial) is not specifically noted, the reader should assume the impact is adverse. Furthermore, to help comply with the page limits in the Department of the Interior's Secretary's Order 3355, BOEM has focused the main body of the EIS on the impacts for resources of most concern and moved the analysis of other resources, including all resources consisting of only negligible to minor Proposed Action impacts, to Appendix H.

BOEM can only approve a COP, after determining that the activities proposed therein, or selected alternatives identified as part of this NEPA process, are consistent with Section 8(p)(4) of OCSLA, 30 CFR Part 585, and the terms of the Lease, including the prevention of interference with reasonable uses of the exclusive economic zone. This determination is made at the ROD stage.

3.1.1 Definitions of Potential Adverse and Beneficial Impact Levels

Table 3.1.1-1. Definitions of Potential Adverse Impact Levels

Impact Level	Physical, Biological, and Cultural Resources	Socioeconomic Resources
Negligible	Either no effect or no measurable impacts	Either no effect or no measurable impacts
Minor	Most adverse impacts on the following affected resource(s) could be avoided; OR impacts that could occur would be small and the affected resource would recover completely without remedial or mitigating action, including the following: Local ecosystem health The extent and quality of local habitat for both special-status species and species common to the Lease Area The richness or abundance of local species common to the Lease Area Air or water quality Cultural resources	Most adverse impacts on the affected activity or community could be avoided; impacts would not disrupt the normal or routine functions of the affected activity or community; or the affected activity or community would return to a condition with no measurable effects without remedial or mitigating action.
Moderate	A notable and measurable adverse impact on the following affected resource(s) could occur, some of which may be irreversible; OR the affected resource would recover completely when remedial or mitigating action is taken, including the following: Local ecosystem health The extent and quality of local habitat for both special-status species and species common to the Lease Area The richness or abundance of local species common to the Lease Area Air or water quality Cultural resources	Mitigation would reduce adverse impacts substantially during the life of the Project, including conceptual decommissioning; the affected activity or community would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts of the Project; or once the impacting agent is gone, the affected activity or community would return to a condition with no measurable effects, when remedial or mitigating action is taken.
Major	A regional or population-level impact on the affected following resource(s) could occur; AND the affected resource would not fully recover, even after the impacting agent is gone and remedial or mitigating action is taken, including the following: Ecosystem health The extent and quality of habitat for both special-status species and species common to the Lease Area Species common to the Lease Area Air or water quality Cultural resources	Mitigation would reduce adverse impacts somewhat during the life of the Project, including conceptual decommissioning; the affected activity or community would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the Project; and the affected activity or community may retain measurable effects indefinitely, even after the impacting agent is gone and remedial action is taken.

Table 3.1.1-2. Definitions of Potential Beneficial Impact Levels

Impact Level	Biological, Cultural, and other Physical Resources	Socioeconomic Resources
Negligible	Either no effect or no measurable impacts	Either no effect or no measurable impacts
Minor	Small and measurable effects that would comprise one of the following: Improvement in ecosystem health Increase in the extent and quality of habitat for both special-status species and species common to the Lease Area Increase in populations of species common to the Lease Area Improvement in air or water quality Limited aerial extent or short-term temporal duration of improved protection of cultural resources	Small and measurable effects that would comprise one of the following: Improvement in human health Benefits for employment Improvement to infrastructure/facilities and community services Economic improvement Benefit for tourism or cultural resources
Moderate	Notable and measurable effects comprising one of the following: Improvement in local ecosystem health Increase in the extent and quality of local habitat for both special-status species and species common to the Lease Area Increase in individuals or populations of species common to the Lease Area Improvement in air or water quality Extensive/complete aerial extent, or long-term temporal duration of, improved protection of cultural resources	Notable and measurable effects comprising one of the following: Improvement in human health Benefits for employment Improvements to facilities/infrastructure and community services Economic improvement Benefit for tourism or cultural resources
Major	Regional or population-level effects comprising one of the following: Improvement in the health of ecosystems Increase in the extent and quality of habitat for both special status and commonly occurring species Improvement in air or water quality Permanent protection of cultural resources	Large local, or notable regional effects comprising one of the following: Improvement in human health Benefits for employment Improvements to facilities and community services Economic improvement Benefit to tourism or cultural resources

3.2 MITIGATION IDENTIFIED FOR ANALYSIS IN THE ENVIRONMENTAL IMPACT STATEMENT

During the development of the DEIS, BOEM considered potential additional mitigation measures that could further avoid, minimize, or mitigate impacts on the physical, biological, socioeconomic, and cultural resources assessed in this document. Table G-2 in Appendix G describes these potential additional mitigation measures and the subsequent Chapter 3 sections analyze them separately by resource. BOEM may choose to incorporate one or more additional mitigation measures in the record of decision. As discussed previously, all DWSF-committed measures are part of the Proposed Action (see Section 2.1.1.6 for details).

3.3 PHYSICAL RESOURCES

3.3.1 Air Quality

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to air quality from implementation of the Proposed Action and other considered alternatives.

3.3.2 Water Quality

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to water quality from implementation of the Proposed Action and other considered alternatives.

3.4 BIOLOGICAL RESOURCES

3.4.1 Bats

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to bats from implementation of the Proposed Action and other considered alternatives.

3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish

3.4.2.1 Affected Environment

The regional waters off the coast of Rhode Island, Massachusetts, and Long Island, New York, are a transitional zone separating Narragansett Bay and Long Island Sound from the OCS (BOEM 2013). These waters straddle the Mid-Atlantic and New England ecoregions and provide a diverse and abundant fish assemblage in the region. The species evaluated as possibly present in the area of direct effects[6] (see Figure C-3) reflect the multiple fisheries management boundaries and the transitional nature of this portion of the OCS. The larger geographic analysis area used as part of some analyses is discussed in Appendix E. The SFWF overlaps Cox Ledge, an area of concern for fishery managers because it provides important habitat for commercially important species, including spawning habitat for Atlantic cod (*Gadus morhua*).

Table F-6 in Appendix F, Inspire Environmental (2020), and Section 4.0 in Stantec (2020) detail the factors that make up the baseline condition. BOEM and the applicant are currently working with NOAA to refine this baseline assessment as part of the EFH consultation. This information and analysis will be detailed in the EFH report and summarized in the FEIS.

3.4.2.1.1 BENTHIC HABITAT

Mid-Atlantic Regional Council on the Ocean (MARCO 2019), BOEM (Guida et al. 2017), NYSDEC (Nelson, Pope & Voorhis, LLC 2014), and DWSF (Fugro 2019a, 2019b; Stantec 2020) have conducted large-scale general benthic habitat mapping within the SFWF and along the SFEC corridor. Inspire Environmental (2020) has collected extensive side scan sonar and backscatter data to determine site-specific benthic habitat conditions as part of the EFH analysis. Inspire Environmental (2020) identified four benthic habitat types in the area of direct effects: 1) glacial moraine, 2) coarse sediment, 3) sand and muddy sand, and 4) mud and sandy mud.

[6] The area of direct effects for benthic habitat, EFH, invertebrates, and finfish includes the footprint of the SFWF and offshore SFEC and surrounding areas that could be measurably affected by Project construction and installation, O&M, and conceptual decommissioning. Short-term underwater noise from construction would create the largest area of potential Project effects to fish, invertebrates, and their habitat and is therefore used to define the maximum boundary of the area. Significant noise effects based on sound attenuation modeling could extend outward in a circle up to 8 miles from each SFWF monopile foundation, in a semicircle extending 0.5 mile from the Long Island shoreline adjacent to the SFEC sea-to-shore transition, and up to 0.1 mile from vessels burying the offshore SFEC (see Figure C-3). This analysis of direct effects encompasses coastal nearshore habitats in waters abutting eastern Long Island and ocean habitats in the RI/MA WEA on the OCS, adjacent to New York, Rhode Island, and Massachusetts.

For the purposes of analysis, these four habitat types are consolidated into two groups: 1) complex habitat and 2) non-complex habitat (Figure 3.4.2-1). Groups were based on substrate sizes and composition and by their use by marine organisms. Glacial moraine and coarse sediment are categorized under complex habitat because boulders, cobbles, and pebbles dominate the sea floor in these areas, along with finer material (e.g., pebbles in a sand matrix), thus providing a heterogeneous variety of hard surfaces and fine material that provide habitat for many different species. Sand and muddy sand and mud and sandy mud areas are categorized under non-complex habitat because they do not include a substantial portion of coarse-grained sediment.

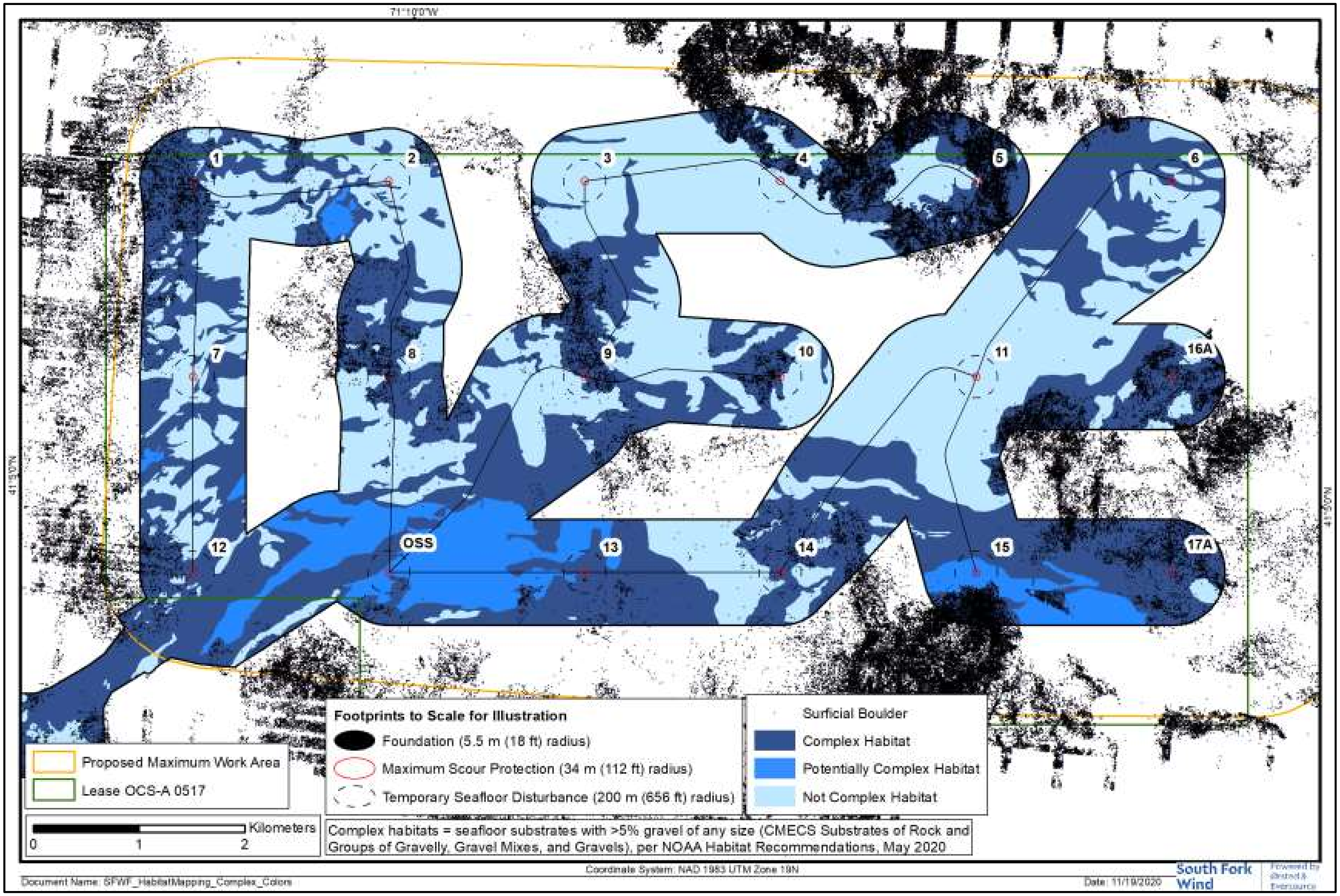


Figure 3.4.2-1. Layout of the proposed wind farm overlain on habitat in the Lease Area. Habitat boundaries may be refined in the final environmental impact statement.

However, it is important to note that within an area categorized as non-complex habitat there may be scattered (e.g., patchy) areas of complex habitat. Inspire Environmental (2019a, 2019b, 2020) provides photographic examples of these habitat types.

3.4.2.1.2 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on activities that could adversely affect EFH. NOAA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA 2004, 2018). EFH-listed species, managed through fishery management plans (FMPs) by the New England and Mid-Atlantic Fishery Management Councils (NEFMC and MAFMC, respectively), are known to occur near the SFWF and SFEC (NEFMC 2018; MAFMC 2018). In addition, highly migratory species, managed through an FMP by NMFS, are known to occur near the SFWF and SFEC (NOAA 2019). BOEM has prepared an EFH assessment for the Project (BOEM 2020a). The EFH assessment provides detailed species descriptions and life history information. In summary, EFH has been designated for the following species or management groups (MARCO 2019):

- Northeast multispecies, e.g., Atlantic cod, haddock (*Melanogrammus aeglefinus*), Atlantic pollock (*Pollachius virens*), and summer flounder (*Paralichthys dentatus*)
- Shellfish, Atlantic sea scallop (*Placopecten magellanicus*), Atlantic surfclam (*Spisula solidissima*), and ocean quahog (*Arctica islandica)*
- Monkfish (*Lophius americanus*)
- Atlantic herring (*Clupea harengus*)
- Skates (Rajidae)
- Small-mesh species, e.g., silver hake (*Merluccius bilinearis*) and red hake (*Urophycis chuss*)
- Bluefish (*Pomatomus saltatrix*)
- Mackerel (*Scomber scombrus*), squids (Decapodiformes), and butterfish (*Peprilus triacanthus)*
- Highly migratory species, e.g., tunas (Thunnini), swordfish (*Xiphias gladius)*, sharks (Selachimorpha), and billfish (Istiophoridae)
- Atlantic salmon (*Salmo salar*)
- Tilefish (Malacanthidae)
- Red crab (*Chaceon quinquedens*)
- Scup (*Stenotomus chrysops*) and black sea bass (*Centropristis striata)*
- Spiny dogfish (*Squalus acanthias*)

To call attention to high-priority EFH, NOAA and fishery management councils also identify habitat areas of particular concern (HAPCs). HAPCs are high-priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. The designated HAPCs present in the area of direct effects are specific habitats for summer flounder and juvenile Atlantic cod. These HAPCs are defined by the presence of specific habitat types wherever they occur within designated EFH rather than a discrete area. Summer flounder HAPCs include "all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes (i.e., submerged aquatic vegetation [SAV]) in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH" (MAFMC et al. 1998). HAPCs for juvenile Atlantic cod occur between the mean high-water line and a depth of 66 feet (20 meters) in rocky habitats, in SAV, or in sandy habitats adjacent to rocky and SAV habitats for foraging from Maine through Rhode Island.

The NEFMC approved designating portions of Cox Ledge as special habitat management areas to protect EFH for a number of managed fish species. NOAA acknowledged the importance of Cox Ledge because of its habitat value, but disapproved this designation because the habitat protection measures that were approved by the NEFMC would not have been effective in minimizing the habitat impacts of fishing (NEFMC 2018; NOAA 2017a). BOEM is currently funding a 3-year study (study #AT-19-08) of commercial fish species use of the SFWF and surroundings conducted by NMFS and a team of state resource agency, university, and non-profit organizations (NOAA 2020a). The outcome of this study will inform future management decisions about Cox Ledge and surroundings.

3.4.2.1.3 INVERTEBRATES

For the purposes of the DEIS, marine invertebrates are grouped into two categories: 1) soft-sediment invertebrates and 2) hard-surface invertebrates. Soft-sediment invertebrates prefer the softer sediments defined in Section 3.4.2.1.1 as non-complex habitat species. Soft-sediment invertebrates create a permanent or semi-permanent home in the substrate; they move slowly over the sediment surface but are not capable of moving outside of the boundaries of the subclass within 1 day. Most of these invertebrates possess specialized organs for burrowing, digging, embedding, tube-building, anchoring, or locomotion in soft substrates. Soft-sediment invertebrates include oligochaetes, polychaetes, flatworms [Platyhelminthes], and nematodes [Nematoda]); burrowing amphipods, mysids, and copepods; crabs (Brachyura); sand dollars (Clypeasteroida); starfish (Asteroidea); and sea urchins (Echinoidea) (Federal Geographic Data Committee 2012; Inspire Environmental 2019a; Stantec 2020). Economically important species, including Atlantic sea scallop, bay scallop (*Argopecten irradians*), horseshoe crab (*Limulus polyphemus*), Atlantic surfclam, squid, and ocean quahog, are also associated with soft sediments.

Hard-surface invertebrates prefer harder substrate (such as boulders) and cobbles (defined in Section 3.4.2.1.1) as complex habitat. Hard-surface invertebrates include species that are firmly attached, crawling, resting, interstitial, or clinging. Attached invertebrates could be found on, between, or under rocks or other hard substrates or substrate mixes. These invertebrates use pedal discs, cement, byssal threads, feet, claws, appendages, spines, suction, negative buoyancy, or other means to stay in contact with the hard substrate, and may or may not be capable of slow movement over the substrate. Attached invertebrates include sea anemones, barnacles, corals, mussels, oysters, crabs, small shrimp, amphipods, starfish, and sea urchins (Federal Geographic Data Committee 2012; Inspire Environmental 2019a). Economically important species, notably American lobster (*Homarus americanus*; also referred to as lobster) and squids, are associated with hard substrates. These hard-substrate areas serve as important nursery habitat for juvenile lobster and as substrate upon which squid lay their eggs.

Both soft-sediment invertebrates and hard-surface invertebrates would be present within complex habitats. Although soft-sediment invertebrates would dominate non-complex habitats, hard-surface invertebrates could be present on scattered hard surfaces within the non-complex habitat area. As stated above, detailed benthic habitat mapping is underway, and BOEM will work closely with NMFS during the EFH consultation process to quantify impacts to benthic habitat, which will then be used to analyze impacts to invertebrates. This analysis will be included in the EFH assessment and summarized in the FEIS.

Invertebrates with commercial importance, such as lobster, Atlantic sea scallop, squid, and ocean quahog, are present in the SFWF and offshore SFEC (Inspire Environmental 2019a), and bay scallop, lobster, channeled whelk (*Busycotypus canaliculatus*), and ocean quahog are present within the Montauk O&M facility site (Stantec 2020). Squid eggs were observed in two locations within the SFWF, and longfin inshore squid (*Doryteuthis pealeii*) is present within Lake Montauk (Inspire Environmental 2019a; Stantec 2020. There is a permanent shellfish closure area at the Montauk O&M facility (6 New York Code: Rules and Regulations 41). Disturbance of benthic invertebrate communities by commercial fishing activities can impact community structure and diversity and limit recovery (Nilsson and Rosenberg 2003; Rosenberg et al. 2003).

3.4.2.1.4 FINFISH

Numerous species of finfish belonging to the demersal, pelagic, and shark assemblages occur in and near the RI/MA WEA and the Montauk O&M facility. BOEM summarizes recent surveys of finfish species occurrence in the RI/MA WEA (Guida et al. 2017), and Table 4.3-11 of the COP provides a summary of common habitat types for finfish species that could occur in the SFWF and SFEC. Stantec (2020) summarizes recent surveys of finfish species in Lake Montauk, and Table 2 in Appendix A of COP Stantec (2020) provides a summary of common habitat types for finfish species that could occur in the Montauk O&M facility. See the EFH assessment prepared for the Project (BOEM 2020a) for additional detail on fish species occurrence in the area of direct effects.

Five ESA-listed fish species occur in the waters of the Northwest Atlantic OCS: giant manta ray (*Manta birostris*), Atlantic salmon, oceanic whitetip shark (*Carcharhinus longimanus*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and shortnose sturgeon (*Acipenser brevirostrum*). Oceanic whitetip sharks are not known to occur in the Lease Area; the only portion of the area of direct effects that overlaps with their distribution is the open ocean waters that may be transited by vessels from Europe. Vessel strikes are not identified as a threat in the status review (Young et al. 2017). BOEM has no information to suggest that vessels in the ocean have any effects on this species; therefore, BOEM does not expect any effects to this species even if individuals co-occur with Project vessels. Only the giant manta ray and Atlantic sturgeon are expected to occur in the area of direct effects and potentially experience Project effects. Refer to the Project BA (BOEM 2020b) for a detailed assessment of the potential effects on these species.

The giant manta ray is a pelagic fish, is closely related to sharks, and is typically found in oceanic waters south of the SFWF and SFEC. However, manta rays travel long distances during seasonal migrations, and the northern extent of their range may extend to upwelling waters at the edge of the continental shelf break immediately south of the SFWF. The Atlantic sturgeon is a large, demersal, estuarine-dependent, anadromous species that historically spawned in medium to large rivers on the U.S. Atlantic Coast from Labrador to Florida (Atlantic Sturgeon Status Review Team 2007). Five separate distinct population segments of Atlantic sturgeon were listed under the ESA in 2012 (NOAA 2012): Chesapeake Bay (endangered), Carolina (endangered), New York Bight (endangered), South Atlantic (endangered), and Gulf of Maine (threatened). Atlantic sturgeon originating from rivers in Canada are currently not listed. The current range of the Atlantic sturgeon distinct population segments within marine waters extends from Labrador Inlet, Labrador, Canada, to Cape Canaveral, Florida (NOAA 2012).

Demersal species (groundfish) spend their adult life stage on or close to the ocean bottom. They are generally considered to be high-value fish, and many species are sought by both commercial and recreational anglers. Squid, another high-value commercial fishery resource, are dependent on demersal substrates for reproduction because they attach their eggs to bottom substrates. Within nearby Narragansett Sound, demersal fish community structure has been changing over the past 6 decades, with some demersal species declining (winter flounder, whiting, and red hake), whereas others have increased (Atlantic butterfish, scup, and squid) (Collie et al. 2008).

Pelagic fishes are generally schooling fish that occupy the mid- to upper water column as juveniles and adults. Some species are highly migratory and are reported to be present in the near-coastal and shelf surface waters of the Southern New England-New York Bight in the summer, taking advantage of the abundant prey in the warm surface waters. Pelagic species occupy the surface to midwater depths (0 to 3,281 feet [0 to 1,000 meters]) from the shoreline to the continental shelf and beyond.

Pelagic finfish species are characterized as estuarine, marine, or anadromous species. Estuarine species tend to reside in nearshore areas with reduced salinities (e.g., where rivers enter the ocean), whereas marine species are found offshore in deeper waters and include species such as yellowfin tuna (*Thunnus* *albacares*), bluefin tuna (*Thunnus thynnus*), bluefish, swordfish, blue shark (*Prionace glauca*), common thresher shark (*Alopias vulpinus*), and shortfin mako shark (*Isurus oxyrinchus*). Anadromous species prefer both nearshore and offshore areas but migrate up rivers to lower salinity environments to spawn. Juvenile anadromous species leave coastal rivers and estuaries to enter the ocean where they grow and mature prior to returning to freshwater habitat to spawn. Five pelagic species of anadromous fish could be present in the area of direct effects: American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), Atlantic menhaden (*Brevoortia tyrannus*), and the Atlantic herring (*Clupea harengus*) (BOEM 2013; Petruny-Parker et al. 2015; Scotti et al. 2010). Two demersal species of anadromous fish could be present: striped bass (*Morone saxatilis*) and Atlantic sturgeon. The catadromous American eel (*Anguilla rostrata*) also occurs as larvae, juvenile glass eels migrating to freshwater, and adults migrating to spawning habitats in the Sargasso Sea. Continental shelf habitats are important for larval and juvenile metamorphosis, migration, feeding, and growth (ASFMC 2000).

3.4.2.2 Environmental Consequences

3.4.2.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.2-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this EIS.

Table 3.4.2-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Underwater noise</td><td>Extent, frequency, and duration of noise above established effects thresholds, as noted below:
Benthic habitat: not applicable
Invertebrates: egg and larvae impact: 210 dB_{RMS}
Juveniles and adults: qualitative*
Finfish: Table 3.4.2-3</td><td rowspan="8">Negligible: No measurable impacts to species would occur.
Minor: Most impacts to species could be avoided with EPMs; if impacts occur, the loss of one or a few individuals of a population could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate: Impacts to species are unavoidable but would not result in population-level effects.
Major: Impacts would affect the viability of the population and would not be fully recoverable, even if DWSF applies mitigation.</td></tr>
<tr><td>Seabed and water column alteration</td><td>Affected water column and acres of seabed disturbance, loss, or conversion</td></tr>
<tr><td>Direct mortality</td><td>Estimated extent of burial/crushing of invertebrates from Project construction and recolonization rates</td></tr>
<tr><td>Increased erosion</td><td>Estimated increase in suspended sediments from scouring at base of structure foundations and recolonization rates</td></tr>
<tr><td rowspan="2">Water quality impacts</td><td>Quantitative estimate of intensity and duration of suspended sediment effects</td></tr>
<tr><td>Qualitative analysis of potential discharges (fuel spills, trash, and debris) relative to baseline</td></tr>
<tr><td>Artificial light</td><td>Intensity, frequency, and duration relative to baseline conditions</td></tr>
<tr><td>Power transmission</td><td>Theoretical extent of detectable electromagnetic field effects above established effects thresholds, as noted below:
Benthic habitat/EFH: Not applicable
Invertebrates: 10,000 milligauss
Finfish: qualitative*</td></tr>
</table>

* No published methods, significance criteria, or effect thresholds identified. Qualitative assessment of effects based on probability of exposure and magnitude, extent, and duration of impact mechanism relative to baseline conditions.

Note: dB_{RMS} = root mean square decibels.

3.4.2.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing benthic habitat, EFH, invertebrates, and finfish species and habitat trends from past and present activities. Attachment 3 in Appendix E also provides additional information regarding past and present activities and associated species impacts. Future non-Project actions include offshore wind development activities, tidal energy projects, dredging and port improvement projects (see Appendix E). and future marine transportation and fisheries use and management. Attachment 3 in Appendix E also discloses future non-offshore wind activities and associated species impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Accidental releases and discharges: Offshore wind-energy development could result in the accidental release of water quality contaminants or trash/debris (see Section 3.3.2.2.2 [No Action Alternative] for quantities and details). Hazardous materials that could be released include fuels, lubricating oils, and other petroleum products. These materials tend to float in seawater, so are unlikely to contact benthic or other sea floor resources. Compliance with USCG regulations would also minimize the risk of accidental release of trash or debris. Therefore, the volumes of contaminants, trash, or debris potentially released accidentally would be negligible and not measurably contribute to potential adverse impacts in the geographic analysis area. Another potential impact related to vessels and vessel transit includes the release of invasive species during discharge of ballast and bilge water. However, vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and EPA National Pollutant Discharge Elimination System Vessel General Permit standards, which would reduce the likelihood of discharge of ballast or bilge water contaminated with nonnative species and those nonnative species becoming established as a result of offshore energy related vessel activities.

Anchoring and new cable emplacement/maintenance: Up to 262 acres could be affected by anchoring/mooring activities during offshore wind energy development. These activities would increase turbidity and could result in direct mortality of benthic, finfish, and invertebrate resources and/or degradation of sensitive habitats, including EFH. However, impacts would be temporary, minor, and localized, and species would recover in the short term, although degradation of sensitive habitats could persist in the long term.

Future offshore wind projects could disturb up to 7,951 acres of seabed (both complex and non-complex habitat) while installing associated undersea cables, increasing suspended sediment and potentially disturbing, displacing, or injuring benthic habitat, finfish, and invertebrates. This disturbance would be localized, minor, and temporary and would represent less than 1% of total available benthic habitat (941,526 acres) within the geographic analysis area. Benthic resources would recover in the short term. However, if routes intersect eelgrass or hard-bottom habitats, impacts could be long term or permanent.

EMF: Under the No Action alternative, up to 5,779 miles of cable would be added in the geographic analysis area, producing EMF in the immediate vicinity of each cable during operations. Submarine power cables are assumed to have appropriate shielding and burial depth to reduce potential EMF from cable operation to low levels, thereby reducing potential EMF related impacts to negligible levels. When submarine cables are laid, installers typically maintain a minimum separation of at least 330 feet from other known cables to avoid inadvertent damage during installation. This separation distance ensures that there are no additive EMF effects from adjacent cables.

Population-level impacts on finfish, invertebrates, and EFH have not been documented for EMF from alternating current (AC) cables (CSA Ocean Sciences Inc. and Exponent 2019; Thomsen et al. 2015). However, behavioral impacts have been documented for benthic species, such as skates and lobsters, near operating direct current (DC) cables (Hutchison et al. 2018). In the case of lobster, the effects included subtle changes in activity (e.g., broader search areas and a tendency to cluster near the EMF source). Skates exhibited significant changes in behavior in the form of increased exploratory searching and slower movement speeds near the EMF field. EMFs do not appear to present a barrier to animal movement. Burrowing infauna may be exposed to stronger EMFs, but scientific data are limited. A review of the available literature revealed no documented long-term impacts from EMFs on clam habitat as a result of the existing power cables connecting Nantucket Island to mainland Massachusetts. There is no evidence to indicate that EMF from undersea AC power cables adversely affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences Inc. and Exponent 2019).

Impacts would be highly localized and undetectable beyond the immediate vicinity of the cables, but localized effects would persist as long as the cables are in operation. Most exposures are expected to be of short duration, lasting minutes, and the affected area would represent an insignificant portion of the available habitat for most migratory species, many of which travel several miles a day (CSA Ocean Sciences Inc. and Exponent 2019).

Light: Artificial light can attract finfish and invertebrates and can disrupt their natural cyclical activity, e.g., spawning. Offshore wind development would result in additional temporary artificial light from construction vessels and long-term artificial light from an additional 2,050 offshore WTGs and OSS foundations. These lighting sources would not be downward directed toward the water surface. Construction vessels would also follow BOEM guidelines for lighting. Therefore, the amount of light penetrating the sea surface would be minimal and would not impact finfish, invertebrates, or EFH. Artificial lighting would not be expected to impact benthic habitat, due to depth of water where artificial light would be used.

Noise: Numerous offshore wind project construction periods could overlap between 2022 to 2030 (see Appendix E). Construction of these projects would generate underwater noise via activities such as pile driving, geological and geophysical (G&G) survey activities, O&M, and trenching/cable burial. Pile driving would result in the greatest potential impacts. Noise generated during pile driving can be transmitted through water and/or through the seabed, and can cause injury and mortality, result in moderate, short-term stress and behavioral changes to finfish and invertebrates, and cause EFH to be unsuitable while pile driving is occurring.

The radius for finfish and invertebrate behavioral impacts is approximately 13.4 miles from each foundation. The extent of potential benthic habitat disturbance from pile driving that could result in sessile mortality would be approximately 0.9 acre per foundation. Based on the anticipated number of foundations within the geographic analysis area, approximately 1,896 acres of benthic habitat would be disturbed and the risk of injury or behavioral impacts to invertebrates and finfish would cover approximately 7,000 square miles. This area would completely overlap the estimated area of foundations and foundation scour protection.

Noise impacts could be greater if they occur in important spawning habitat, occur during peak spawning periods, and/or result in reduced reproductive success in one or more spawning seasons, which could result in long-term effects to populations if one or more year classes suffer suppressed recruitment. Atlantic cod and squid are known to spawn in the area of direct effects. Recent studies on the behavioral impacts of pile-driving noise on black sea bass and longfin squid have shown behavioral responses to elevated underwater noise, but behavior returns to a pre-exposure state after the cessation of the underwater noise (Jones et al. 2020; Shelledy et al. 2018). Stanley et al. (2020) determined peak sound sensitivity in black sea bass at 150 hertz (Hz; range of 100 to 200 Hz), significantly lower sensitivity at 80 Hz, and the fish responded to stimuli up to 1,000 Hz. This is a typical detection range for fish without bony structures in their ears to amplify sound. Black sea bass are somewhat atypical of fish in general in that hearing sensitivity appears to decrease with size and age. Stanley et al. (2020) concluded that although wind farm construction and operational noise would overlap with the species' detection ability, the effects of noise exposure would be limited. Importantly, the authors found little to no evidence that black sea bass use acoustic communication outside of spawning events, so operational noise would unlikely affect normal behavior. Although construction noise, specifically impact pile driving, could affect communication during spawning, Stanley et al. (2020) assumed that black sea bass would return to normal spawning behavior once the construction-related underwater noise ceases. Underwater noise associated with other sources, such as G&G survey activities, O&M, and trenching/cable burial, could result in temporary behavioral changes but would not result in adverse impacts to benthic resources.

Port utilization: Port expansions or increased use could increase the total amount of disturbed habitat or vessel traffic. However, existing ports have already affected finfish, invertebrates, and EFH by temporarily displacing finfish and invertebrates, disturbing habitats, and permanently converting habitats. Additionally, BOEM anticipates that future port expansions would implement BMPs (e.g., storm water management, turbidity curtains) to further minimize impacts. Therefore, the degree of impacts on finfish, invertebrates, and EFH would be undetectable outside the immediate vicinity of the affected port.

Presence of structures: The addition of up to 2,050 new WTG and OSS foundations in the geographic analysis area could result in hydrodynamic disturbance, fish aggregation, increased entanglement of lost fishing gear, habitat conversion, and migration disturbances.

Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016; Cazenave et al. 2016; Stegtnan and Christakos 2015). During summer when water is more stratified, increased mixing could increase pelagic primary productivity near the structure. However, the presence of new hard surfaces combined with changes in productivity could result in increased abundance of filter feeders, such as mussels that colonize the structure surfaces, which could consume much of the increased primary productivity (Slavik et al. 2019). Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish that are at the southern or inshore extent of the range of suitable temperatures. Finfish aggregate trends along the mid-Atlantic shelf have been shifting northeast, into deeper and cooler waters (NOAA 2020b): the presence of structures may reinforce these trends. However, changes to local oceanographic and atmospheric conditions caused by the presence of offshore structures would impact benthic habitat, EFH, invertebrates, and finfish locally, and impacts would vary seasonally and regionally.

Hydrodynamic disturbance is a topic of emerging concern because of potential effects on the Mid-Atlantic Bight cold pool. This cold pool is a seasonal oceanographic feature that provides important ecological functions for fish and other marine species by providing habitat and through its influence on regional biological oceanography (Chen 2018; Lentz 2017). Changes in the size and seasonal duration of the cold pool over the past 5 decades have been associated with shifts in the fish community composition of the Mid-Atlantic Bight (Chen 2018; Saba and Munroe 2019). The Lease Area and neighboring WEAs are located on the approximate northern boundary of the cold pool. The potential for wind farm development to affect cold pool dynamics is a topic of emerging interest and ongoing research (Changsheng Chen et al. 2016). The presence of wind turbine structures could reduce wind-forced mixing of surface waters and increase vertical mixing of water forced by currents flowing around the foundations (Carpenter et al. 2016; Cazenave et al. 2016; Schultze et al. 2020). During summer stratification, increased mixing could increase pelagic primary productivity in local areas. However, if the increased productivity is consumed by filter feeders, such as mussels that colonize the structure surfaces, then changes in productivity may not translate into effects on finfish and commercially important invertebrates (Slavik et al. 2019). Increased mixing may also result in warmer bottom temperatures, which may increase stress on some shellfish and fish that are using habitat to the extent of their temperature tolerance. Impacts on finfish and invertebrates from potential changes to local oceanographic and atmospheric conditions caused by the presence of offshore structures are expected to be localized, and likely to vary seasonally and regionally.

Structures could attract some fish species, resulting in increased predation on benthic resources and/or attracting other prey species near the structures. New structures may subsequently and indirectly also increase recreational and commercial fishing efforts nearby. These increased fishing efforts, associated with structures attracting certain fish species, may also adversely impact benthic habitat, EFH, invertebrates, and finfish because gear may be damaged or lost near structures, or may be moved into the vicinity by currents. Damaged and lost fishing gear caught on the structures may result in ghost fishing or other disturbances. Impacts from fishing gear would be localized; however, the risk of occurrence would remain as long as structures remain. Additionally, species may alter their migratory behaviors in response to underwater noise generated by Project construction and operations, or by the presence of food or shelter associated with the structures. The potential for disruption of inshore to offshore migratory patterns of important species like lobster and black sea bass has been identified as a topic of concern (Petruny-Parker et al. 2015) and is a subject of ongoing research (e.g., Stanley et al. 2020).

The dominant habitat type in the region is soft bottom. Structures would create new hard surfaces that could provide new habitat for hard-bottom species like blue mussel (*Mytilus edulis*) and sea anemones (Actiniaria), as seen at the BIWF (Kerckhof et al. 2019; HDR 2019a). Although structures would create hard surfaces, these hard surfaces may not function as fully as natural hard-bottom substrates. Species that rely on soft-bottom habitat, such as surfclams and longfin squid, would experience a reduction in favorable conditions. However, the impacts from structures are not expected to result in population-level impacts (Guida et al. 2017). The potential effects of wind farms on offshore ecosystem functioning has been studied using simulations calibrated with field observations (Raoux et al. 2017; Pezy et al. 2018; Wang et al. 2019). These studies found increased biomass for benthic fish and invertebrates. This indicates that offshore wind farms could generate some beneficial impacts on local ecosystems.

<u>Sediment deposition and burial and seabed profile alterations</u>: As previously noted, under the No Action alternative, up to 5,779 miles of cable would be added in the geographic analysis area. Cable placement and maintenance activities (including dredging) would disturb sediments and cause sediment suspension. Based on modeled total suspended solids (TSS) levels and burial depths for offshore Project construction (Fugro 2019a, 2019b), these effects would likely last for 1 to 6 hours at a time, after which the sediment would resettle on the seafloor. Sediment disturbance and resettlement could impact eggs and larvae, particularly demersal eggs such as longfin-squid eggs, which have high rates of mortality if egg masses are exposed to abrasion. The area with a cumulatively greater sediment disturbance from simultaneous or sequential activities would be insignificant because the areas of sediment disturbance would result in light sediment deposition and resettlement (less than 0.04 inch [1 millimeter]) (Vinhateiro et al. 2018) and would recover relatively quickly.

Dredged material disposal during construction would cause localized effects. In disposal areas with soft bottoms, these effects are expected to include short-term negligible increases in turbidity and long-term sedimentation and burial of benthic organisms at the disposal site. In disposal areas with hard bottoms, these effects are expected to also include short-term, negligible increases in turbidity and long-term sedimentation and burial of organisms at the disposal site, but also have the potential to convert hard-bottom habitats to soft-bottom habitats, depending on the disposal material composition.

Dredging can cause localized, minor short-term impacts (habitat alteration, injury and mortality of finfish and invertebrates, changes in benthic habitat complexity) on benthic resources through seabed profile alterations and through sediment deposition. Dredging typically occurs only in sandy or silty habitats, which are abundant in the analysis area and are quick to recover from disturbance (Dernie et al. 2003; Desprez 2000). Therefore, seabed profile alterations, although locally intense, would have little impact on benthic resources in the geographic analysis area.

Climate change: Global climate change could alter ecological characteristics of benthic habitat, EFH, invertebrates, and finfish, primarily through increasing water temperatures. Finfish distribution has been shifting northeast, further from shore and into deeper waters (NOAA 2020b). This shift is linked to increasing surface heatwaves and bottom temperatures experienced shelf-wide. Warmer water may influence finfish and invertebrate migration and may increase the frequency or magnitude of disease (Brothers et al. 2016; Hoegh-Guldberg and Bruno 2010). Ocean acidification, also a function of climate change, is contributing to reduced growth or the decline of invertebrates that have calcareous shells (PMEL 2020). Furthermore, climate change is impacting nearshore habitats through unprecedented freshwater input into estuarine environments resulting in compromised water quality and mortality events for native finfish and invertebrate species, as well as the spread of nonnative species into nursery habitats (NOAA 2020b).

Other considerations: Adult and subadult endangered Atlantic sturgeon are expected to occur in offshore waters within the geographic analysis area throughout the year, but appear to be present in lower numbers in the summer (Savoy and Pacileo 2003; Stein et al. 2004). Dunton et al. (2015) caught sturgeon as bycatch in waters less than 50 feet deep during the New York summer flounder fishery, and Atlantic sturgeon occurred along eastern Long Island in all seasons except for the winter. Ingram et al. (2019) studied Atlantic sturgeon distribution using acoustic tags and determined peak seasonal occurrence in the offshore waters of the OCS from November through January, whereas tagged individuals were uncommon or absent from July to September. The authors reported that the transition from coastal to offshore areas was predictably associated with the photoperiod and river temperature, which typically occurred in the fall and winter months. The threatened giant manta ray is expected to occur in the offshore waters south of the SFWF, within upwelling waters at the edge of the continental shelf break. All impacts on finfish and EFH discussed above could also apply to Atlantic sturgeon, giant manta ray, and their habitat. The most prominent impact for Atlantic sturgeon and giant manta ray is expected to be noise from pile driving. Giant manta rays have rarely been identified in the fisheries data in the Atlantic; thus, it is assumed that populations within the Atlantic are small and sparsely distributed (NOAA 2017b). However, should giant manta rays be within the area of direct effects during pile driving, they could be exposed to pile-driving noise.

Potential impacts associated with regulated fishing are addressed in Section 3.5.1.2.2 (No Action Alternative).

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on benthic habitat, EFH, invertebrates, and finfish species associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on benthic habitat, EFH, invertebrates, and finfish species.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts to benthic habitat, EFH, invertebrates, and finfish species because the overall effect would be notable, but the resource would be expected to recover completely.

3.4.2.2.3 PROPOSED ACTION ALTERNATIVE

Table 3.4.2-2 summarizes potential short-term and long-term benthic habitat disturbance by offshore Project components (CH2M HILL 2018). As stated previously, Inspire Environmental (2020) has collected extensive side-scan sonar and backscatter data to determine site-specific benthic habitat conditions. BOEM will work closely with NMFS during the EFH consultation process to quantify impacts to benthic habitat by types (i.e., complex and non-complex). This information and analysis will be included in the EFH report and summarized in the FEIS.

Table 3.4.2-2. Short-Term and Long-Term Benthic Habitat Disturbance by Project Component

Project Component	Project Component Acres	Short-Term Disturbance		Long-Term Disturbance	
		Acres	%	Acres	%
SFWF	13,700*	814.8†	5.9%	126.8	0.9%
SFEC	4,944‡	618.7	12.5%	179.3	3.6%
O&M facility	0.9	0.9	0%	0.007	0.8%
Total	**18,644**	**1,731.2**	**9.3%**	**306.1**	**1.6%**

* Acreage of SFWF Lease Area.

† Includes conservative estimate on the total area disturbed by vessel anchoring, but it is expected that only 4.5 acres of benthic habitat disturbance by vessel anchors occurs at a time.

‡ Area defined by a 330-foot suspended sediment disturbance area around the 61.8-mile combined SFEC offshore and SFEC NYS corridors.

Construction and Installation

Benthic Habitat

Temporary disturbance within the SFWF associated with pile driving, placement of scour protection, boulder removal/relocation, and the inter-array cable would occur for approximately 60 days over a 4-month construction window. These activities would disturb the seabed, temporarily exclude the use of benthic habitat by fish and invertebrates within the footprints of vessel anchors and foundations, and release suspended sediments into the water column. Once constructed, the presence of up to 15 WTG foundations, one OSS foundation, and scour protection around the foundations and segments of the inter-array cable would result in direct, long-term changes to benthic habitat. These long-term impacts would affect up to 354.8 acres of bed surface within the SFWF. Along the SFEC and inter-array cable routes, the cable burial method would be dependent on suitable seabed conditions and sediments. The SFEC and inter-array cable paths would be sited to avoid boulder fields and other hard-bottomed habitats where practicable. Large boulders that cannot be avoided would be relocated from the cable path to maintain their habitat value. The cable would be buried using a self-propelled mechanical trenching plow, a mechanical cutter, or a jet plow to create a trench along the seabed, in which the cable is simultaneously laid and buried in a single pass. The cable burial methods would result in an increase in suspended sediments and an increase in the water content (i.e., the ratio of the mass of fluid to the mass of solids) within the trench. Cable segments that cannot be buried due to subsurface conditions would be laid on the surface under a protective layer of rock or concrete.

Although active construction would temporarily disturb benthic habitat, benthic habitat would rapidly return to pre-Project conditions in non-complex habitats after burial is complete (HDR 2020). Complex habitats may take longer to recover but would still recover (HDR 2020). Suspended sediments would resettle and return to pre-construction conditions within 1.4 hours, and measurable suspended sediment pulses would not extend beyond 300 feet from either side of the cable path (Vinhateiro et al. 2018). Heat from the buried SFEC and inter-array cables could affect some benthic organisms and sediment biochemistry, but the magnitude and significance of heat effects on the benthic habitat function remain subjects of ongoing study (Taormina et al. 2018). Most of the cable would be buried into the anaerobic zone below the substrate layers inhabited by invertebrates and bottom-dwelling fish.

Temporary disturbance within the SFEC would occur for approximately 74 days over a 12-month construction window. Cable burial, placement of cable protection, vessel anchoring, temporary cofferdam placement, and construction within the temporary cofferdam at the sea-to-shore transition would temporarily impact approximately 573 acres, or 11.5% of the 4,944-acre SFEC. In areas where the cable transitions from being buried under the surface to having a protective layer placed could result in habitat conversions from soft bottom to hard surface. Fish and mobile invertebrates within this short-term disturbance footprint would be temporarily displaced, although it should be noted that mobility does not preclude mortality or non-lethal effects from suspended sediments. Immobile organisms may be injured or killed. Invertebrate recovery rates would range from recovering quickly to taking years, depending on the species.

Hydroplowing would also release suspended sediments into the water column. These sediments would gradually disperse and settle out onto the seafloor, with coarse material settling rapidly and finer material dispersing more widely. The amount of suspended sediment dispersed in any given area would be small, limiting the potential for burial of benthic organisms. Sediment dispersal modeling for the Project predicted that deposition depths in habitats surrounding the cable path would be less than 0.05 inch (below the resolution of the model) along most SFEC lengths. Deposition of up to 0.5 inch could occur in a few areas, totaling approximately 4.3 acres, scattered along the cable path (Vinhateiro et al. 2018). Burial depths of this magnitude would have negligible effects on fish and invertebrates. Soft substrates are widespread throughout the area of direct effects and are naturally mobile, and bottom-oriented fish and invertebrates are well adapted to periodic suspended sediments and sediment deposition. These species are therefore unlikely to be adversely affected by burial depths this small. Because the projected effects of Project construction would be short term and minimal in extent and magnitude, the associated adverse effects on benthic habitat conditions are considered negligible.

In areas where seabed conditions might not allow for cable burial to the desired depth, other methods of cable protection would be employed, such as articulated concrete mattresses or rock covering. DWSF may need up to 179.3 acres of cable protection for the SFEC (Inspire Environmental 2020), or 3.6% of the SFEC. In these areas, the hard surfaces would be impacted by burial from the cable protection material, another hard surface. Recovery rates of these disturbed surfaces would depend on species present and protection material. Concrete mattresses are not colonized as effectively as rock (HDR 2020). How well the protection mimics the existing substrate may dictate the recovery rate and thus, habitat value and functions provided by the protection material used. However, over time, hard surfaces are expected to become colonized by sessile invertebrates and other benthic organisms, providing similar habitat functions as existing cobble and boulder substrates. These long-term effects make up a small percentage of the area of direct effects and, given that the affected area would still provide habitat benefits, the resulting effect on benthic habitat function would be minimal. Thus, direct, long-term adverse impacts to benthic habitat from cable burial would be negligible to minor, although local impacts to complex habitat may be moderate. Post-construction, benthic habitat would recover to conditions similar to the existing baseline. Therefore, potential adverse impacts to benthic habitat from the conversion of soft bottom to hard bottom are considered minor.

Temporary disturbance of the seabed at the Montauk O&M facility associated with dredging, bulkhead improvements, bank stabilization, and potential pile installation in support of the addition of vessel berths may last for up to 5 months over a 12-month construction window. Initial construction dredging and annual maintenance dredging within the 0.86-acre area would be repeated annually. These activities would disturb the seabed, temporarily exclude the use of benthic habitat by fish and invertebrates within the footprints of the dredging and dewatered areas, and release suspended sediments into the water column. Vibratory pile-driving activities would occur concurrent with dredging activities to minimize the duration of disturbance. The bulkhead over-sheeting would convert a small area (< 0.007 acre) of existing habitat from soft bottom to a hard vertical surface. The affected habitat represents less than 0.8% of the O&M facility construction footprint. Dredging of the berths and navigational channel would occur only within a previously dredged footprint and would not substantially change existing patterns of disturbance and associated effects on benthic habitat. Turbidity and deposition of disturbed sediments from pile-driving and dredging activities are anticipated to be disbursed to baseline conditions within one or two tide cycles (Stantec 2020). Turbidity plumes from dredging of the main navigational channel are anticipated to mimic turbidity levels during natural storm events and would be comparable to turbidity generated by propwash from existing vessel traffic (USACE 2019). Because the impacts on benthic habitat generated by construction and operation of the Montauk O&M facility would not differ substantively from existing patterns of disturbance, the resulting effects on benthic habitats would be negligible to minor.

Essential Fish Habitat

The Project's EFH assessment provides a detailed analysis of potential effects to EFH (BOEM 2020a) and is summarized here. Project impacts to waters designated as EFH are discussed in Section 3.3.2 Water Quality. As discussed, Project construction would result in short-term, negligible adverse impacts to water quality from suspended sediments released during hydroplowing and boulder relocation. Construction is not expected to affect HAPCs for summer flounder (i.e., HAPC is limited to areas of SAV) because DWSF would take measures to avoid all SAV during construction. EPMs described in Table G-1 in Appendix G are also planned to ensure HDD pits would be located to avoid SAV. Some minor adverse impacts to EFH are anticipated from the long-term conversion of soft bottom to hard bottom by the monopile foundations and scour and cable protection. These Project features would slightly increase EFH for species that use hard-bottom substrates (e.g., black sea bass) and slightly decrease EFH for species that prefer soft-bottom substrates (e.g., flounders) (Jacobs 2020). Although hard-bottom substrates would slightly increase, these hard surfaces are artificial and do not provide the same ecological benefits as natural hard-bottom substrates (Kerckhof et al. 2019; HDR 2019b). The use of natural materials and nature-inclusive designs would increase the probability of recolonization by benthic organisms and use of the introduced substrate as habitat. Micrositing of WTGs and cable routes would also reduce impacts to EFH.

Although these effects on EFH are unavoidable, the proposed habitat modifications represent a fraction of the area of direct effects. However, the Project may have localized effects on habitat availability and habitat suitability for some EFH species. Localized impacts to EFH that are not abundant or widespread could have a greater effect on that particular EFH compared to impacts to EFH that are abundant within the area. Overall effects on EFH would be negligible to minor.

Project construction would also affect EFH by generating short-term and long-term underwater noise impacts. The nature and significance of these impacts are described in the following sections as they pertain to fish and invertebrates.

Invertebrates

Construction of the SFWF, SFEC, and Montauk O&M facility would result in potential impacts due to 1) habitat alteration; 2) direct mortality; 3) changes in water quality; 4) potential discharges, spills, and trash; 5) noise; and 6) artificial lighting.

Habitat alteration: Cable trenching, vessel anchoring, and boulder relocation during Project construction would temporarily disturb bottom substrates. Scars on the seabed from anchoring disturbance are expected to recover to baseline conditions within 18 months to 2 years, based on post-construction monitoring at the nearby BIWF (HDR 2018). Seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for rapid recolonization (MMS 2009a). Boulder relocation is described in the COP and includes using a dragging technique that would have similar impacts as trenching. Therefore, substrates from drag scars are expected to recover in time frames similar to trenching and jet plowing. Although recovery to baseline conditions is expected to occur quickly, actual recovery rates will vary depending on habitat types and local processes.

Employing EPMs listed in Table G-1 in Appendix G, such as establishing no-anchor areas in sensitive areas (e.g., squid spawning sites), would minimize short-term adverse impacts to invertebrates. Boulder relocation would be carefully executed to minimize damage to colonizing organisms. The disturbed boulder surfaces would recolonize over time, likely regaining full habitat function.

Long-term changes to benthic habitat within the SFWF, SFEC, and Montauk O&M facility would result from the conversion of approximately of soft-bottom benthic habitat to hard-bottom (e.g., steel piles, rock scour protection, bulkhead improvements) habitat. This change would reduce the amount of available habitat for soft-sediment invertebrates while increasing habitat for the hard-surface invertebrates. Additionally, impacts to hard-surface invertebrates from the addition of hard surfaces (e.g., cable protection) would not change the habitat type, but would result in temporary impacts to individuals and predators until the area could recolonize. These new hard substrates may provide favorable habitat for invasive species to colonize before native species colonize (Langhamer 2012).

The conversion of 0.007 acre of benthic habitat in Montauk Harbor from soft bottom to hard surfaces represents less than 1% of this component of the area of direct effects and would not substantively change invertebrate community composition within these limits. Because the long-term effects of each Project element make up such a small percentage of the area of direct effects, and the affected areas would provide suitable habitat for attached fauna, impacts to invertebrates from long-term habitat alteration are considered negligible.

Direct mortality: Direct mortality of invertebrates would occur from burial during jet plowing, crushing during construction of foundations and laying of cable, crushing and burial by boulder relocation and placement of scour and cable protection, and disturbance or smothering during dredging activities at the O&M facility. Because most invertebrates in the area of direct effects generally reach reproductive maturity quickly and are adapted to a dynamic environment, the macroinvertebrate community would recover quickly through dispersal and recolonization from the abundant soft-bottom habitat adjacent to disturbed areas within the SFEC, SFWF, and Montauk O&M facility footprints. Disrupted infaunal communities typically recover in 6 to 18 months (Dernie et al. 2003; Desprez 2000) through dispersal from adjacent areas if the impacted area is not disturbed during the re-colonization period. Although mortality of some individual invertebrates is anticipated, these impacts would not be significant at the population level, and would not measurably alter the environmental baseline. Dredging of the berths and navigation channel at the Montauk O&M facility would occur only within a previously dredged footprint and would not substantially change existing patterns of disturbance and associated effects on benthic invertebrates. It may take longer for invertebrate species associated with hard-substrate/complex habitat to recover from individual mortality events than for species associated with soft-bottom habitats.

Regardless of habitat type, there is a range of recolonization rates, with opportunistic species colonizing initially, and larger, longer lived species slower to recover. Therefore, adverse impacts to invertebrates from direct mortality are considered negligible.

Water quality: Impacts to water quality from construction of the Project addressed in detail in Section 3.3.2 Water Quality. These impacts are summarized here to assess potential associated effects on fish and invertebrates. Project construction would generate suspended sediment that could cause mobile invertebrates to temporarily leave the immediate area. Immobile invertebrates within a 4.3-acre area surrounding the cable-laying hydroplow activity could be exposed to suspended sediment pulses. Elevated suspended sediment can temporarily interfere with feeding, causing stress to invertebrates (Johnson 2018). However, the extent and magnitude of these effects would be limited and within the range of baseline variability in the area of direct effects.

Dredging activity at the Montauk O&M facility would occur only within a previously dredged footprint and would not substantially change existing patterns of sediment disturbance and associated water quality effects on benthic infauna. Elevated TSS levels could extend as far as 330 feet from hydroplowing, with measurable sediment deposition within 26 feet of the cable burial routes (13 feet either side of centerline). Burial depths would be less than 0.05 inch in most affected habitats. Depths could reach up to 0.5 inch in a few scattered areas. These areas would total approximately 4.3 acres (Vinhateiro et al. 2018). Invertebrates like burrowing bivalve clams and burrow-forming amphipods are highly tolerant to burial (Gingras et al 2008; Johnson 2018). More sedentary invertebrates that cannot move within the sediment column as quickly, such as tube-dwelling polychaetas, could exhibit stress or mortality if buried (Johnson 2018). However, burial depths associated with stress are typically greater than those anticipated from the Project on the order of 2 inches or more). The deposition depths expected to result from the Project are much smaller and comparable to those that naturally occur in an environment with mobile bed conditions. Therefore, the macroinvertebrate community is not expected to experience widespread adverse effects from suspended sediment deposition, and should any such effects occur, the invertebrate community would recover quickly through dispersal and recolonization from adjacent, undisturbed habitat. Benthic infauna communities are generally resilient to and recover rapidly from short-term disturbance (Desprez 2000). Although temporary impacts from water quality effects are anticipated, these impacts would not measurably affect invertebrates at the population level (see Table F-11 in Appendix F and Section 4.3.2 in Stantec 2020). Therefore, water quality impacts to invertebrates are considered negligible.

Potential discharges, spills, and trash: 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 250.300). 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 risk to benthic invertebrates from trash and debris from the Project is negligible.

Construction vessels also pose a potential risk for Project-related accidental spills. Small spills could occur during fuel transfers or collisions with other vessels or structures. DWSF would follow strict oil spill prevention and response procedures during all Project phases, effectively avoiding the risk of significant spills. Given the low potential for spills and minimal risk of exposure to small, temporary spills, the risk from construction-related petroleum spills is negligible.

Noise: Increased noise associated with construction of the SFWF, SFEC, and the O&M facility (e.g., noise from pile driving, dredging, and dynamic positioning vessels) could impact invertebrates. The susceptibility of invertebrates to human-made sounds is unclear, and there is currently insufficient scientific basis to guide the setting of impact thresholds for invertebrate species (NOAA 2016a). Few studies have been conducted on the effect of noise on invertebrates (Carroll et al. 2016; Hawkins and Popper 2014; Weilgart 2018). Most available studies evaluate invertebrate response from noise sources such as air guns and tidal turbines, which create noise profiles that differ from the noise profiles anticipated to result from Project activities (e.g., impact pile driving, vibratory sheet pile driving, dredging, and dynamic vessel positioning) (Carroll et al. 2016; Hawkins and Popper 2014; Pine et al. 2012; Weilgart 2018).

Although there are no established noise thresholds for invertebrates during pile driving, Popper et al. (2014) recommend a noise threshold of less than 210 decibel (dB) sound exposure level (SEL) and less than 207 peak dB (dB_{PEAK}) for fish eggs and larvae. Because invertebrate egg and larvae have similar morphology to fish eggs and larvae, the fish egg and larvae threshold is used here as a reasonable surrogate threshold for impacts to invertebrate eggs and larvae.

Noise thresholds for adult invertebrates have not been developed because of a lack of available data. Crustaceans as a group are less sensitive to injury compared with vertebrate species because they lack internal air spaces and they have relatively dense body structure. As a consequence, they are less expected to experience injury from over-expansion or rupturing of internal organs, the typical cause of lethal noise-related injury in vertebrates (Popper et al. 2001). Most invertebrates lack the organs required to sense sound pressure in the same manner that hearing organs and lateral lines allow marine mammals and sea turtles, and fish to hear, respectively. Some invertebrate groups can, however, sense vibrations, or particle motion, through and the water or through contact with the substrate. Current research suggests that only certain invertebrate species groups, such as cephalopods (e.g., octopus, squid), crustaceans (e.g., crabs, shrimp), and some bivalves (e.g., scallops, ocean quahog) are capable of sensing sound through particle motion (Carroll et al. 2016; Edmonds et al. 2016; Hawkins and Popper 2014). Particle motion effects dissipate rapidly and are highly localized around the noise source. Studies of the effects of intense noise sources on invertebrates, similar in magnitude to those expected from Project construction, found little or no measurable effects even in test subjects within 1 meter of the source (Edmonds et al. 2016; Payne et al. 2007). Jones et al. (2020) evaluated squid sensitivity to high-intensity impulsive sound comparable to monopile installation. They observed that squid displayed behavioral responses to particle motion effects within 2 meters of high-intensity noise sources, and theorized that intense particle motion exposure could have indirect effects (e.g., impaired ability to detect predators or prey) on squid close to noise sources. Additional research is necessary to determine the likelihood and significance of such effects.

Loud noise resulting from pile-driving activities would create vibrations in nearby substrates that are expected to elicit a disturbance response in nearby invertebrates, potentially causing retraction or discontinuation of feeding activity. These impacts are anticipated to be temporary and intermittent, occurring only during active impact and vibratory pile driving. Collectively, the available evidence indicates that invertebrates are unlikely to be directly injured by noise and, although short-term indirect and behavioral could occur, these effects would be limited to individuals within the immediate vicinity of pile-driving activity (e.g., within a few meters). Although short-term noise impacts to individual invertebrates may occur, these impacts would not have a measurable effect on invertebrate populations. Therefore, adverse impacts to invertebrates from noise would be negligible to minor.

Light: Light is an important cue in guiding the settlement of invertebrate larvae (Davies et al. 2015). Artificial light can change the behavior of aquatic invertebrates, although the direction of response can be species and life stage specific. Currently there are no artificial lighting sources present in the SFWF or SFEC, except for periodic vessel transit. The O&M facility would be sited in a developed commercial moorage with existing artificial lighting. Lights would be required offshore platforms and structures, vessels, and construction equipment during construction of SFWF. Orr et al (2013) did not identify lighting impacts to benthic invertebrates. Although individual invertebrates could experience behavioral effects from vessel lighting during construction (e.g., squid being attracted to the lights), impacts are not expected to appreciably alter invertebrate populations because of the limited size of the lit area during construction and the depth of the water in the Lease Area. EPMs in COP Section 4.7-2 (Orr et al. 2013), such as lighting direction, would eliminate or reduce impacts to pelagic invertebrates. Any impacts would be short term. Therefore, adverse impacts to invertebrates from artificial lighting are considered negligible.

Finfish

Construction of the SFWF, SFEC, and Montauk O&M facility could result in potential impacts from 1) changes in water quality; 2) potential discharges, spills, and trash; 3) underwater noise; 4) vessel activity; 5) water withdrawal; and 6) artificial lighting. These impacts may affect individual fish but would not measurably impact any species at the stock or population level.

Water quality: The Project would result in temporary, elevated levels of suspended sediment in the immediate proximity of bed-disturbing activities like pile driving, dredging, placement of scour protection, trenching, cofferdam placement, and burial of the SFEC and inter-array cable. Because of the coarse material of the substrate, sediment would return to baseline conditions soon after any activity that suspends sediment (see Section 3.3.2.2.3 [Proposed Action Alternative] and Vinhateiro et al. [2018] and Stantec [2020]).

Increases in sediment suspension could result in abrasion of gill membranes, respiration impairment, impairment of feeding, or inhibition of migratory movements. Most marine species have some degree of tolerance to higher concentrations of suspended sediment because storms, currents, and other natural processes regularly result in increases in turbidity (MMS 2009b). Juvenile and adult life stages would temporarily avoid the area of increased TSS, resulting in behavioral changes such as changes in foraging behavior (Salo et al. 1980; Servizi 1988). The projected effects of elevated TSS on fish species in the area of direct effects are expected to be short term and limited in severity and extent. TSS levels are discussed in Section 3.3.2.2.3 (Proposed Action Alternative). Vibratory pile installation would use a turbidity curtain to minimize suspended sediments. Because proposed EPMs would minimize suspended sediment effects, and observed effects have been lower than predicted in Project modeling, the 330-foot effect buffer used here is likely a conservative overestimate of actual TSS effects. Given the limited extent and duration of the elevated TSS relative to baseline variability offshore, and the small footprint of dredging at the O&M facility, impacts to fish species would be minor.

Construction and operational EPMs (e.g., management of spills through oil spill response plans, compliance with regulatory requirements intended to prevent and control of accidental spills) are expected to avoid or minimize water quality impacts from accidental spills or releases of pollutants over the life of the Project. Therefore, the potential for adverse impacts to finfish from accidental spills is considered negligible.

Potential discharges, spills, and trash: Potential impacts from potential discharges, spills, and trash are the same as those discussed above in the Invertebrates section. In summary, BOEM and the USCG prohibit the discharge of trash and debris, and the Project EPMs (see Table G-1 in Appendix G) include specific measures for avoiding and minimizing accidental spills and discharges of hazardous substances. Therefore, there would be negligible Project-related adverse effects on fish in the area of direct effects from potential discharges, spills, and trash.

Noise: Project construction would generate underwater noise during impact pile-driving installation of the monopile foundations, vibratory installation of sheet piles for the SFEC sea-to-shore transition cofferdam and the bulkhead improvements at the O&M facility, and construction and dredging vessel operation. Vessel noise impacts are discussed in the following section. Noise impacts on fish would vary depending on the method of sound detection used by the animal. Fish are likely more sensitive to particle motion rather than to sound pressure levels (SPLs), a common measurement for noise. Unfortunately, standards for measuring and modeling particle motion are still a developing field of research (Hawkins and Popper 2017), and there are no agreed-upon thresholds for injury or behavioral effects for fish based on particle motion as there are for SPLs (NOAA 2016b). Therefore, noise impacts are analyzed using the standards and thresholds for SPLs, while acknowledging that impacts from particle motion are likely to occur.

Pile driving is the loudest potential underwater noise source associated with the Project and would produce the most extensive effects to fish. Impact and vibratory pile driving can produce high levels of underwater sound that can adversely affect a variety of aquatic species (Hastings and Popper 2005; Yelverton et al. 1973; Yelverton and Richmond 1981). Noise impacts on fish vary depending on the ability of the fish to detect sound pressure. Fish with a gas chamber involved in hearing (e.g., Atlantic herring and fish in the cod family) are the most susceptible, whereas those without swim bladders (e.g., sharks, rays, flatfish) are the least susceptible (Popper et al. 2014). Additionally, although eggs, larvae, sessile species, and less mobile species (i.e., whelks, longfin squid egg mops) are less sensitive than other fish species to pile-driving noise, they are more vulnerable because of their lack of motility.

Exposure to underwater noise can temporarily stun, injure, or kill individuals. Denes et al. (2020) modeled impacts likely to be created from construction to determine the distance to noise thresholds that could impact marine mammals, sea turtles, and fish near the Project. The radial distance within which injury could occur from driving an 11-m-diameter monopile with attenuation equipment (6-dB attenuation goal) and a hammer energy of 4,000 kilojoule (kJ) is provided in Table 3.4.2-3. The values shown reflect the maximum extent of potential effects from a "difficult" pile installation requiring double the number of anticipated hammer strikes to achieve the desired installation depth. The effect threshold distances for typical pile installation would be approximately 25% to 30% shorter. Although individual fish within these threshold distances may be injured or killed, adverse effects at the stock or population level are anticipated to be minor because pile-driving activity would be sporadic, the impact area would be small compared to the overall habitat and spatial distribution of fish in the region, and pile-driving noise would be short term (i.e., approximately 2 to 4 hours per 11-meter-diameter foundation per day). The values shown in Table 3.4.2-3 assume the use of noise attenuation systems capable of achieving a minimum 10 dB reduction in peak and cumulative noise exposure. The proposed EPMs include the use of the most effective attenuation system practicable for the Project environment, meaning that higher attenuation levels are likely achievable. Therefore, the effect of threshold distances shown here are likely a conservative overestimate of probable effects.

Table 3.4.2-3. Distance Required to Attenuate Underwater Construction Noise Below Finfish Injury and Behavioral Effect Thresholds by Species Group

Species Group	Threshold (dB)*			Distance to Single Strike Injury Threshold (feet)†	Distance to Cumulative Injury Threshold (feet)†	Distance to Behavioral Effect Threshold (feet)†
	Single (peak)	Cumulative (SEL)	Behavioral (RMS)			
Fish without swim bladder	213	219	150	94	394	41,818
Fish with swim bladder, no hearing involved	207	210	150	377	1,499	41,818
Fish with swim bladder, hearing involved	207	207	150	377	2,421	41,818
Fish < 2 grams	206	183	150	436	39,265	41,818
Fish > 2 grams	206	187	150	436	25,863	41,818

Note: RMS = root mean square; SEL = sound exposure level.

* Data from Popper et al. (2014).

† Data from Denes et al. (2020). Values reflect maximum possible effect from "difficult" pile installation, requiring double the number of strikes achieve desired installation depth using an IHC-4000 hammer with 10-dB attenuation.

Vessel traffic: Vessel traffic associated with the construction of the SFWF, SFEC, and Montauk O&M facility would not significantly alter the environmental baseline in the area of direct effects (DNV-GL 2018; Stantec 2020). SFWF and SFEC construction would involve 13 vessels, ranging in size from small inflatable support vessels to large derrick barges and cable-laying vessels, with construction occurring over a 1- to 2-year period. Large vessels would typically remain on-station during construction, supported by a smaller crew transfer vessel. This equates to an estimated 209.5 one-way trips per year. Vessel noise would not be loud enough to induce injury or mortality (MMS 2009c). Analysis of vessel noise related to the Cape Wind Energy Project found that noise levels from construction vessels at 10 feet were loud enough to induce avoidance, but not physically harm fish (MMS 2009c). Adverse impacts to fish from vessel noise are considered negligible.

Propeller boats and barges can also pose a mortality risk to fish that swim near the water surface. Vessel traffic could be a source of mortality for Atlantic sturgeon as a result of direct collisions with the hull or propeller (Brown and Murphy 2010). Most vessel-related sturgeon mortality is caused by large, deep-draft, transoceanic vessels, with less mortality caused by smaller vessels (Balazik et al. 2012; Brown and Murphy 2010). Because the construction vessels (tugboats, barge cranes, hopper scows) have relatively shallow drafts and the vessels and fish (within the SFWF and SFEC) are not confined to a narrow channel, vessel-related mortalities are unlikely. In addition, a variety of vessels, ranging from private pleasure craft and fishing boats to large cargo ships, travel through the area of direct effects on an annual basis. The additional vessel trips associated with the Project would not significantly alter the marine traffic baseline. Therefore, the adverse impact of vessel traffic to finfish is considered negligible to minor.

Water withdrawals: A jet plow would be used to install the SFEC and inter-array cables. The jet plow sucks water and pumps it below the surface of the seabed, which liquefies the seabed allowing the cables to be more easily buried. Water would be taken from near the bed surface, which could entrain eggs and larvae of finfish including flatfish species (e.g., windowpane flounder [*Scophthalmus aquosus*], winter flounder, witch flounder [*Glyptocephalus cynoglossus*], yellowtail flounder [*Limanda ferruginea*], and summer flounder), important commercial groundfish species (e.g., Atlantic cod, haddock, Atlantic pollock), and other recreationally and commercially important species (e.g., monkfish, Atlantic herring, Atlantic mackerel, silver hake, Atlantic butterfish). Mortality rates for entrained eggs and larvae are assumed to approach 100% (MMS 2009c). Species with demersal eggs (e.g., longfin squid, Atlantic wolffish [*Anarhichas lupus*], ocean pout [*Zoarces americanus*], winter flounder), which adhere to bottom substrate, would not be affected by the jet plow intake but would be directly exposed to bed disturbance as described above. The jet plow would move at a rate of approximately 1 to 2 miles per day along the SFEC and inter-array cable routes, withdrawing an estimated 1,674 cubic yards of sea water per hour or approximately 16,740 cubic yards per day (assuming a 12-hour work day). Based on the limited duration (i.e., 90 to 180 days) and extent of hydroplowing, entrainment impacts would affect a miniscule percentage of the water column habitat available for pelagic eggs and larvae in the area of direct effects. Moreover, because planktonic eggs and larvae experience very high mortality rates under natural conditions, the incremental effect of entrainment is likely insignificant relative to baseline conditions. On this basis, adverse impacts from water withdrawals are anticipated to be negligible to minor.

Light: Artificial lighting during construction at the SFWF and O&M facility would be associated with navigational and deck lighting on vessels from dusk to dawn. Lighting would be hooded and directed downward to avoid unnecessary illumination of the surrounding environment to the extent practicable. Reaction of finfish to this artificial light is highly species-dependent and could include attraction and/or avoidance of the area. Artificial lighting could disrupt the migration patterns of fish, and this could affect species richness and community composition (Nightingale et al. 2006). Artificial light could also increase the risk of predation and disrupt predator/prey interactions and result in the loss of opportunity for dark-adapted behaviors including foraging and migration (Orr et al. 2013). Because of the limited area associated with the artificial lighting used on support vessels relative to the surrounding unlit areas, the adverse impacts would be negligible and short term for benthic early life stages and negligible to minor for benthic adult life stages and pelagic juvenile and adult life stages during construction.

Operations and Maintenance and Conceptual Decommissioning

Benthic Habitat

Project O&M would have continuing effects on benthic habitat conditions throughout the life of the Project. Limited bed disturbance may be required for certain maintenance activities. Specifically, placement of additional scour protection may periodically be required to control erosion. Although unlikely, it may be necessary to replace segments of the inter-array or SFEC in the case of cable failure or accidental damage (e.g., by a vessel anchor). These maintenance activities would have similar adverse effects on benthic habitat to those described above for construction, but they would be periodic, limited in scale, and dispersed over a wide area. The vessel berth and navigation area at the Montauk O&M facility would require periodic dredging of 0.86 acre to maintain water depth for safe vessel access. This area has been routinely dredged, and maintenance dredging would continue as needed. Future maintenance dredging of the O&M facility would not significantly change the area and frequency of maintenance dredging activities in Lake Montauk harbor relative to baseline conditions. Maintenance effects to benthic habitat are therefore considered negligible.

The Project would alter existing benthic habitat, converting soft-bottom substrate to hard surfaces and vice versa. As stated previously, analysis of the types and qualities of these conversions is ongoing and will be completed during the EFH consultation and summarized in the FEIS. Scour protection would be required for the SFEC. Depending on the material used, the scour protection could produce a reef effect that would continue to develop throughout the life of the Project. Depending on depth, a mixture of kelp, coralline algae, and epibenthic organisms like mussels, anemones, bryozoans, and possibly invasive species would colonize the available hard surfaces, forming a reef-like habitat (HDR 2019b; Langhamer 2012; Taormina et al. 2018). As the reef matures, deposition of shell hash and other detritus is expected to build up around the monopile foundations (Causon and Gill 2018). Moreover, the presence of vertical structures in the water column creates turbulence that can transport nutrients upward toward the surface, increasing primary productivity at localized scales (Danheim et al. 2020). These changes have been reported to increase food availability for filter-feeders on and near the structures, which in turn leads to increased densities of mobile invertebrates (e.g., crabs, lobsters), attraction of pelagic and demersal fish, and foraging opportunities for marine mammals (Coates et al. 2014; Danheim et al. 2020; English et al. 2017). On the other hand, these hard surfaces also provide additional attachment points for nonnative species that may be brought through new shipping activities, and the organic enrichment can be detrimental if they occur in oxygen-deficient sediments (De Mesel et al. 2015; Wilding 2014). These effects would increase benthic habitat complexity around the structures. Benthic monitoring at the Block Island Wind Farm (BIWF) has found that mussels and other organisms have failed to colonize concrete mattresses, whereas other hard surfaces have seen rapid growth by mussels and other organisms (HDR 2019b). In general, this conversion of soft-bottom habitat to a more reef-like structure has potential minor benefits to the surrounding biological community.

Conceptual decommissioning of the SFWF and SFEC components would follow the same relative sequence and time frame as construction, but in reverse. The SFEC and inter-array cable would be removed from the seabed to recover valuable metals. Cable segments that cannot be removed successfully would be cut, capped, and buried. Rock and concrete blanket scour and cable protection would be removed and disposed of. The WTGs and OSS would be disassembled, and the foundation piles would be cut below the seabed using a cable saw. These conceptual decommissioning activities would produce short-term bed disturbance and suspended sediment effects similar to those described above for Project construction. The associated adverse effects on benthic habitat would be minor.

Conceptual decommissioning would reverse the artificial reef effect, converting approximately 50.2 acres (2.8% of the SFWF and SFEC footprints) from hard-bottom habitat back to soft-bottom habitat. Decommissioning effects on benthic habitat would be similar to those described above for construction. However, leftover shell hash and detritus from the reef effect would remain on the seabed after conceptual decommissioning. This would alter the character of the underlying sediments. Although this represents a long-term change from baseline conditions, localized alteration of sediment characteristics is unlikely to measurably change the ability of benthic habitat to support the biological community structure in the area of direct effects, which is relatively uniform across the diversity of substrate types that occur in the Lease Area (Guida et al. 2017). Therefore, the post-decommissioning adverse effects of the Project on benthic habitat would be negligible.

Essential Fish Habitat

Project O&M and conceptual decommissioning would have minimal impacts to EFH. The types and magnitude of effects would be similar to the vessel noise and bed disturbance effects described for Project construction, except that maintenance activities would occur sporadically and would be far more limited in extent and duration. Most offshore maintenance activities would be conducted by crews transported to the WTGs and OSS. Although unlikely, maintenance may include placement of additional scour protection around the WTG foundations if necessary. No additional offshore pile driving is anticipated. Periodic maintenance dredging and pile driving may be required to at the Montauk O&M facility over the lifetime of the Project. Although unlikely, sections of the SFEC or inter-array cable may need to be replaced if damaged. Should this occur, the damaged cable segment would be excavated by a remotely operated vehicle and pulled to a surface vessel. The damaged segment would be removed and a replacement segment would be spliced in. These activities would produce impacts of similar magnitude but lesser duration and extent than those generated during Project construction and would have negligible to minor short-term impacts on EFH.

The conversion of 176 acres of soft-bottom habitat to hard-bottom habitat and the presence of the WTG monopiles would create an artificial reef effect. Initially, these structures would locally alter the composition of EFH in portions of the Lease Area, increasing the amount of habitat available for species that prefer hard-bottom habitat (e.g., Atlantic cod and American lobster), and decreasing the amount of habitat for species that prefer soft-bottom habitat (e.g., summer flounder and Atlantic surfclam). However, as the reef community ages and matures, biodiversity is likely to increase, producing additional beneficial habitat effects for some species (Causon and Gill 2018). For example, mussel bed formation on monopiles would provide complex habitat with abundant shelter and feeding opportunities for small fish and invertebrates, which in turn would provide prey resources for larger fish (Causon and Gill 2018).

The converted hard-bottom habitat could impact EFH by modifying local hydrodynamics, potentially affecting the transport and dispersal of pelagic eggs and larvae (Causon and Gill 2018). However, in the case of the SFWF, significant hydrodynamic effects are unlikely because the monopile foundations would be widely spaced. NMFS (2006) concluded that hydrodynamic effects of the much-larger Vineyard Wind offshore wind facility, which proposes many more similarly spaced WTGs, would be highly localized and insignificant at the regional scale.

EFH for summer flounder, winter flounder, or juvenile Atlantic cod in Lake Montauk could be affected by periodic maintenance dredging of approximately 0.84 acre at the O&M facility. This facility and the adjacent navigation channel are routinely dredged to maintain vessel access, and this activity would continue into the future whether or not the Project is developed. Therefore, dredging of the O&M facility would not substantially change existing patterns of disturbance and associated effects on EFH. Although sediment suspension and re-distribution during maintenance dredging could have short-term localized impacts on water quality, these effects would be similar to those that occur under the existing maintenance dredging regime. Although SAV beds near the O&M facility may be exposed to short-term pulses of suspended sediments from maintenance dredging, the presence and persistence of these beds under the existing dredging regime suggest that Project-related water quality impacts on this component of EFH would be negligible. Neither summer flounder HAPC (i.e., SAV beds) nor juvenile cod HAPC (i.e., rocky substrates shallower than 20 m) occur within the footprint of the O&M facility; therefore, no significant impacts to HAPCs are anticipated from Project O&M.

Project conceptual decommissioning would follow the same relative sequence and time frame as construction and installation, but in reverse. Conceptual decommissioning of the SFWF would not require pile driving. After the WTGs and OSS are removed, the monopile foundations would be cut below the bed surface using a cable saw. Pangerc et al. (2016) found that underwater noise levels produced by this type of equipment are difficult to distinguish from the associated construction vessel noise and are below levels that would cause injury or behavioral effects on fish or invertebrates. Therefore, the effects of Project conceptual decommissioning on EFH would be negligible to minor.

Collectively, the combined effects of Project O&M and conceptual decommissioning on EFH are potentially beneficial or adverse, depending on the species of interest and site-specific conditions. Given the relatively small scale of potential maintenance activities or operational impacts relative to the size of the area of direct effects, the adverse effects of these Project activities on EFH are anticipated to be minor.

Invertebrates

Operation of the SFWF and SFEC would result in an emission of an electromagnetic field (EMF) from the inter-array cable and SFEC. Exponent Engineering, P.C. (2018) modeled anticipated EMF levels generated by the Project. They estimated induced magnetic field levels ranging from 13.7 to 76.6 milligauss (mG) on the bed surface above the buried and exposed SFEC cable, and 9.1 to 65.3 mG above the buried and exposed inter-array cable, respectively. Induced field strength would decrease effectively to 0 mG within 25 feet of each cable. By comparison, the earth's natural magnetic field is more than five times the maximum potential EMF effect from the Project (see Figure F-7 in Appendix F). Background magnetic field conditions would fluctuate by 1 to 10 mG from the natural field effects produced by waves and currents. These results indicate that the Project would produce minimal adverse EMF effects that would become indistinguishable from natural variation within 25 feet of the cable path. Schultz et al. (2010) and Woodruff et al. (2012, 2013) conducted experiments exposing American lobsters and Dungeness crabs (both male and female) to EMF fields ranging from 3,000 to 10,000 mG. Lobsters and crabs exhibited a high level of variability in both space use and behavior within the experimental tanks regardless of the EMF treatment, suggesting that the EMF was not affecting their behavior. In contrast, Hutchison et al. (2018) detected behavioral responses in American lobsters exposed to magnetic fields ranging from 497 to 653 mG. However, although the authors noted some behavioral responses, the test lobsters did not appear to alter their overall movement patterns or distribution relative to the field. The findings of these studies suggest that Project-related EMF could result in minor behavioral impacts to individual lobsters and crabs. However, this conclusion may overestimate potential behavioral effects because the EMF levels used in these studies were one to two orders of magnitude larger than the largest effect expected to result from the Project.

EMF levels would be highest at the seabed and in the water column above the cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Invertebrates in proximity to these areas could experience detectable EMF levels and associated behavioral effects. These unburied cable segments would be short (less than 100 feet) and widely dispersed. EMF levels generated by this limits the potential for widespread behavioral effects on large numbers of individuals, so population-level EMF impacts on lobsters, crabs and other mobile invertebrate species are not anticipated. Therefore, effects to invertebrates from EMF are considered negligible.

The reef effect created by hard structures (SFWF monopiles, scour protection around the monopile foundations, transmission cable armoring, etc.) would last throughout Project O&M. The potential effects on invertebrates would be similar to those described above under the Benthic Habitat and Essential Fish Habitat sections. Epibenthic organisms (e.g., mussels and anemones) and crustaceans that prefer hard-bottom habitat (e.g., American lobster and crab) would gain habitat. Hard surfaces could also provide colonizing surfaces for nonnative species, increases in sediment organic content, and nutrient enrichment due to the deposition from the community that attaches to the hard surfaces (Coates et al. 2014; Danheim et al. 2020; De Mesel et al. 2015). Species that prefer soft-bottom habitats (e.g., Atlantic surfclam, tube worms, and other burrowing organisms) would lose a small amount of suitable habitat. This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on invertebrates. As the reef community ages and the effect matures over time, biodiversity is expected to increase, producing additional minor beneficial habitat effects for some species (Causon and Gill 2018). These hard structures can also be viewed as fish aggregating devices because of their ability to attract pelagic and demersal fish that are structure-oriented (Kramer et al. 2015). For example, mussel bed formation on monopiles would provide complex habitat with abundant shelter and feeding opportunities for small invertebrates and would increase the surface area available for attachment by epibenthic organisms. This mix of habitat changes implies the potential for both adverse and beneficial effects, depending on the species and could result in a net beneficial effect from an overall increase in biodiversity. Fish congregating around fish aggregating devices can attract recreational fishing activity. Kramer et al. (2015) determined that fish aggregating device structures can act like a small-scale artificial reef attracting high densities of fish. The authors cautioned that the full extent and significance of these effects were unclear and required additional study.

Operations and conceptual decommissioning of the Montauk O&M facility would include increased crew transfer vessel traffic to and from the facility; however, both are considered negligible additions to the background traffic conditions within Lake Montauk. Project maintenance of the Montauk O&M facility and effects on invertebrates would be similar to those described above under the Benthic Habitat and Essential Fish Habitat sections. The vessel berth and navigational channel have been routinely dredged, and maintenance dredging would continue as needed. Annual maintenance dredging is anticipated, which would not substantially change existing patterns of sediment disturbance and associated water quality effects on benthic infauna. Maintenance effects to invertebrates would therefore be considered negligible to minor.

SFWF and SFEC maintenance and conceptual decommissioning effects on invertebrates would be similar to those described above under the Benthic Habitat and Essential Fish Habitat sections. Removal of the monopiles and scour protection would injure or kill invertebrates attached to the surfaces or hiding in interstitial spaces. Once removed, invertebrates that remain may or may not survive if they are unable to disperse to suitable habitats. These adverse effects would be localized, short term, and limited to individual organisms in the decommissioning footprint. The surrounding invertebrate community would be expected to quickly recolonize the new available habitat. Therefore, the adverse effects of conceptual decommissioning on invertebrates would be negligible to minor.

Finfish

The ongoing presence of monopiles, their foundations, and scour protection during Project O&M within the SFWF and SFEC would create an artificial reef effect. Initially, these structures would shift substrate conditions in localized areas of the Project footprint from soft bottom to hard bottom. Fish species that prefer hard-bottom habitat (e.g., Atlantic cod) would gain habitat, whereas species that prefer soft-bottom habitat (e.g., summer flounder) would lose a small amount of suitable habitat. This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding. However, as the reef community ages and the effect matures over time, biodiversity is expected to increase, producing a range of beneficial habitat effects for fish, as described above in the Essential Fish Habitat section. These beneficial reef effects would be localized around each structure.

The SFEC and inter-array cables would induce electric and magnetic fields directly above the seabed and within 50 feet of the cable along the length of the cables during operation. The strongest magnetic fields would occur close to the cable and would decrease rapidly with distance (Exponent Engineering, P.C. 2018). These effects would also be most intense where the SFEC cannot be buried and is laid on the bed surface covered by an armoring blanket, which does not provide as much shielding as burying the cable 6 feet below the seabed.

Available evidence suggests that most marine finfish species do not sense EMF at the levels associated with offshore renewable energy projects. Exponent Engineering, P.C. (2018) modeled anticipated EMF levels and determined that the Project would produce induced magnetic fields ranging from 13.7 to 76.6 mG on the bed surface above buried and exposed cables, respectively, diminishing to 0 mG within 25 feet. These levels are within the range of natural baseline conditions and would unlikely affect fish health or behavior. The magnetite-based sensory organs of fish are expected unable to detect AC magnetic fields below 50 mG (Normandeau et al. 2011), meaning that even the most sensitive fish would only be able to detect EMF in the limited areas where the cables lie on the bed surface. Even when detectable, these EMF effects may not be high enough to affect fish behavior. For example, Armstrong et al. (2015) and Orpwood et al. (2015) found that magnetic fields up to 950 mG had no measurable effect on Atlantic salmon and eel behavior.

Certain fish species are highly sensitive to electrical fields and could be more susceptible to Project-related EMF effects. For example, Atlantic sturgeon have specialized electrosensory organs capable of detecting electrical fields on the order of 0.5 millivolts per meter (mV/m) (Normandeau et al. 2011). Exponent Engineering, P.C. (2018) calculated that the maximum induced electrical field strength from the SFWF inter-array cable and the SFEC would be below the detection threshold for this species. However, this analysis only considered EMF from cable segments buried 6 feet below the surface. Based on relative magnetic field strength, the induced electrical field in cable segments that are covered by armoring blankets is expected to exceed the 0.5-mV/m threshold. This suggests that Atlantic sturgeon would be able to detect the induced electrical fields in immediate proximity to those cable segments. Sturgeon species have been reported to respond to low-frequency AC electric signals, but insufficient information is available to associate exposure with significant behavioral or physiological effects (Gill et al. 2012). The electrical field around blanketed cable segments would be within the range of natural electrical field effects generated by wave and current actions.

Elasmobranchs (e.g., skates, rays, and sharks) are capable of detecting EMF, but it is unclear if they can discern human-made EMF from the earth’s natural magnetic field (Hutchison et al. 2018). Studies show that skates react to EMF produced by DC cables by slowing their swimming speed, swimming closer to the seabed, and making wider turns (Hutchison et al. 2018).

BOEM has evaluated the potential sensitivity of commercially and recreationally important fish and invertebrate species to likely EMF levels generated by commercial wind farm transmission cables on the OCS (CSA Ocean Sciences Inc. and Exponent 2019). They determined that most fish species would not be measurably affected by transmission cable EMF, and those species that are able to detect EMF would not experience significant physiological or behavioral effects. The Project would limit the potential for EMF effects as a function of design. All cables would be contained in grounded metallic shielding to prevent detectable direct electric fields and minimize EMF effects. Cable burial to a target depth of approximately 6 feet would reduce EMF below detectable levels for most fish species. Although EMF may be detectable to certain sensitive fish species in select locations where cables lie on the bed surface, the exposed cable segments would be short and widely distributed. This would limit the number of individuals exposed to potential behavioral effects and the duration of exposure. Based on these findings, EMF effects on finfish are likely to be negligible.

Project O&M would generate underwater noise with the potential to cause behavioral effects on finfish. Noise sources would include continuous sound generated by the WTGs, maintenance vessel traffic, and maintenance dredging at the Montauk O&M facility. Vessel traffic and maintenance dredging would have similar impacts to construction phase impacts. However, O&M would typically require smaller vessels and less overall vessel traffic. Therefore, the associated noise effects would be of lesser magnitude but would occur intermittently over the lifetime of the Project. As discussed above for Project construction, the effects of vessel noise on fish would be minor.

Offshore WTGs produce audible underwater noise mostly in lower frequency bands. Typical noise levels range from 110 root mean square decibels (dB_{RMS}) to 130 dB_{RMS}, sometimes louder under extreme operating conditions (Betke et al. 2004; Jansen and de Jong 2016; Marmo et al. 2013; Nedwell and Howell 2004; Tougaard et al. 2009). According to measurements at the BIWF, low-frequency noise generated by turbines reaches ambient levels at 164 feet but is drowned out by waves and boat engine sound (HDR 2019b). Operational noise increases with ambient wind and wave noise and generally remains indistinguishable from background within a few hundred feet from the source. These operational noise levels are below recommended underwater noise thresholds for behavioral effects on fish. This indicates that the effects of WTG operational noise on fish are likely to be negligible to minor.

Conceptual decommissioning of the SFWF and SFEC would lead to impacts similar to construction, with the exception that there would be no pile-driving impacts. Conceptual decommissioning of the SFWF would not require pile driving. After the WTGs and OSS are removed, the monopile foundations would be cut below the bed surface using a cable saw. Pangerc et al. (2016) found that underwater noise levels produced by this type of equipment are difficult to distinguish from the associated construction vessel noise and are below levels that would cause injury or behavioral effects on fish or invertebrates. The impacts of short-term bed disturbance and water quality effects on fish would be similar to those caused by construction: negligible to minor.

Conceptual decommissioning and removal of the monopile foundations and scour protection from the seabed and water column would reverse the artificial reef effect provided by these structures, returning the environment to near pre-Project conditions. Some individual fish species (e.g., small fish sheltering in epibenthic structure on the monopiles) may be injured or killed during removal. Individual fish displaced during structure removal may or may not survive, depending on their ability to disperse to new suitable habitats. Impacts from conceptual decommissioning would be limited in extent and duration, and loss of some individual fish would not have a significant effect on the viability and health of local stocks or populations, therefore the associated adverse effects on fish would be negligible to minor. Conceptual decommissioning of the Montauk O&M facility would only include increased crew transfer vessel traffic to and from the facility and would be considered a negligible impact relative to the background traffic conditions within Lake Montauk.

Cumulative Impacts

Accidental releases and discharges: The Proposed Action could result in accidental releases of contaminants, trash/debris, or invasive species that could add to releases from other reasonably foreseeable projects. BOEM estimates that the Project would result in a negligible 2% incremental increase in total chemical usage over the No Action alternative. When combined with other offshore wind projects, up to approximately 350,000 gallons of coolants and 3 million gallons of oils and lubricants could cumulatively be stored within WTG foundations and the OSS within the geographic analysis area (see Section 3.3.2.2.3 [Proposed Action Alternative] for quantities and details). Compliance with USCG regulations and existing state and federal regulations related to ballast and bilge water discharge would limit volumes of Project-related trash/debris or invasive species potentially released accidentally. Additionally, as discussed in Section 3.4.2.2.2 No Action Alternative, the volumes of trash and debris potentially released accidentally under the No Action alternative would be negligible and would not contribute to potential adverse impacts. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in negligible to minor cumulative impacts to benthic habitats, EFH, invertebrates, and finfish.

Anchoring and new cable emplacement/maintenance: The Proposed Action would result in localized, temporary, minor to moderate incremental impacts to benthic habitats, finfish, invertebrates, and EFH through an estimated 821 acres of anchoring and mooring-related disturbance and 913 acres of cabling-related seabed disturbance. BOEM estimates a cumulative total of 1,083 acres of anchoring and mooring-related disturbance and 8,864 acres of cabling-related disturbance for the Proposed Action plus all other future offshore wind projects. All anchoring impacts would be temporary and localized, and benthic habitats and species would be expected to recover relatively quickly. Degradation of sensitive habitats, if it occurs, could be more long term. The Proposed Action would not anchor in eelgrass. In most locations, cabling impacts would also be short term (seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks) and affected areas are expected to recover naturally, allowing for relatively rapid recolonization (MMS 2009c). 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 minor to moderate impacts to benthic habitats, EFH, invertebrates, and finfish.

EMF: The Proposed Action would not incrementally increase the impacts of EMF beyond those impacts described under the No Action alternative. As discussed in Section 3.4.2.2.2 (No Action Alternative), there is no evidence that EMF from existing submarine cables has a significant effect on benthic habitats, finfish, invertebrates, and EFH in the geographic analysis area. The SFEC and inter-array cable would maintain a minimum separation of 330 feet from existing and future cables, ensuring that there are no additive EMF effects. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be the same those impacts described under the No Action alternative and would be negligible to minor.

Light: The Proposed Action would result in negligible incremental impacts to benthic habitats, finfish, invertebrates, and EFH through the installation of 16 lighted structures (15 WTGs and one OSS). This represents less than a 1% increase to conditions under the No Action alternative. BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. However, lighting sources would not be downward directed toward the water surface, and construction vessels would also follow BOEM guidelines for lighting. 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, mostly attributable to existing, ongoing activities.

Noise: The Proposed Action would result in localized, temporary, negligible to moderate incremental impacts to benthic habitats, finfish, invertebrates, and EFH through the generation of underwater noise. The Proposed Action would produce injury or behavioral-level noise effects on fish extending up to 84,233 feet from impact pile-driving activities. These effects could be additive to areas ensonified by other temporally or spatially overlapping future activities. BOEM estimates that underwater noise from the construction of up to 16 other offshore wind facilities would result in short-term injury or behavioral effects on finfish over a cumulative area of up to 7,000 square miles. Vessel noise may cause startle and avoidance responses in fish but would not cause injury. Invertebrate species are only sensitive to sound within the immediate vicinity of the source regardless of intensity. Exposed invertebrates would be killed by seabed disturbance from related construction activities, such as trenching and armor placement, so short-term underwater noise effects on these individuals would not occur. Therefore, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would be negligible to moderate.

Port utilization: Although dredging or in-water work for the Port of Montauk could be required for the Proposed Action, these actions would occur within heavily modified habitats. BOEM expect impacts to benthic habitats, finfish, invertebrates, and EFH due to the incremental increase in port expansion resulting from the Proposed Action to be negligible. Therefore, the incremental impact from the Proposed Action would be negligible and the overall cumulative impact associated with the Proposed Action when combined with past, present, and reasonably foreseeable future activities would be similar to the impacts under the No Action alternative and would also be negligible.

Presence of structures: The Proposed Action would result in long-term negligible and minor beneficial incremental impacts to benthic habitats, finfish, invertebrates, and EFH through the installation of 16 structures (15 WTGs and one OSS) to conditions under the No Action alternative. Although the additional structures would alter existing benthic habitat, micrositing would allow for the minimization of impacts to complex habitats. These additional structures could result in entanglement and gear loss/damage, hydrodynamic disturbance, fish aggregation/artificial reef effect, introduction of invasive species, habitat conversion, and migration disturbances, as described in detail in Section 3.4.2.1 Affected Environment. However, effects would be limited in extent.

BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. For similar reasons as described above, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in minor to moderate and minor beneficial impacts.

Sediment deposition and burial and seabed profile alterations: The Proposed Action would result in localized, temporary, minor incremental impacts to benthic habitats, finfish, invertebrates, and EFH through an estimated 913 acres of seabed disturbance in the geographic analysis area. These actions would increase suspended sediment and potentially disturb, displace, or injure benthic habitat, finfish, and invertebrates. BOEM estimates a cumulative total of 8,864 acres of cabling-related disturbance for the Proposed Action plus all other future offshore wind projects.

Although the amount of sediment deposition from this seabed disturbance are not known, it is expected to be similar to estimates of seabed disturbance. Dredged material disposal during construction would cause localized, short-term increases in turbidity and long-term sedimentation and burial of benthic organisms at the disposal site. Dredging typically occurs only in sandy or silty habitats, which are abundant in the analysis area and are quick to recover from disturbance (Dernie et al. 2003; Desprez 2000; HDR 2020).

Benthic community formation on the foundations and scour protection would create artificial reef habitat, which would transfer shell and organic materials to the sediments. The changes in sediment organic content and nutrient enrichment could result in adverse effects if these occur in oxygen-deficient sediments (De Mesel et al. 2015; Wilding 2014;). Most of the studies evaluating the reef effect associated with wind farms have concluded that increased habitat complexity, productivity, and biomass offset these marginal adverse effects, providing a minor beneficial effect overall (Causon and Gill 2018; Coates et al. 2014; Danheim et al. 2020; English et al. 2017). Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable future activities would result in negligible to minor impacts with possibly beneficial effects at local scales.

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. This difference may not be measurable, but would be expected to help reduce climate change impacts, resulting in minor to moderate incremental impacts. When combined with other past, present, and reasonably foreseeable actions, the Proposed Action would result in moderate impacts.

Other considerations: The Proposed Action could affect the endangered Atlantic sturgeon, consistent with the analysis in BOEM's BA for the Proposed Action (BOEM 2020b). Although individuals from the five distinct population segments of ESA-listed Atlantic sturgeon could be affected by the Proposed Action, no Atlantic sturgeon would be injured or killed. The most significant impact for individual sturgeon would be underwater noise from pile driving; however, incremental Project effects to individual Atlantic sturgeon would be limited to temporary, minor behavioral effects and disturbance. For this reason, the Proposed Action when combined with past, present, and reasonably foreseeable future activities would also be minor and are not anticipated to result in adverse population level consequences.

Conclusions

Project construction and installation and conceptual decommissioning would result in seabed and habitat disturbance, increased suspended sediments, noise, lighting, vessel traffic, and accidental spills and discharge. Similar impacts from Project O&M would occur, although at a lesser extent and duration. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible to minor** for benthic resources**, minor** for EFH, and **negligible** to **minor** for invertebrates and finfish. Therefore, BOEM expects the overall impact on benthic habitats, finfish, invertebrates, and EFH from the Proposed Action alone to be **minor** because the overall effect would be small and the resources would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate**. 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 **moderate** impacts to benthic resource, EFH, invertebrates, and finfish. BOEM made this call because the overall effect would be notable but the resources would be expected to recover completely.

3.4.2.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would lead to the same types of impacts on benthic resource, EFH, invertebrates, and finfish from construction and installation, O&M, and conceptual decommissioning as described for the Proposed Action. However, construction of this alternative would install fewer WTGs and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Therefore, the Transit alternative would result in less soft-bottom benthic habitat permanently converted to hard-bottom habitat. As discussed under the Proposed Action, micrositing would avoid or reduce impacts to localized complex habitats. Given that the Transit alternative would further limit these effects, they are likely to be negligible to minor. Likewise, the reduction in the number of turbines under the Transit alternative would marginally decrease the addition of hard surfaces contributing to the reef effect; however, the associated beneficial impacts on benthic habitat complexity and biodiversity would persist. Therefore, this alternative would result in negligible to minor long-term impacts (both beneficial and adverse) to benthic habitat, EFH, invertebrates, and finfish related to habitat alteration, changes in biodiversity, EMF levels, and operational noise.

Cumulative Impacts

As noted above, the Transit alternative would result in incremental impacts to benthic resources, EFH, invertebrates, and finfish at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative when combined with past, present, and reasonably foreseeable activities would be negligible to moderate and short term.

If the Transit alternative is implemented, proposed future offshore WTGs may need to be relocated or eliminated within lease areas to accommodate the proposed transit lanes. These shifts could shorten or increase vessel trips, transmission cable lengths, and installation times for other future projects, depending on what WTG changes occur. If WTG shifts result in changes that increase turbidity and sedimentation, alter water currents, or increase risks of inadvertent spills, these effects could increase cumulative impacts relative to the Proposed Action.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in impacts from construction and installation, O&M, and conceptual decommissioning, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

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

3.4.2.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would include additional micrositing and could reduce the number of monopile foundations that make up the SFWF. The Project configuration and specific micrositing locations under this alternative are currently in development as part of the EFH consultation. However, four probable scenarios have been identified to qualitatively describe impacts to benthic habitats:

- Scenario A: WTGs are sited within and adjacent to complex habitat and micrositing would not reduce impacts to complex habitats.
- Scenario B: WTGs are sited within and/or adjacent to complex habitats and micrositing (if engineering and spacing restrictions allow) would reduce, but not fully avoid, impacts to complex habitats.
- Scenario C: WTGs are sited within and/or adjacent to complex habitats and micrositing, (if engineering and spacing restrictions allow) would fully avoid impacts to complex habitats.
- Scenario D: WTGS are sited in areas outside of complex habitats (i.e., sited wholly in non-complex habitat) and micrositing is not necessary to avoid impacts to complex habitats.

Quantities of benthic habitat types impacted by the Project cannot be calculated until the data analysis is completed during the EFH consultation. Therefore, the DEIS provides a qualitative analysis of general impacts. Quantification of areal extent of impacts to complex habitat will be provided in the FEIS.

Benthic Habitat

The Habitat alternative would incorporate additional micrositing and could include installation of fewer monopile foundations than would occur under the Proposed Action. These measures are intended to avoid and minimize long-term impacts to hard-bottomed substrates that provide complex fisheries habitat. If the Habitat alternative reduces the number of foundations installed then fewer acres of complex fisheries habitat would be impacted by piling footprints and placement of scour protection. The areal extent of Habitat alternative impacts on complex habitat will be assessed in the EFH consultation and will be included in the FEIS.

As with the Proposed Action, micrositing would be used to avoid and minimize impacts on complex fisheries habitat by shifting the structures from complex habitats to non-complex habitats. However, the Habitat alternative would involve additional micrositing to minimize impacts on complex habitats to the extent practicable. Micrositing the foundation locations would avoid impacts on existing complex fisheries habitat provided by hard surfaces such as boulders and cobbles by shifting these impacts to the non-complex habitat type (sand and mud bottom). This would result in a non-complex habitat being displaced by monopile footprints, and non-complex habitat would be converted to hard bottom by scour protection placed around the base of each monopile. While this habitat could evolve over time into complex habitat, it is recognized that artificial and engineered hard substrate do not necessarily provide the same ecological benefits as natural hard substrates. However, some materials mimic natural hard substrates (e.g., rounded boulders) better than others (e.g., concrete).

As with the other action alternatives, the Habitat alternative would generate short-term impacts from temporary seafloor disturbance during construction. However, these impacts could be less extensive because fewer turbines could be constructed. Therefore, effects are anticipated to range from negligible to minor.

Piling placement would remove benthic habitat but would create vertical hard structures that would support the attachment and growth of numerous species. For this reason, this temporary adverse impact is considered negligible to minor, and a long-term beneficial impact could occur. However, as noted above, fewer structures could be installed, resulting in less potential reef effect. See Section 3.4.2.2.3 (Proposed Action Alternative) for a detailed description of the impact mechanisms to benthic habitats.

Essential Fish Habitat

Conversion of non-complex fisheries habitat to hard-bottom habitat by placement of scour protection would replace EFH for species preferring soft-bottom habitat with EFH for species preferring hard-bottom habitat and could increase over time as these hard surfaces are colonized by sessile organism. Species preferring hard-bottom habitat (e.g., Atlantic cod and American lobster) would gain habitat, whereas soft-bottom species (e.g., summer flounder and Atlantic surfclam) would lose suitable habitat. As the reef community on the scour protection ages and the reef effect matures over time, biodiversity is expected to increase, producing additional beneficial habitat effects for some species. For example, species using nearby soft-bottom habitat would realize an indirect benefit from increased biodiversity and productivity (Causon and Gill 2018). The proposed habitat modifications would cover a fraction of the area of direct effects, meaning that any adverse effect on habitat availability for EFH species preferring soft-bottom areas would be negligible. Therefore, adverse impacts to EFH are considered minor and may be adverse or beneficial depending upon the fish habitat in question.

The ongoing presence of monopile foundations and scour protection during Project O&M would create an artificial reef effect. Initially, these structures would locally shift EFH in portions of the Project footprint from a soft-bottom to hard-bottom benthic structure. Species preferring hard-bottom habitat (i.e., black sea bass) would gain habitat, whereas soft-bottom species (e.g., summer flounder and Atlantic surfclam) would lose a small amount of suitable habitat. The functional value of these introduced hard surfaces would initially be low; however, biodiversity is expected to increase over time as the reef community ages, producing additional beneficial habitat effects for some species (Causon and Gill 2018). For example, mussel bed formation on monopiles would provide complex habitat with abundant shelter and feeding opportunities for small fish and invertebrates, which in turn would provide prey resources for larger fish (Causon and Gill 2018). Placement of hard substrates would displace existing hard- and soft-bottom substrates, reducing their habitat value in the near term. Over time, the maturing reef effect could provide a long-term beneficial impact to EFH for species that prefer hard, complex, or vertical habitats but may represent an adverse minor impact to EFH for species that prefer soft substrates and those that do not benefit from artificial hard habitat.

Project maintenance would have minimal impacts to EFH. The types and magnitude of effects would be similar to those described for Project construction except that maintenance activities would occur sporadically and in smaller dispersed areas.

Collectively, the combined effect of Project O&Ms on EFH could be potentially beneficial or adverse, depending on the species of interest and site-specific conditions. However, given the relatively small scale of potential maintenance activities or operational impacts relative to the size of the area of direct effects, the adverse effects of Project O&M on EFH are anticipated to be minor.

Invertebrates

Impacts to invertebrates resulting from the construction of the SFWF, SFEC, and Montauk O&M facility under the Habitat alternative would be similar to impacts outlined in Section 3.4.2.2.3 (Proposed Action Alternative); however, because fewer monopiles would be installed under the Habitat alternative, there would be a commensurate reduction in the magnitude of impact. Construction of the SFWF, SFEC, and Montauk O&M facility would result in potential impacts from 1) habitat alteration; 2) direct mortality; 3) changes in water quality; 4) potential discharges, spills, and trash; 5) noise; and 6) artificial lighting. Incremental impacts relative to the Proposed Action are provided below. Additional detail regarding each impact mechanism can be found in Section 3.4.2.2.3 (Proposed Action Alternative).

<u>Habitat alteration</u>: The Habitat alternative would convert non-complex fisheries habitat (sand and mud) to hard substrates, which would be colonized by sessile invertebrates over time. Conversion of soft-bottom habitat to hard-bottom habitat would have a negligible impact to invertebrate populations because although some invertebrate species (e.g., infauna in soft sediments) would lose habitat, other species (e.g., attached epifauna) would gain new habitat.

<u>Direct mortality</u>: The Habitat alternative would result in the same types of direct seabed disturbance as described previously for the Proposed Action, and therefore could injure or kill invertebrates through the same effect mechanisms. However, if the total number of monopile foundations is reduced or those that are constructed are located in less complex habitats under the Habitat alternative, then fewer acres of habitat would be exposed to disturbance and burial effects that could injure or kill invertebrates. Therefore, the direct mortality effects of this alternative are similar to those described for the Proposed Action but could be slightly smaller in terms of extent. Although some individual invertebrates would be injured or killed during Project construction, the invertebrate community would be expected to recover quickly without experiencing measurable effects at the population level. Therefore, adverse impacts to invertebrates from direct mortality are considered negligible.

<u>Water quality</u>: The water quality impacts of the Habitat alternative would be similar to those described for the Proposed Action. Although temporary water quality effects are anticipated, impacts are not expected to alter invertebrate populations and would not measurably alter baseline water quality (see Table F-11 in Appendix F and Section 4.3.2 in Stantec [2020]). Therefore, adverse impacts to invertebrates from water quality effects are considered negligible.

<u>Potential discharges, spills, and trash</u>: The risk of discharges, spills, or trash are the same under the Habitat alternative compared to the Proposed Action. Given the low potential for spills and trash entering marine habitats, the risk from construction-related impacts is negligible.

<u>Noise</u>: Increased noise associated with construction of the SFWF, SFEC, and the Montauk O&M facility (e.g., noise from pile driving, dredging, and dynamic positioning vessels) could impact invertebrates. If fewer monopiles are installed under the Habitat alternative, the duration of pile-driving noise impacts would decrease. Fewer pile-driving days would be required because of the exclusion of monopiles, reducing the duration of noise impacts. Any adverse impacts on invertebrates are anticipated to be

temporary and would occur only during pile driving. Although impacts from noise to individual invertebrates within a few meters of the monopiles are anticipated, impacts are not expected to alter invertebrate populations and, once construction is complete, noise levels would immediately return to baseline conditions. Adverse noise impacts to invertebrates are considered negligible and of shorter duration than those expected under the Proposed Action and Transit alternatives.

Lighting: Lighting impacts from Project construction would be effectively the same under the Habitat alternative as those described for the Proposed Action. The Project would employ the same type of operational lighting under the Habitat alternative, though potentially on a smaller number of WTG foundations. Therefore, adverse impacts to invertebrates from artificial lighting under the Habitat alternative would be negligible under the same rationale provided above for the Proposed Action.

Finfish

The impacts of the Habitat alternative on finfish species are anticipated to be similar to those described for the Proposed Action.

The placement of scour protection would convert soft-bottom habitats preferred by some fish species to hard substrates, resulting in different effects on finfish depending on species-specific habitat preferences. Species preferring hard-bottom habitat (e.g., black sea bass) would gain habitat, whereas soft-bottom species (e.g., summer flounder) would lose a small amount of suitable habitat. The habitat value provided by artificial structures is expected to increase over time as the encrusting invertebrate community develops. This maturing reef effect is expected to generate beneficial habitat effects, even for species that have been displaced. For example, species using nearby soft-bottom habitat would realize an indirect benefit from increased biodiversity and productivity (Causon and Gill 2018). The proposed habitat modifications would cover a fraction of the area of direct effects, meaning that any adverse effect on habitat availability for species preferring soft-bottom areas would be negligible. Therefore, adverse impacts to finfish are considered minor and may be adverse or beneficial depending upon the fish in question.

Operation of the SFWF, SFEC, and O&M facility would be similar to impacts under the Habitat alternative as the Proposed Action. The small decrease in the number of monopiles and resulting decrease in the acreage of scour protection would not measurably change impacts to finfish compared to impacts outlined in Section 3.4.2.2.3 (Proposed Action Alternative).

A long-term beneficial impact is anticipated from reef effects as the epiphytic community on the monopiles and scour protection boulders matures.

Cumulative Impacts

As noted above, the Habitat alternative would result in incremental impacts to benthic resources, EFH, invertebrates, and finfish at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative when combined with past, present, and reasonably foreseeable activities would be negligible to moderate and short term.

Conclusions

Because the Habitat alternative could microsite or reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in habitat impacts related to construction and installation, O&M, and conceptual decommissioning, BOEM expects that the impacts resulting from the alternative alone could be lower than the Proposed Action and would range from **negligible** to **minor**.

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

3.4.2.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the number of WTGs and their associated inter-array cables varies slightly, BOEM expects that benthic resource, EFH, invertebrate, and finfish impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.4.2.4 Mitigation

Table G-2 in Appendix G identifies the following potential additional mitigation measures:

- Use of noise reduction technologies and field verification during all impact pile-driving activities to achieve a required minimum attenuation (reduction) of 6 dB re 1 micropascal (µPa) to reduce noise impacts during construction.
- Use of a turbidity curtain during construction and O&M activities involving in-water work such as dredging at ports and at the O&M facility to minimize impacts on flora and fauna from suspended sediments.

If BOEM requires the above measures, then Project impacts to benthic habitat, EFH, invertebrates, and finfish could be further reduced, although impacts would still be negligible to moderate.

3.4.3 Birds

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to birds from implementation of the Proposed Action and other considered alternatives.

3.4.4 Marine Mammals

3.4.4.1 Affected Environment

A diverse marine mammal community inhabits the Northwest Atlantic OCS region (the region). Fifty species, comprising six baleen whales; 39 species of toothed whales, dolphins, and porpoises; four species of seals; and the West Indian manatee (*Trichechus manatus*), could occur, or are known to occur, in the region (BOEM 2014; CSA Ocean Sciences Inc. 2019). All these species are protected under the federal Marine Mammal Protection Act (MMPA), and five are listed as endangered under the ESA. One species, West Indian manatee, is listed as threatened under the ESA. Of these six marine mammals listed under the ESA, critical habitat has been designated for only North Atlantic right whale (NARW) (*Eubalaena glacialis*) and West Indian manatee, but none is located within the analysis area. The closest critical habitat for NARW is the northeastern United States foraging area approximately 100 miles east of the Project. The closest critical habitat for West Indian manatee is more than 1,000 miles south of the Project near Jacksonville, Florida. The *Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS 2007) and the Project BA (BOEM 2020a) provide detailed species descriptions and life history information. NOAA has summarized the most current information about marine mammal population status, occurrence, and use of the region in their 2019 stock status report for the Atlantic OCS and Gulf of Mexico (Hayes et al. 2020).

Table 3.4.4-1 identifies species known or expected to occur in the region and their likelihood and timing of occurrence in the area of direct effects[7] (see Figure C-32). The larger geographic analysis area used as part of some analyses is discussed in Appendix E.

Sixteen species are known to occur in and around the area of direct effects at least regularly. Several are highly migratory and only occur seasonally, some are present year-round, and others could be present year-round but display distinct seasonal peaks. The ESA-listed species expected to occur in the area of direct effects are the NARW, fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), and sperm whale (*Physeter macrocephalus*) (Davis et al. 2020; Kraus et al. 2016; Northeast Fisheries Science Center [NEFSC] and Southeast Fisheries Science Center [SEFSC] 2018). Several other marine mammal species occur in the general vicinity but are unlikely to occur within this area. Current status and population trends for marine mammal species that are expected to occur in the area of direct effects are summarized in Table 3.4.4-2. Species that are not expected to occur in this area are not considered further in the DEIS.

Environmental factors that influence current conditions for marine mammals in the geographic analysis area are listed in Table F-6 in Appendix F. Marine mammals have been organized into different hearing groups for the purpose of evaluating underwater noise impacts based on how they hear and their sensitivity to different types of noise. Low-frequency cetaceans, including NARW and other baleen whales, hear and communicate in low-frequency bands from 7 hertz (Hz) to 35 kilohertz (kHz). Mid-frequency cetaceans, including dolphins and other toothed whales, hear in the 150-Hz to 160-kHz range. High-frequency cetaceans, including the true porpoises, hear in the 275-Hz to 160-kHz range. Phocid pinnipeds (i.e., seals) hear in the 50-Hz to 86-kHz range.

[7] The area of direct effects for marine mammals consists of the offshore Project components and surrounding areas that could be measurably affected by Project construction and installation, O&M, and conceptual decommissioning (see Figure C-32). Short-term underwater noise from construction, specifically pile driving, would create the largest area of potential Project effects and is therefore used to define the boundary of the area of direct effects. Based on sound attenuation modeling, noise effects exceeding marine mammal behavioral thresholds could extend outward in a circle up to 5.4 miles from each SFWF monopile foundation and in a semicircle extending 22.8 miles from the Long Island shoreline adjacent to the SFEC sea-to-shore transition. Construction vessel noise exceeding behavioral thresholds could extend as far as 445 feet from the source along the SFEC path (Denes et al. 2020).

Table 3.4.4-1. Frequency of Marine Mammal Species Occurrence in Northwest Atlantic OCS and Likelihood of Occurrence in the Area of Direct Effects

Common Name	Scientific Name	ESA/MMPA Status [*,†]	Occurrence in Northwest Atlantic OCS[‡]	Annual (Peak) Occurrence[§]	Species Occurs in Area of Direct Effects[‡,§,¶,‡‡]	Critical Habitat Occurs in the Area of Direct Effects[§§]
Baleen Whales – Suborder Mysteceti, Family Balaenopteridae						
NARW	*Eubalaena glacialis*	E/D	Common	YR (W-Sp)	Yes	No
Blue whale	*Balaenoptera musculus*	E/D	Rare	W	Yes	Not yet designated
Sei whale	*B. borealis*	E/D	Regular	YR (Sp)	Yes	Not yet designated
Fin whale	*B. physalus*	E/D	Common	YR	Yes	Not yet designated
Minke whale	*B. acutorostrata*	None/N	Common	YR (Su-F)	Yes	Not applicable (N/A)
Humpback whale	*Megaptera novaeanglia*	None/N	Common	YR (W-Sp)	Yes	N/A
Toothed Whales – Suborder Odontoceti, Family Physeteridae						
Sperm whale	*Physeter macrocephalus*	E/D	Common	YR (Su-F)	Yes	N/A
Toothed Whales – Family Kogiidae						
Dwarf sperm whale	*Kogia sima*	None/N	Rare	Su	No	N/A
Pygmy sperm whale	*K. breviceps*	None/S	Rare	Su	No	N/A
Toothed Whales – Family Ziphiidae						
Blainville's beaked whale	*Mesoplodon densirostris*	None/S	Rare	YR	No	N/A
Cuvier's beaked whale	*Ziphius cavirostris*	None/S	Rare	YR	No	N/A
Gervais' beaked whale	*M. europaeus*	None/S	Rare	YR	No	N/A
Sowerby's beaked whale	*M. bidens*	None/S	Rare	YR	No	N/A
True's beaked whale	*M. mirus*	None/S	Rare	YR	No	N/A
Toothed Whales – Family Delphinidae						
Risso's dolphin	*Grampus griseus*	None/N	Common[§]	YR (Sp-F)	Yes	N/A
Long-finned pilot whale	*Globicephala melas*	None/S	Common[§]	YR (Sp-Su)	Yes	N/A
White-beaked dolphin	*Lagenorhynchus albirostris*	None/N	Regular (north of Cape Cod)[§]	Sp	No	N/A
Atlantic white-sided dolphin	*L. acutus*	None/N	Regular[§]	YR (Sp-F)	Yes	N/A
Atlantic spotted dolphin	*Stenella frontalis*	None/N	Regular[‡,§]	Sp-F	No	N/A

Common Name	Scientific Name	ESA/MMPA Status [*,†]	Occurrence in Northwest Atlantic OCS[‡]	Annual (Peak) Occurrence[§]	Species Occurs in Area of Direct Effects[‡,§,¶,‡‡]	Critical Habitat Occurs in the Area of Direct Effects[§§]
Striped dolphin	*S. coeruleoalba*	None/N	Rare[‡,§]	YR	No	N/A
Short-beaked common dolphin	*Delphinus delphis*	None/N	Common	YR (Su-F)	Yes	N/A
Bottlenose dolphin	*Tursiops truncatus*	None/D	Common	YR	Yes	N/A
Toothed Whales – Family Phococenidae						
Harbor porpoise	*Phocoena phocoena*	None/N	Common	YR (F-Sp)	Yes	N/A
Earless Seals – Order Carnivora, Suborder Caniformia, Family Phocidae						
Harbor seal	*Phoca vitulina concolor*	None/N	Common	YR (F-Sp)	Yes	N/A
Gray seal	*Halichoerus grypus*	None/N	Common	YR	Yes	N/A
Harp seal	*Pagophilus groenlandicus*	None/N	Common	W-Sp	Yes	N/A
Hooded seal	*Cystophora cristata*	None/N	Common	W-Sp	Yes	N/A
Order Sirenia						
West Indian manatee	*Trichechus manatus*	Threatened/S	Rare[‡‡]	Unknown	No	No

Sources: BOEM (2014); CSA Ocean Sciences Inc. (2019); Curtice et al. (2018); Kenney and Vigness-Raposa (2010); Kraus et al. (2016); NEFSC and SEFSC (2018).

Note: Species that do not occur in the analysis area are unexpected to be affected by the Project and are not considered further in this EIS.

[*] ESA status: E = Endangered.

[†] MMPA status: S = Strategic; N = Not Strategic; D = Depleted.

[‡]Kenney and Vigness-Raposa (2010): Common = more than 100 observations; Regular = 10–100 observations; Rare = Fewer than 10 observations.

[§] Data from NEFSC and SEFSC (2018) and Davis et al. (2020). YR = year-round; W = winter; Sp = spring; Su = summer; F = fall.

[¶] Data from Kraus et al. (2016).

[‡‡] Data from CSA Ocean Sciences Inc. (2019).

[§§] Data from NOAA (2019).

Table 3.4.4-2. Population Status, Trend, and Effect of Human-Caused Mortality on Marine Mammal Species Likely to Occur in the Area of Direct Effects

Common Name	Scientific Name	Stock	Population Estimate*	Population Trend†	Annual Human-Caused Mortality‡	Effect of U.S. Human-Caused Mortality§	Reference Source
NARW¶	*Eubalaena glacialis*	Western North Atlantic	428	Decreasing	5.36	Significant	Hayes et al. (2020)
Fin whale¶	*Balaenoptera physalus*	Western North Atlantic	7,418	Unavailable	2.35	Significant	Hayes et al. (2020)
Sei whale¶	*B. borealis*	Nova Scotia	6,292	Unavailable	1.0	Significant	Hayes et al. (2020)
Minke whale	*B. acutorostrata*	Canadian East Coast	24,202	Unavailable	8.2	Insignificant	Hayes et al. (2020)
Blue whale	*B. musculus*	Western North Atlantic	402	Unavailable	Unknown	Unknown	Hayes et al. (2020)
Humpback whale	*Megaptera novaeanglia*	Gulf of Maine	1,396	+2.8%/year	12.15	Significant	Hayes et al. (2020)
Sperm whale¶	*Physeter macrocephalus*	North Atlantic	4,349	Unavailable	Unknown	Unknown	Hayes et al. (2020)
Risso's dolphin	*Grampus griseus*	Western North Atlantic	35,493	Unavailable	53.9	Significant	Hayes et al. (2020)
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic	39,215	Unavailable	21	Insignificant	Hayes et al. (2020)
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic	93,233	Unavailable	26	Insignificant	Hayes et al. (2020)
Short-beaked common dolphin	*Delphinus delphis delphis*	Western North Atlantic	172,825	Unavailable	419	Significant	Hayes et al. (2020)
Bottlenose dolphin	*Tursiops truncatus truncatus*	Western North Atlantic - Offshore	62,851	Unavailable	28	Insignificant	Hayes et al. (2020)
Harbor porpoise	*Phocoena*	Gulf of Maine/Bay of Fundy	95,543	Unavailable	217	Significant	Hayes et al. (2020)
Harbor seal	*Phoca vitulina concolor*	Western North Atlantic	75,834	Unavailable	350	Significant	Hayes et al. (2020)
Gray seal	*Halichoerus grypus*	Western North Atlantic	451,431	Increasing	5,410	Significant	Hayes et al. (2020)
Hooded seal	*Cystophora cristata*	Western North Atlantic	512,000	Increasing	5,199	Insignificant	Waring et al. (2007), Kenney and Vigness-Raposa (2010)
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic	7.4 million	Increasing	232,422	Unknown	Hayes et al. (2020)

* Based on annual human-caused mortality as a percentage of potential biological removal (PBR): Significant = > 10% of PBR; Insignificant = < 10% of PBR. Statistic based on fishing-related mortality with inferred contribution from other sources (e.g., vessel collisions).

† Most recently available stock size estimate, per cited reference.

‡ Increasing = beneficial trend, not quantified; Decreasing = adverse trend, not quantified; Unavailable = population trend analysis not conducted on this species.

§ Reflects human-caused mortality from all known sources, including fishing-related, vessel collisions, and other/unspecified. Per cited reference.

¶ Species is ESA listed.

3.4.4.2 *Environmental Consequences*

3.4.4.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.4-3 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.4.4-3. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Marine Mammals

Issue	Impact Indicator	Significance Criteria
Seabed and water column alteration	Affected water column and acres of seabed disturbance, loss, or conversion	Negligible: No measurable impacts to species would occur. Minor: Most impacts to species could be avoided with EPMs; if impacts occur, the loss of one or a few individuals of a population could represent a minor impact, depending on the time of year and number of individuals involved. Moderate: Impacts to species are unavoidable but would not result in population-level effects. Major: Impacts would affect the viability of the population, and the population would not be fully recoverable, even if DWSF applies mitigation.
Underwater noise from construction/conceptual decommissioning	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral thresholds:[*] Impulsive source: 160 dB_{RMS} Continuous source: 120 dB_{RMS} Injury thresholds (dB_{peak}/dB cSEL):[†] Impact: Low-frequency cetaceans: 219/183 Mid-frequency cetaceans: 230/185 High-frequency cetaceans: 202/155 Phocid pinniped: 218/185 Vibratory: Low-frequency cetaceans: 199 Mid-frequency cetaceans: 198 High-frequency cetaceans: 173 Phocid pinniped: 201	
Underwater noise from operation	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral effect thresholds:[‡] 120 dB_{RMS} Permanent threshold shift (PTS) thresholds All species: Not applicable	
Airborne noise	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral effect thresholds:[§] Phocid pinniped: 90 dB_{RMS} Cetaceans: Not applicable	
Vessel traffic	Qualitative estimate of potential collision risk	
Water quality impacts	Quantitative estimate of intensity and duration of suspended sediment effects	
	Qualitative analysis of potential discharges (fuel spills, trash, and debris) relative to baseline	
Artificial light	Intensity, frequency, and duration relative to baseline	
Power transmission	Theoretical extent of detectable EMF effects	

[*] Behavioral effect thresholds for impact and vibratory pile driving defined by the NMFS (NOAA 2019). Distance to thresholds modeled by Denes et al. (2020). dB_{RMS} = root mean square decibels re: 1 micropascal (μPa).

[†] NOAA (2018) defines a permanent hearing threshold shift as the onset of physical injury from underwater noise exposure. NMFS has identified different PTS thresholds for the low-, mid-, and high-frequency cetacean, and phocid pinnipeds based on group-specific hearing sensitivity. Distance to PTS thresholds modeled by Denes et al. (2020). dBpeak = peak dB re: 1 μPa. dB SEL = cumulative SEL in dB re: 1 $μPa^2$/second.

[‡] Behavioral effect threshold for vibratory pile driving defined by NOAA (2019), assuming WTGs similarly produce continuous low-frequency underwater noise. Distance to behavioral threshold for vibratory pile driving modeled by Denes et al. (2020).

[§] Airborne exposure threshold defined by NOAA (2019). Distance to phocid pinniped threshold estimated using methods described by the Washington State Department of Transportation (2020). No PTS threshold established for pinnipeds. No thresholds established for cetaceans.

3.4.4.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing marine mammal species and habitat trends due to past and present activities. Attachment 3 in Appendix E also provides additional information regarding past and present activities and associated species impacts. Future, non-Project actions include offshore development projects, military activities, dredged material disposal, commercial fishing, and marine transportation. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated marine mammal impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Accidental releases and discharges: Future activities in the offshore components of the OCS could result in the accidental release of trash or contaminants associated primarily with vessel activity during Project construction. The inadvertent releases would contribute to the existing hazard posed by chronic marine pollution and debris. Entanglement in or ingestion of marine debris is a significant source of human-caused mortality in marine mammals. For example, ingested debris was documented in up to 22% of beached marine mammal carcasses. Autopsies identified blockage of the digestive tract, injury, and malnutrition caused by ingested debris as the likely cause of mortality (Baulch and Perry 2014). Approximately 50% of marine mammal species worldwide have been documented ingesting marine litter (Werner et al. 2016).

Vessels associated with future offshore activities could generate exhaust and could be a source of potential accidental spills of petroleum-based toxics (see Section 3.3.2.2.2 [No Action Alternative]). Marine mammals that occur in the analysis area could be exposed to these contaminants. Inhalation of fumes from oil spills can result in mortality or sublethal effects on individual fitness, including adrenal effects, hematological effects, liver effects, lung disease, poor body condition, skin lesions, and several other health effects (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Although these effects are acknowledged, the likelihood of adverse population-level impacts on marine mammals from accidental releases of debris or contaminants from future activities on the OCS is low. Current regulations and requirements imposed on federally approved activities prohibit vessels from dumping potentially harmful debris, require measures to avoid and minimize spills of toxic materials, and provide mechanisms for spill reporting and response. Based on these factors, accidental releases and discharges from federally approved activities on the OCS are not expected to appreciably contribute to adverse marine mammal impacts.

EMF: Marine mammals appear to detect magnetic field intensity as low as 50 mG (Normandeau et al. 2011); however, scientific evidence is limited. Exposure to EMF could cause marine mammals to temporarily change swimming direction (Gill et al. 2005). These effects are more likely with exposure to DC cables versus AC cables (Normandeau et al. 2011). Under the No Action alternative, up to 5,779 miles (9,300 km) of cable would be added (BOEM 2020b), producing EMF in the immediate vicinity of each cable during operations. Submarine power cables would be installed with appropriate shielding and burial depth to reduce potential EMF at the surface. Submarine cables typically maintain a minimum separation of at least 330 feet to avoid inadvertent damage to existing infrastructure during installation. This separation distance ensures that there are no additive EMF effects from adjacent cables. Additionally, exposure to submarine cable EMF would be limited to extremely small portions of the areas used by migrating marine mammals. Therefore, EMF exposure is anticipated to be low, and impacts such as changes in swimming direction and altered migration routes would not be biologically significant. Further discussion of potential EMF effects on marine mammals is available in the SFWF BA (BOEM 2020a).

New cable emplacement/maintenance: Future offshore wind projects could disturb up to 7,951 acres of seabed while installing associated undersea cables, causing an increase in suspended sediment (see Appendix E, Attachment 4 for calculation details). These disturbances would be localized in extent, limited in magnitude, and short term. Data describing behavioral responses of marine mammals to localized turbidity plumes are limited, but available information suggests that most species would be insensitive to the associated changes in visibility. For example, visual impairment does not appear to impair the ability of gray seal (*Halichoerus grypus*) and harbor seal (*Phoca vitulina concolor*) to forage and move effectively (McConnell et al. 1999; Newby et al. 1970; Todd et al. 2015). Research on the TSS sensitivity of other marine mammal species, such as dolphins and large whales, is generally lacking. However, these species have developed echolocation for communicating, foraging, and navigating by evolving in an environment with variable and often low visibility (Tyack and Miller 2002). This suggests that temporary reduction in visibility would not significantly impair behavior. Even if marine mammals were to alter their behavior in response to elevated TSS (e.g., by avoiding the disturbance and/or interrupting foraging), any potential exposures would be localized in extent, limited in magnitude, short term, and therefore unlikely to result in biologically significant effects. Therefore, the anticipated effects of construction-related seabed disturbance on marine mammals would be minor and no population-level effects would be expected.

Noise: Offshore wind project construction periods would overlap between 2022 to 2030 (see Appendix E, Attachment 4). Construction from these projects, most notably pile driving, would create airborne and underwater noise with moderate potential to affect marine mammals. These effects range from low-level behavioral effects and interference with communication, foraging, mating, predator avoidance, and navigation to temporary hearing impairment (Madsen et al. 2006; Weilgart 2007). Permanent sublethal hearing injuries, although possible, are unlikely to occur based on current and anticipated future impact avoidance and minimization requirements. Other sources of noise from wind projects include helicopters and aircraft used for transportation and facility monitoring, G&G surveys, WTG operation, and vessel traffic associated with these activities. The noise associated with offshore wind project construction and operation generally falls into two categories: impulsive noise sources, such as pile driving, which generate sharp instantaneous changes in sound pressure; and intermittent non-impulsive noise sources, such as vessel engine noise, vibratory pile driving, and WTG operation, which remain relatively constant and stable over a given time period. Impulsive and non-impulsive noise sources associated with offshore wind projects and other activities likely to occur on the OCS in the future are discussed below.

Impulsive noise: There are several intrinsic, extrinsic, and ecological drivers that can result in cumulative impacts on individuals and populations. Underwater noise can be characterized as an extrinsic factor, which is a factor in an animal's external environment that creates stress in an animal (Roberts 2016). Anthropogenic noise on the OCS associated with the future offshore wind development, including noise from project aircraft, G&G surveys, vessel traffic, operational WTGs, and pile driving, has the potential to result in impacts on marine mammals foraging, orientation, migration, predator detection, social interactions, or other activities (Southall et al. 2007). Future offshore wind development may require the use of helicopters to supplement crew transport during construction and operations. BOEM expects that helicopters transiting to the offshore WDAs would fly at altitudes above those that would cause behavioral responses from marine mammals except when flying low to inspect WTGs or take off and land on the service operations vessel. Noise associated with helicopter and/or aircraft use during construction and operations of future offshore wind development may result in some short-term and temporary non-biologically significant behavioral responses, including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). If a listed whale is located within 820 to 1,181 feet of the helicopter, behavior responses may occur, but they are expected to be temporary and short term. NARW approach regulations (50 CFR 222.32) prohibit approaches within 1,500 feet. BOEM would require all aircraft operations to comply with current approach regulations for any sighted NARWs or unidentified large whale. Although helicopter traffic may cause some temporary and short-term behavioral reactions in marine mammals while helicopters move to a safe distance, BOEM does not expect exposure to aircraft noise to result in injury to any marine mammals. Similarly, aircraft could disturb hauled-out seals if aircraft overflights occur within 2,000 feet of a haul-out area. However, this disturbance would be temporary and short term, with individuals seeking refuge in the water for a few minutes to a few hours (Southall et al. 2007).

Without mitigation, certain types of G&G surveys could result in long-term, high-intensity impacts on marine mammals. These effects may include behavioral avoidance of the ensonified area and increased stress; temporary loss of hearing sensitivity; and permanent auditory injury depending on the type of sound source, distance from the source, and duration of exposure. However, G&G noise resulting from offshore wind site characterization surveys is of less intensity than the acoustic energy characterized by seismic air guns and affects a much smaller area than G&G noise from seismic air gun surveys typically associated with oil and gas exploration. Although seismic air guns are not used for offshore wind site characterization surveys, sub-bottom profiler technologies that are hull-mounted on survey vessels may incidentally harass marine mammals and would be required to follow mitigation and monitoring measures. Typically, mitigation and monitoring measures are required by BOEM through requirements of lease stipulations and required by ITAs from NOAA Fisheries pursuant to Section 101(a)(5) of the MMPA. Mitigation and monitoring measures would lower the stock-level effects of the take of any marine mammals to negligible levels, as required by the MMPA, including potential for adverse behavioral responses and auditory injury (permanent threshold shift/temporary threshold shift [PTS/TTS]). Similarly, the requirement to comply with avoidance and minimization measures for these surveys would avoid any effects on individuals that could result in population-level effects to threatened and endangered populations listed under the ESA These measures may include protected species observers (PSOs), passive acoustic monitoring, pre-survey monitoring, and the establishment of exclusion zones in which sound sources would be shut down when marine mammals are present.

The following analysis assesses the impacts of pile-driving activities associated with offshore wind facilities on marine mammals under the No Action alternative. The most significant impulsive noise source associated with offshore wind projects is pile-driving noise during the construction phase due to relatively high SPLs associated with this activity.

WTG foundation installation involves impact pile driving, which produces high sound pressure levels in both the surrounding in-air and underwater environments. A typical foundation pile installation generates 4 to 6 continuous hours of impulsive or vibratory noise with intensity levels like those described for the Proposed Action. Potential noise exposure events would occur intermittently over several weeks during the allowable construction window (which may vary and would be determined through consultation with NMFS) in the marine mammal geographic analysis area. Under the No Action alternative, construction of 2,050 offshore structures would generate short-term and intermittent impulsive underwater noise with the potential to impact marine mammals. These effects would be limited to specific construction windows beginning in 2022 and continuing through 2030.

Depending on their distribution in relation to construction activities and the timing of that construction, the duration and frequency of any exposure of marine mammals to construction noise would be variable. An individual may be exposed to anywhere from a single pile-driving event (lasting no more than a few hours on a single day) to intermittent noise over a period of weeks if an individual travels over the larger geographic analysis area where pile driving may be occurring. The potential effects of exposure to pile-driving noise would range from minor, temporary behavioral disturbance with no biological consequences to auditory injury. As explained above, the use of measures to mitigate exposure is expected to reduce the potential for injury, and most individuals would only be exposed to noise that would result in recoverable auditory injuries and behavioral impacts. The probability and extent of potential impacts are situational and are dependent on several factors including pile size, impact energy, duration, site characteristics (i.e., water depth, sediment type), time of year, and species, among others that have been considered in the acoustic exposure modeling.

Impacts on marine mammals arising from pile-driving activities could occur under three different scenarios:

1. Concurrent pile driving associated with neighboring projects or within a project
2. Non-concurrent pile driving in the same year
3. Multi-year pile driving (concurrent or non-concurrent)

A limited amount of concurrent pile driving at neighboring projects is anticipated under the No Action alternative. The RI/MA WEA has the greatest potential for concurrent pile driving for construction of adjacent projects. The total number of concurrent construction days ranges from 16 to 103 days under the 1-foundation-per-day scenario and 8 to 52 days of pile driving under the 2-foundations-per-day scenario, depending on the year. The Delaware and Maryland lease areas have a potential for 11 days of concurrent pile driving in 2022. An individual marine mammal present in either of these areas on those days could be exposed to the noise from more than one pile driving event per day, repeated over a period of days. Concurrent pile driving could occur for one or more projects on the same day. Concurrent pile driving increases the daily amount of noise exposure in an area but decreases the total number of days of exposure in the same area. Concurrent pile driving occurring within the same 24-hour period would extend the exposure period and create a greater impact area(s) in which marine mammals could be exposed to noise that may cause PTS or behavioral impacts. The number of foundations for each project is the primary factor determining the maximum number of overlapping pile-driving days from neighboring projects. One foundation installed per day results in the maximum-case scenario for the greatest number of overlapping pile-driving days for neighboring projects. Individual marine mammals are not likely to be exposed to concurrent pile-driving days on non-neighboring projects because the distances separating leases in the different regions results in an unlikely potential of exposure to noise between two areas in a 24-hour period. Non-concurrent pile driving in the same year could result in the exposure of an individual marine mammal to pile-driving noise on multiple days over the same year but not necessarily in the same geographic area. Non-concurrent pile driving associated with neighboring projects could occur when pile driving does not overlap and when it occurs on different days. Non-concurrent pile driving potentially decreases the daily amount of impulsive noise exposure in an area from neighboring projects but increases the total number of days of exposure in the same area. A pile-driving scenario with project construction occurring on different days would result in the greatest number of exposure days. If project construction is timed to not overlap and occurs on separate days, the number of non-concurrent days of pile driving in any given year is greater than the concurrent pile-driving scenario.

Finally, as pile driving is anticipated to occur over multiple years (2022 to 2030), individuals may be exposed to pile-driving noise across multiple years (concurrent or non-concurrent) and in the same or different geographic areas. Cumulatively, pile driving may be occurring up to 4.4% of the time over this period under the maximum-case scenario for non-concurrent pile driving where an individual could be exposed to pile driving in each geographic analysis area. For this scenario to occur, the timing of pile driving would need to co-occur with the movements of an individual whale over the course of a year through each geographic analysis area. Under such a scenario, a marine mammal could be intermittently exposed to pile driving noise for up to 6 consecutive years, from one or more projects, if no mitigation measures were implemented.

***Intermittent non-impulsive noise*:** The majority of anthropogenic underwater noise in the marine environment is continuous noise from large vessel engines, specifically ocean-going cargo, tanker, and container vessels. Other sources of noise like small vessels, wind farm operations, and other activities are likely to account for a small percentage of the total anthropogenic sound energy in the future ocean environment (e.g., Basset et al. 2012). Virtually all of the long-term noise effects associated with offshore wind energy projects during operations would be intermittent and non-impulsive in nature. Non-impulsive noise sources include helicopters and fixed-wing aircraft used for facility monitoring, vibratory pile driving, construction and O&M vessel noise, and operational noise from WTGs.

Helicopters and fixed-wing aircraft may be used during initial site surveys, marine mammal monitoring prior to and during construction, and facility monitoring. Noise and disturbance associated with helicopter and/or aircraft use may result in some short-term and temporary behavioral responses. These include reduced surfacing duration, abrupt dives, and alarm reactions such as breaching and tail slapping (Patenaude et al. 2002). However, these effects have only been observed at distances of less than 1,000 feet. Most aircraft associated with future wind farm projects would operate at greater altitudes except when flying low to inspect WTGs or take off and land on the service operations vessel. For this reason, aircraft operations are not expected to result in biologically significant effects on marine mammals.

Vibratory pile driving would likely be used during offshore wind farm construction, typically to install temporary cofferdams at the sea-to-shore transition points for transmission cables. Vibratory pile driving produces significant underwater noise with the potential to cause behavioral effects on marine mammals within 10 to up to 23 miles of the source depending on species-specific hearing sensitivity.

Vessel noise is likely the most significant source of non-impulsive noise associated with offshore wind projects. The frequency range for vessel noise falls within the known range of hearing for marine mammals and would be audible. Although vessel noise may have some effect on marine mammal behavior, it would be limited to temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes (Erbe et al. 2018; Erbe et al. 2019; Nowacek et al. 2007). Studies indicate noise from shipping increases stress hormone levels in NARW (Rolland et al. 2012), and modeling suggests that their communication space has been reduced substantially by anthropogenic noise (Hatch et al. 2012). The authors also suggest that physiological stress may contribute to suppressed immunity and reduced reproductive rates and fecundity in NARW (Hatch et al. 2012; Rolland et al. 2012). Similar impacts could occur for other marine mammal species.

Other behavioral responses to vessel noise could include animals avoiding the ensonified area, which may have been used as a forage, migratory, or socializing area. Results from studies on acoustic impacts from vessel noise on odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 feet (50 m) of the vessel by 26% (Jensen et al. 2009). In a quieter, deepwater habitat, model results suggest that there could be a 58% reduction in the communication range of pilot whales from a similar size boat and speed (Jensen et al. 2009). Because lower frequencies propagate farther away from the sound source compared to higher frequencies, low-frequency cetaceans (mysticetes) are at a greater risk of experiencing behavioral noise effects from vessel traffic. BOEM assumes that construction of future offshore wind projects (construction period estimated to last 2 years per project) would begin in earnest in 2021, peak in 2025, and conclude in 2030. Vessel activity could peak in 2025 with as many as 207 vessels involved in construction of reasonably foreseeable projects in the geographic analysis area (see Section 3.5.6.2.2 [No Action Alternative]), although actual vessel numbers and trip numbers would vary based on individual project designs and port locations. This increased offshore wind–related vessel traffic during construction and associated noise impacts could result in repeated localized, intermittent, short-term impacts on marine mammals, resulting in brief 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 unlikely given the patchy distribution of marine mammals; no stock or population-level effects would be expected. Should multiple project construction activities occur in close spatial and temporal proximity, the implementation of relevant avoidance, minimization, and mitigation measures would further reduce the potential for impact to marine mammals.

WTG operation is another source of continuous noise but is not expected to result in biologically significant effects on marine mammals. According to measurements at the BIWF, low-frequency noise generated by turbines reach ambient levels at 164 feet (50 m) (Miller and Potty 2017). Other studies have observed noise levels ranging from 109 to 127 dB re 1 µPa at 46 and 65.6 feet, respectively, at operational wind farms (Tougaard and Henrikson 2009). Operational noise and ambient noise both increase in conjunction with wind speed, meaning that WTG noise is only audible within a short distance from the source (Kraus et al. 2016; Thomsen et al. 2015). Therefore, operational noise from regional wind farm development would not result in any effects on marine mammal recruitment or survival.

Noise associated with cable laying would be produced by vessels and equipment during route identification, trenching, jet plow embedment, backfilling, dredging, and cable protection installation. Noise intensity and propagation would depend upon bathymetry, local seafloor characteristics, vessels, and equipment used (Taormina et al. 2018). Modeling estimates that underwater noise would remain above 120 dB re 1 µPa in an area of 98,842 acres (400 km^2) around the source (Bald et al. 2015; Nedwell and Howell 2004, Taormina et al. 2018). Assuming cable laying activities occur 24 hours per day and vessels continually move along the cable route, then estimated ensonified areas would not remain in the same location for more than a few hours (developed using Kirkpatrick et al. [2017] and BOEM [2020a]). Although this suggests a large area of effect, it is important to place construction vessel noise in context with the existing underwater noise environment. A significant proportion of cable-laying activities would cross through high vessel traffic areas (see Section 3.5.6.2.2) where ambient underwater noise levels are likely to exceed the 120-dB behavioral threshold. Although anthropogenic noise effects, particularly from vessel noise, would continue to adversely marine mammals into the future, construction vessel noise is unlikely to substantially alter this baseline condition and therefore would not substantially change existing levels of adverse effects on marine mammals.

Port utilization: Any port expansions required for reasonably foreseeable projects could increase the total amount of disturbed benthic habitat, potentially resulting in impacts on some marine mammal prey species. Increases in port utilization due to other offshore wind energy projects would also lead to increases in vessel traffic and associated risk of vessel strike (see Traffic subsection below). This increase would be at its peak during construction activities and would decrease during operations but would increase again during conceptual decommissioning. Nonetheless, resulting impacts on marine mammals would be short term, localized to the respective port vicinity, and therefore negligible.

Presence of structures: The addition of up to 2,050 new offshore structures in the geographic analysis area could increase marine mammal prey availability through creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014 as cited in English et al. 2017). The presence of WTGs can alter circulation and stratification downcurrent from the structures, potentially altering oceanographic conditions at the local scale. However, the presence of an estimated 2,050 structures could have broader effects on oceanographic conditions with the potential to influence the distribution marine mammals prey species at broader spatial scales. These potential effects are discussed in Section 3.4.2.2.2.

Current data suggest seals (Russel et al. 2014) and harbor porpoises (Schiedat et al. 2011) may be attracted to future offshore wind development infrastructure, likely because of the foraging opportunities and shelter provided. These species are expected to use habitat in between the WTGs, as well as around offshore wind infrastructure, for feeding, resting, and migrating. However, the presence of structures may indirectly concentrate recreational fishing around foundations. In addition, ghost gear or lost commercial fishing nets may tangle around WTG foundations. Both could indirectly increase the potential for marine mammal entanglement leading to injury and mortality due to infection, starvation, or drowning (Moore and van de Hoop 2012). Entanglement in commercial fishing gear has been identified as one of the leading causes of mortality in NARWs and may be a limiting factor in the species recovery, with more than 80% of observed individuals showing evidence of at least one and 60% showing evidence of multiple entanglements (Knowlton et al. 2012). Wind farm mitigation measures include annual inspections of WTG foundations and surroundings to find and remove derelict fishing gear and debris. This would reduce entanglement risk for seals and porpoise foraging around the foundations. Importantly these mitigation measures would provide a new mechanism for removing derelict gear from the environment, incrementally reducing entanglement risk for all marine mammal species in the analysis area.

The long-term presence of WTG structures could displace marine mammals from preferred habitats or alter movement patterns, potentially changing exposure to commercial and recreational fishing activity. The evidence for long-term displacement is unclear and varies by species. For example, Long (2017) studied marine mammal habitat use around two commercial wind farm facilities before and after construction and found that habitat use appeared to return to normal after construction. He cautioned that these findings were not definitive and additional research was needed. In contrast, Tielmann and Carstensen (2012) observed clear long-term (greater than 10 year) displacement of harbor porpoises from commercial wind farm areas in Denmark. Displacement effects remain a focus of ongoing study (Kraus et al. 2019).

The combined effects of the presence of wind farm structures on marine mammals are variable, ranging from incrementally adverse to incrementally beneficial, and difficult to predict with certainty. Broadly speaking, any effects on marine mammal prey species are expected to be localized and seasonal (NMFS 2020). On balance, the presence of wind farm structures could alter marine mammal behavior at local scales and could indirectly expose individuals to injury but would not adversely affect marine mammal populations. Potential long-term, intermittent impacts would persist until conceptual decommissioning is complete and structures are removed.

Light: The addition of up to 2,050 new offshore structures in the geographic analysis area with long-term hazard and aviation lighting, as well as lighting associated with construction vessels, would increase artificial lighting. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities to marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. The cumulative impact of artificial lighting from future wind farm development and other offshore activities is anticipated to be negligible.

Traffic: Vessel traffic associated with future offshore wind development poses a collision risk to marine mammals, especially NARWs, other baleen whales, and calves that spend more time at and near the ocean surface. Vessel strike is relatively common with cetaceans (Kraus et al. 2005) and one of the primary causes of death to NARWs. The minimum rate of human-caused mortality and serious injury to right whales between 2013 and 2017 was estimated at 6.85 per year, with vessel strikes accounting for 1.3 mortalities per year (Hayes et al. 2020). Marine mammals are more vulnerable to vessel strike when they are within the draft of the vessel, vessels are larger or faster, and when they are beneath the surface and not detectable by visual observers (Vanderlaan and Taggert 2007). Weather conditions (e.g., fog, rain, and wave height) and nighttime operations also reduce marine mammal. The probability of vessel strike for NARWs decreased substantially as vessel speed fell below 15 knots (Vanderlaan and Taggart 2007); serious injury may rarely occur at speeds below 10 knots (Laist et al. 2001).

At the peak of projected offshore wind farm development in 2025, up to 207 construction vessels may be operating in the geographic analysis area. Although this is a large number, the overall increase in vessel activity is small relative to the baseline level and year to year variability of vessel traffic in the analysis area. In addition, the risk of marine mammal collisions is negligible for most wind farm construction activities. Vessels working in the WDAs either remain stationary during turbine placement or are travelling slowly (i.e., at less than 10 knots) between turbine locations. Vessel speeds may increase when traveling between the WDAs and area ports unless voluntary or mandatory speed restrictions are in effect. Timing restrictions, use of PSOs, and other mitigation measures required by BOEM and NMFS would further minimize the potential for fatal vessel interactions. These measures would effectively minimize but not completely avoid collision risk. Any incremental increase risk must be considered relative to the baseline level of risk associated with existing vessel traffic. Project O&M would involve fewer vessels that are smaller in size, and the level of vessel activity would be far lower than during construction. Smaller vessels (i.e., less than 260 feet in length) pose a lower risk of fatal collisions than larger vessels (Laist et al. 2001).

Offshore wind development could also alter commercial and recreation fishing activity, which may lead to increased interactions with marine mammals that are also temporarily displaced out of lease areas during construction. See Sections 3.5.1 Commercial Fisheries and For-Hire Recreational Fishing and 3.5.6 Navigation and Vessel Traffic for details.

Climate change: Global climate change is an ongoing risk to marine mammals, although the associated impact mechanisms are complex, not fully understood, and difficult to predict with certainty. Possible impacts to marine mammals include increased storm severity and frequency, increased erosion and sediment deposition, disease frequency, ocean acidification, and altered habitat, ecology, and migration patterns. Over time climate change and coastal development would alter existing habitats, rendering some areas unsuitable for certain species and more suitable for others.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on marine mammals associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on marine mammals, primarily through construction-related accidental releases and discharge, noise, lighting, collision risk, habitat changes, and climate change.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **moderate**.

Considering all the impact-producing factors (IPFs) together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts because the overall effect would be notable, but the resource would be expected to recover completely.

3.4.4.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Seabed and water column disturbance: Construction of the SFWF and SFEC Project components would physically disturb the water column and seabed. However, the area affected at any given time would be minimal relative to the size of the area of direct effects and insignificant compared to current baseline levels of disturbance. Similarly, the water column and seabed in Lake Montauk would be disturbed during dredging and construction activities at the O&M facility. However, the affected area would be limited in size and relatively confined within the harbor (Stantec 2020) where routine maintenance dredging already occurs. Therefore, direct effects to marine mammals and indirect effects to fish and invertebrate prey resources would not adversely impact annual rates of recruitment or survival: effects would be negligible (see Section 3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish for additional discussion).

Noise: Construction of the SFWF and SFEC would produce short-term underwater and airborne noise with the potential to affect marine mammals. Construction noise sources include impact and vibratory pile driving, construction vessels, and helicopters and fixed-wing aircraft.

Construction of the SFWF and SFEC requires the use of impact and vibratory pile driving, producing short-term intermittent underwater noise of sufficient magnitude to cause behavioral and potential injury-level effects on marine mammals. Project EPMs (see Table G-1 in Appendix G) include an in-water construction window of May 1 to December 31 to minimize potential noise impacts on NARW. No pile driving would occur at the SFWF, SFEC, or O&M facility outside of this period. This would effectively reduce the potential for NARW exposure to pile-driving noise; however, other marine mammal species may be present in the vicinity during this construction window and could be exposed to behavioral and injury-level noise effects. In addition, underwater noise could indirectly affect marine mammals by killing, injuring, or altering the behavior of fish prey species. Additional EMPs, including noise attenuation devices, soft starts, PSOs, and a detailed species monitoring and response plan, would be used to avoid and minimize adverse noise impacts to the greatest extent practicable. The MMPA IHA and Project permitting would require similar and additional impact avoidance and minimization measures to limit the potential for adverse effects on marine mammals (see Section 3.4.4.4 [Mitigation]).

Impact pile-driving installation of WTG foundation piles and vibratory pile driving used during SFEC and O&M facility construction are the most intensive noise sources associated with the Proposed Action. This noise source would be intermittent and short term. Vibratory pile driving used to install the temporary cofferdam at the SFEC sea-to-shore transition site would also produce intense, short-term intermittent underwater noise. Potential noise effects on marine mammals are evaluated based on the intensity of the noise source, distance from the source, the duration of sound exposure, and species-specific sound sensitivity.

Underwater noise impacts on marine mammals were evaluated using behavioral and injury-level thresholds for different marine mammal species groups developed by NMFS (Table 3.4.4-3) (NOAA 2018, 2019). Specific injury thresholds are defined for different marine mammal species groups based on hearing sensitivity. Dual injury criteria have been defined for each group for instantaneous exposure to a single pile strike, and cumulative exposure to multiple pile strikes or extended non-impulsive sources like vibratory pile-driving or vessel noise over a 24-hour period (NOAA 2018). NMFS behavioral thresholds are based on noise levels known to alter behavior and/or interfere with communication (NOAA 2019). These thresholds by species group for impulsive and non-impulsive noise are summarized in Table 3.4.4-3.

Denes et al. (2020) modeled the distance required to attenuate all sources of underwater noise expected to result from SFWF and SFEC construction to the NMFS behavioral and injury-level effect thresholds. A separate noise analysis was performed to estimate the distance required to attenuate O&M facility construction noise to phocid pinniped thresholds, following NOAA (2019) guidance. These results are also presented in Table 3.4.4-4. The threshold distances shown are the distance from each noise-producing activity (e.g., pile driving, cofferdam installation, vessel positioning, and bulkhead armoring) within which those potential effects could occur. The noise produced by these sources is most intense in lower frequency bands that overlap with peak hearing sensitivity of the low-frequency cetacean hearing group, which includes species like NARW and fin whale. As shown in Table 3.4.4-4, this hearing group is therefore sensitive to construction noise effects at greater distances than the other species groups.

Table 3.4.4-4. Distance Required to Attenuate Underwater Construction Noise Below Marine Mammal Injury and Behavioral Effect Thresholds by Activity and Species Group

Construction Activity	Species Group	Exposure Distance to Single Strike Injury Threshold (feet)	Exposure Distance to Cumulative Injury Threshold (feet)	Exposure Distance to Behavioral Effect Threshold (feet)
Monopile foundation installation*	Low-frequency cetaceans	30	28,517	15,794
	Mid-frequency cetaceans	3	197	8,465
	High-frequency cetaceans	797	11,900	7,142
	Phocid pinnipeds (seals)	39	3,750	11,837
Temporary cofferdam installation†,*	Low-frequency cetaceans	Not applicable (N/A)	4,823	120,374
	Mid-frequency cetaceans	N/A	0	68,537
	High-frequency cetaceans	N/A	207	52,598
	Phocid pinnipeds (seals)	N/A	338	100,784
Construction vessel operation‡,*	Low-frequency cetaceans	N/A	367	48,077
	Mid-frequency cetaceans	N/A	115	44,236
	High-frequency cetaceans	N/A	338	42,362
	Phocid pinnipeds (seals)	N/A	164	47,001
O&M facility improvements§,¶	Low-frequency cetaceans	N/A	169	N/A
	Mid-frequency cetaceans	N/A	15	N/A
	High-frequency cetaceans	N/A	250	N/A
	Phocid pinnipeds (seals)	N/A	103	N/A

* Data from Denes et al. (2020). Values are maximum modeled effect distance estimates for difficult installation of an 11-meter monopile using an IHC S-4000 impact hammer with 10-dB attenuation. A difficult installation would require double the number of hammer strikes anticipated for a typical pile installation. The cumulative injury threshold distances for typical pile installation would be smaller, as described under *Impulsive noise* below.

† Sheet pile cofferdam installed using a vibratory hammer.

‡ Analysis considered use of dynamic positioning thrusters by construction vessels. This analysis did not consider the timing, frequency, and duration of noise from background vessel traffic in and near the Lease Area. Noise levels produced by construction vessels are expected to be similar to these background sources.

§ Distance to threshold estimated assuming the use of AZ-type sheet piles, with a maximum of 33 piles driven within a 24-hour period.

¶ Calculated using the methods and associated analysis tools described in NOAA (2018).

Effects of impact and vibratory pile driving are further discussed in the impulsive and intermittent non-impulsive noise sections below, respectively.

Impulsive noise: The installation of the WTG and OSS monopile foundations using an impact hammer is the only source of impulsive noise from the Proposed Action. Up to 16 foundations would be installed. The typical SFWF foundation pile installation would require approximately 2 hours of impact pile driving, with possibly one or two piles requiring up to 4 hours to install due to more difficult substrate conditions. After installation, the WTG would be placed on top of the foundation pile and the vessels would be repositioned to the next site. Each period of pile driving would be separated by 2 to 4 days.

Impact pile driving is the most likely source of temporary or permanent hearing injury effects to marine mammals as a result of the Project. The likelihood of injury depends on proximity to the noise source, the intensity of the source, the effectiveness of noise attenuation measures, and the duration of noise exposure. For example, a low-frequency cetacean remaining within 5.4 miles (28,517 feet) of impact hammer operation over the 4 hours required for a difficult monopile installation could experience permanent hearing injury, referred to as a permanent threshold shift (PTS). This estimate assumes the use of a noise attenuation system that reduces source noise levels by 10 dB, which is achievable with currently available technologies (Bellman et al. 2020). Mid-frequency cetaceans and phocid pinnipeds are less sensitive to the intense, low-frequency sounds produced by impact pile driving and would have to be much closer to the source to be injured. For example, phocid pinnipeds would need to remain within less than 0.7 mile (3,750 feet) from the same noise source with 10 dB of attenuation.

The difficult installation scenario represents a worst case, as most installations are expected to require only 2 hours and would produce comparatively smaller areas of effect. For example, the threshold distance for permanent hearing injury in low- and high-frequency cetaceans from a typical 2-hour installation using 10 dB of attenuation would be less than 4.1 and 1.4 miles, respectively, whereas the threshold distance for seals would be only 39 feet (Denes et al. 2020). Impulsive sound exposure can also cause a TTS, or a temporary loss of hearing sensitivity, that recovers to normal over periods ranging from hours to days. TTS effects could occur over greater distances than the permanent injury threshold distances shown here. Impact pile driving would also produce behavioral-level noise effects, with low-frequency cetaceans again being the most sensitive. Marine mammals belonging to this hearing group that occur within 3.0 miles (15,794 feet) of monopile installation could experience temporary physiological and behavioral effects.

Overall, the use of EPMs would reduce the likelihood of injury-level noise exposure to marine mammals. EPMs include noise attenuation technologies, soft starts for pile driving, timing restrictions, and the use of trained marine mammal observers. Marine mammal observers would monitor the area surrounding the construction site and would have the authority to halt pile-driving activity when marine mammals are in the vicinity. NOAA and BOEM are likely to require additional mitigation measures to reduce the likelihood of harmful noise exposure. These measures would effectively avoid and minimize harmful noise exposure in most cases. However, the effect areas for PTS impacts to low-frequency cetaceans, auditory masking, and behavioral impacts to all marine mammal species are large enough that the potential for exposure cannot be ruled out. Some individual marine mammals, most likely belonging to the low-frequency cetacean group, could suffer permanent hearing injuries. Depending upon the severity of the injury, affected individuals may be less able to communicate, feed effectively, or identify predators. This could adversely affect their long-term survival and fitness. Masking and behavioral effects may include decreased ability to communicate, find food, or identify predators; increased physiological stress; interruption of feeding; and avoidance of desirable habitats and interruption of feeding. These physiological and behavioral effects are likely to dissipate within hours to days after the exposure ceases (NMFS 2020; Pyć et al. 2018).

CSA Ocean Sciences Inc. (2020) has estimated the number of individual marine mammals that could experience PTS (i.e., permanent hearing injury) and TTS (temporary loss of hearing sensitivity) or other short-term physiological and behavioral effects from exposure to construction-related underwater noise. They used an exposure model that considered proposed construction timing restrictions, the overall duration of monopile installation, and monthly species occurrence and density within and around the noise impact area. The impact scenario assumed the installation of 16 11-meter monopiles over approximately 48 days, including one difficult installation as described above, and use of a noise attenuation system achieving 10 dB of source reduction.

CSA Ocean Sciences Inc. (2020) results are summarized in Table 3.4.4-5. As shown, the model findings estimate that up to one fin whale, one sei whale, four humpback whales, and three harbor porpoise could experience PTS from exposure to cumulative and/or peak impact pile-driving noise under the modeled scenario. None of the other marine mammal species that occur in the noise impact area, including NARW, are likely to experience PTS (as indicated by an individual exposure estimate of < 1). Individuals from several species are likely to experience noise exposure sufficient to cause TTS or behavioral effects. Common dolphin and sei, blue, sperm, and pilot whales are unlikely to experience biologically significant effects from impact pile-driving noise (Table 3.4.4-5). Based on the significance criteria defined in Table 3.4.4-3, impact pile-driving noise from construction of the Proposed Action would result in negligible to moderate impacts on marine mammals.

Table 3.4.4-5. Estimated Number of Marine Mammals Experiencing a Permanent Threshold Shift and Temporary Threshold Shift or Behavioral Effects from Construction-related Impact Pile Driving

Functional Hearing Group	Species	Estimated Number of Affected Individuals*			Effect Significance†
		PTS Cumulative Sound Exposure	PTS from Peak Sound Pressure Exposure	TTS or Physiological Behavioral Effects	
Low-frequency cetaceans	Fin whale	1	< 1	6	Moderate
	Minke whale	1	< 1	10	Moderate
	Sei whale	< 1	< 1	< 1	Negligible
	Humpback whale	4	< 1	8	Moderate
	NARW	< 1	< 1	4	Minor
	Blue whale	< 1	< 1	< 1	Negligible
Mid-frequency cetaceans	Sperm whale	< 1	< 1	< 1	Negligible
	Atlantic spotted dolphin	< 1	< 1	2	Minor
	Atlantic white sided dolphin	< 1	< 1	107	Minor
	Common bottlenose dolphin	< 1	< 1	197	Minor
	Common dolphin	< 1	< 1	< 1	Negligible
	Risso's dolphin	< 1	< 1	43	Minor
	Pilot whale	< 1	< 1	< 1	Negligible
High-frequency cetaceans	Harbor porpoise	1	2	78	Moderate
Phocid pinnipeds	Gray seal	< 1	< 1	60	Minor
	Harbor seal	< 1	< 1	54	Minor

Source: CSA Ocean Sciences Inc. (2020).

* Modeled exposure estimates based on impact hammer installation of 16 11-meter monopiles. Installation scenario assumes one difficult and 15 normal installations requiring 4 hours and 2 hours of pile driving, respectively, and 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 individual, which is considered a result of zero for regulatory purposes.

† See impact significance criteria definitions in Table 3.4.4-3.

Impact pile-driving noise could kill or injure or temporarily alter the distribution of fish and invertebrate prey (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish), leading to indirect effects on marine mammal prey resources. These effects would be limited in extent, short term, and are unlikely to measurably affect the amount of prey available to marine mammals across the OCS. Therefore, the indirect adverse effects of underwater noise on marine mammal prey species would be negligible.

Pile driving also produces airborne noise. The NMFS has established a behavioral threshold of 90 A-weighted decibels for otariid and phocid pinniped exposure to airborne noise sources like pile driving (NOAA 2019). No equivalent airborne noise behavioral thresholds have been established for other marine mammal species. Seals are the only pinniped species group expected to occur in the analysis area. Based on methods described by the Washington State Department of Transportation (2020), behavioral-level effects could be experienced within approximately 500 and 10 feet from impact and vibratory pile-driving locations, respectively. However, because seals are expected to avoid construction activities, exposure to these noise effects is unlikely. In addition, marine mammal observers would be able to spot seals within those limits and halt construction, effectively avoiding any risk of seal exposure to airborne noise impacts (Baker et al. 2013; Jacobs 2020). Therefore, the adverse effects of airborne noise on seals are unlikely to impact annual rates of recruitment or survival of the species and would be negligible.

Intermittent non-impulsive noise: Non-impulsive noise sources associated with the Project would include construction-related vibratory pile-driving and vessel noise, aircraft noise, O&M vessel noise, and operational noise from the WTGs.

Vibratory installation of the temporary cofferdam around the SFEC sea-to-shore transition site would produce the most extensive noise effects resulting from Project construction. Low-frequency cetaceans within 22.8 miles (120,374 feet) of the SFEC sea-to-shore transition could experience behavioral effects from vibratory pile-driving noise during temporary cofferdam installation, excluding areas sheltered by Long Island and other land masses. While this exposure area is large, it is predominantly in shallow waters close to shore that are used infrequently by many of the larger marine mammal species.

Although vibratory pile-driving noise can cause behavioral effects at greater distances compared to impact pile-driving noise, the overall sound levels are less intense and less likely to cause injury. Low-frequency cetaceans would have to remain within 0.9 mile (4,823 feet) over an entire day of vibratory pile driving during temporary cofferdam installation and could experience permanent hearing injury. Mid-frequency cetaceans and phocid pinnipeds are less sensitive to the intense, low-frequency sounds produced by vibratory pile driving. For example, phocid pinnipeds would need to remain within less than 0.1 mile (338 feet) from the cofferdam installation for an entire workday to experience hearing injury (see Table 3.4.4-4). It is unlikely that highly mobile species like whales and seals would remain so close to a source of behavioral disturbance for an entire construction day, meaning that the likelihood of permanent hearing injury is low. CSA (2020) evaluated potential marine mammal exposure to two 18-hour periods of vibratory pile driving occurring between October 1 and May 31 and concluded that cofferdam installation would not result in PTS effects on any of the 11 marine mammal species likely to occur in this noise exposure area. In contrast, depending on the month in which the activity occurs, 8 to 11 of these species could experience TTS or behavioral exposures. Based on the significance criteria defined in Table 3.4.4-3, vibratory pile-driving noise from construction of the Proposed Action would result in negligible to minor impacts on marine mammals.

O&M facility construction would include vibratory installation of sheet piles to improve a bulkhead. Underwater noise from vibratory pile driving would be confined to Lake Montauk by the surrounding geography. Gray and harbor seals, harbor porpoise, and potentially some dolphin species may occur in Lake Montauk and could be exposed to O&M facility construction effects. The larger whales, including the ESA-listed species (see Table 3.4.4-1), are not likely to occur in Lake Montauk (USACE 2019). High-frequency cetaceans, including harbor porpoise, would need to remain within 250 feet of pile driving for an entire day to experience permanent injury. Phocid pinnipeds, which are less sensitive to low-frequency sounds produced by vibratory pile driving, would need to remain within 103 feet of pile installation for an entire day to experience injury-level effects (see Table 3.4.4-4). These species are highly mobile and would likely avoid areas affected by construction-related disturbance. Therefore, the likelihood that these species would experience permanent injury is low. When EPMs are considered, the likelihood of injury-level effects from vibratory pile driving in Lake Montauk is negligible.

Additional sources of non-impulsive noise associated with construction of the Proposed Action include aircraft noise, vessel noise, and noise associated with dredging activities. Fixed-wing aircraft may be used during construction for marine mammal monitoring, and helicopters may be used for crew transport to and from construction vessels. Monitoring aircraft would operate at an altitude of 1,000 feet consistent with established guidance (BOEM 2019). Noise levels generated by helicopters and propeller-driven aircraft at this altitude range from 65to 85 dBA (Behr and Reindel 2008; Brown and Sutherland 1980), below the 90-dBA airborne noise thresholds for seals (NOAA 2019). Aircraft operations at these altitudes have not been associated with observable behavioral effects on marine mammals (Patenaude et al. 2002). Noise from crew transport helicopters would increase during approach and departure from vessel landing pads but would not be expected to exceed disturbance thresholds or add significantly to behavioral disturbance caused by the presence of the vessels. For this reason, the effects of noise from aircraft operations on marine mammals would be negligible.

Denes et al. (2020) modeled the distance required for construction vessel noise to drop below marine mammal behavioral thresholds. They determined that marine mammals would have to remain within 115 to 367 feet (35 to 112 m) of a stationary vessel using its dynamic positioning thrusters for 24 hours to experience cumulative injury (see Table 3.4.4-4). Construction vessel noise would exceed marine mammal behavioral thresholds over a larger area, extending from 42,362 to 48,077 feet (12,911 to 14,654 m) from the source (see Table 3.4.4-4). The likelihood of any marine mammal species remaining close enough to a construction vessel for long enough to experience hearing injury is remote because marine mammals are mobile and unlikely to stay so close to noise exceeding behavioral thresholds for extended periods. Vessels under way produce lower noise levels and are moving, so the likelihood of injury level exposure for any marine mammal species is similarly remote.

Although construction vessels can produce noise levels sufficient to cause behavioral effects in marine mammals, BOEM anticipate that significant impacts affecting many individuals are unlikely given the patchy distribution of species in the area of direct effects. In addition, a substantial portion of construction vessel activity would occur in an area having high levels of existing levels of vessel traffic. Construction vessel noise would be similar to baseline noise levels produced by existing large vessel traffic in the vicinity. BOEM has concluded that although some individual marine mammals may experience short-term behavioral effects from vessel noise exposure, the limited nature of these effects and number of individuals affected would not be significant at stock or population levels. On this basis, the effects of vessel noise on marine mammals would be minor.

Construction of the O&M facility would include dredging to bring the proposed berthing area to suitable depth for crew transport and maintenance vessels. Dredging also generates underwater noise in excess of ambient conditions. However, Lake Montauk Harbor is routinely dredged to maintain navigation. Noise levels produced by construction dredging would be similar to background conditions associated with existing maintenance dredging and routine vessel traffic in the harbor area. Dredging noise effects on marine mammals from O&M facility construction would therefore be negligible relative to this baseline.

<u>Water quality degradation</u>: Seabed disturbance during Project construction would result in temporary plumes of suspended sediments in the immediate construction area. Fugro modeled TSS levels expected to result from SFWF and SFEC construction (Fugro 2019a, 2019b). Fugro determined that elevated TSS plumes could extend 330 feet and last up to 1 hour before returning to background levels. Elliott et al. (2017) monitored TSS levels during construction of the BIWF. The observed TSS levels were far lower than levels predicted using the same modeling methods, dissipating to baseline levels less than 50 feet from the disturbance. Both the modeled TSS effects, which are conservatively high, and the observed TSS effects were short term and within the range of baseline variability. Dredging activities at the O&M facility would also result in temporary TSS plumes. However, these effects would be short term (lasting only a few tide cycles) due to the low mobility of sediments (primarily sand) in the proposed dredge area (Stantec 2020). As discussed in Section 3.4.4.2.2, seals and dolphins have evolved in and are able to forage and move effectively in low-visibility conditions. This suggests that temporary reduction in visibility would not significantly impair behavior in response to elevated TSS. Even if marine mammals were to temporarily alter their behavior (e.g., by avoiding the disturbance and/or interrupting foraging), the disturbance would be localized in extent, limited in magnitude, and short term. Therefore, the anticipated effects of construction-related seabed disturbance on marine mammals would be minor, and no population-level effects would be expected.

<u>Vessel traffic</u>: Construction vessels pose a potential collision risk and generate disturbance and artificial light. Long (2017) observed that marine mammals were temporarily displaced by offshore energy facility construction vessels. However, as stated in Section 3.5.6 (Navigation and Vessel Traffic), the Project would only have a minor impact to baseline vessel traffic in the analysis area. Based on information provided by DWSF, Project construction would require an estimated total of 50 vessel trips between the

Port of New London, Connecticut, and the SFWF over the 2-year construction period, with an estimated maximum of six trips in any given month from U.S. ports outside of the RI/MA WEA. Port traffic within the RI/MA WEA would add an additional 127 one-way trips during WTG installation and 146 one-way trips during cable installation to the SFWF. Depending on the contractor selected, up to eight construction vessels could travel to the Lease Area from unspecified ports in Europe or elsewhere in the world. The construction vessels used for Project construction are described in Section 3.1.3.1 and Table 3.1-6 of the COP. Typical large construction vessels used in this type of project range from 325 to 350 feet in length, 60 to 100 feet in beam, and draft from 16 to 20 feet (Denes et al. 2020).

NMFS (2020) evaluated marine mammal collision risk for the much larger Vineyard Wind project. They concluded that the collision risk was negligible because of the nature of construction and planned mitigation measures. Specifically, construction vessels either remain stationary when installing the monopiles and WTG/OSS equipment or move slowly (i.e., at less than 10 knots) when travelling between foundation locations. Cable laying vessels move very slowly, on the order of 1 mile per day. Planned mitigation measures, including voluntary speed restrictions and use of PSOs, would effectively limit collision risk when travelling to and from area ports. The Proposed Action would involve a smaller number of vessels and vessel trips and would employ a similar suite of mitigation measures to those proposed for the Vineyard Wind project. On this basis, BOEM concludes that collision-related effects on marine mammal species from the Project would be negligible.

Marine debris and accidental spills: Construction vessels pose a theoretical source of marine debris and accidental discharges of petroleum products and other toxic substances. Marine debris are a known source of adverse effects to marine mammals (Laist 1997; NOAA-MDP 2014a, 2014b). 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 250.300). 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 risk to marine mammals from trash and debris from the Project is negligible.

Construction vessels also pose the greatest risk of accidental spills that could result from the Project. Small spills could occur during fuel transfers or collisions with other vessels or structures. The applicant would follow strict oil spill prevention and response procedures during all Project phases, effectively avoiding the risk of significant spills. Given the low potential for spills and minimal risk of exposure to small, temporary spills, the risk from construction-related petroleum spills is negligible.

Operations and Maintenance and Conceptual Decommissioning

The operational effects of the Project include the physical presence of the SFWF turbine and substation foundations, alteration of benthic habitat by rock armoring and scour protection, underwater and airborne noise from the operating turbines, O&M vessel traffic and associated underwater noise, and annual maintenance dredging of the O&M facility, water quality degradation due to maintenance dredging, EMF effects generated by the inter-array cable and SFEC, maintenance vessel trips, and artificial lighting on the WTG and substation towers.

Project construction and conceptual decommissioning would involve similar vessels, equipment, and methods, and, except for noise, would produce similar effects. Pile driving would not be required for conceptual decommissioning. The monopile foundations would be cut at 15 feet below the seabed in accordance with 30 CFR 585.910 using a cable saw or an internal abrasive waterjet cutting tool and returned to shore for recycling. Noise produced by cutting equipment is generally indistinguishable from engine noise (Pangerc et al. 2016), and therefore would not lead to additional effects beyond vessel noise.

The presence of SFWF monopile foundations over the life of the Project would alter the character of the ocean environment, and their presence could affect marine mammal behavior; however, the likelihood and significance of these effects are difficult to determine. Long (2017) compiled a statistical study of seal and cetacean (including porpoises and baleen whales) behavior in and around Scottish marine energy facilities. The study found evidence of displacement during construction, but habitat use appeared to return to previous levels once construction was complete and the projects were in operation. Long cautioned that observational evidence was limited for certain species and further research would be required to draw a definitive conclusion about operational effects. Delefosse et al. (2017) reviewed marine mammal sighting data around oil and gas structures in the North Sea and found no clear evidence of species attraction or displacement. However, studies of marine mammal behavior around wind energy facilities have found evidence for species attraction and displacement, depending on the species. For example, Russel et al. (2014) found clear evidence that seals were attracted to a European wind farm, apparently exploiting the abundant concentrations of prey produced by artificial reef effects. In contrast, Teilmann and Carstensen (2012) documented the apparent long-term displacement of harbor porpoises from previously occupied habitats within and around a wind farm in the Baltic Sea.

NMFS (2020) considered the effects of structure presence on ESA-listed marine mammals and concluded the following:

> The WTGs are proposed to be laid out in a grid-like pattern with spacing of 0.76-1.0 nautical mile between turbines. The minimum distance between nearest turbines is no less than 0.65 nautical mile and the maximum distance between nearest turbines is no more than 1.1 nm. The average spacing between turbines is 0.86 nm. The upper range of whale lengths are as follows: North Atlantic right whale (59 feet [18 meters]), fin whale (79 feet [24 meters]), sei whale (59 feet [18 meters]), and sperm whales (59 feet [18 meters]). As noted in the BA, for reference, about 103, 59-ft long North Atlantic right whales (large females) would fit end-to-end between two foundations spaced at 1 nm. Based on a simple assessment of spacing, it does not appear that the WTGs would be a barrier to the movement of any listed species through the area. (NMFS 2020:249–250)

The presence of the SFWF could also cause indirect effects on marine mammals by changing the distribution and abundance of preferred prey and forage species. Monopiles and scour protection would create an artificial reef effect (Langhamer 2012; Wilson and Elliot 2009), potentially increasing fish and invertebrate abundance within the facility footprint. This could alter predator-prey interactions in and around the facility with uncertain and potentially beneficial or adverse effects on marine mammals. For example, seals and porpoises could benefit from increased abundance and concentration of prey generated by the reef effect (e.g., Russel et al. 2014). In contrast, the presence of vertical structures in the water column could cause localized changes in circulation and stratification patterns, with potential implications for primary and secondary productivity and fish distribution. These potential effects and their implications for marine mammal prey resources are discussed in Section 3.4.2.2.3.

The Vineyard Wind project is located approximately 30 miles east of the SFWF, similarly situated near the northern edge of the seasonal cold pool in the Mid-Atlantic Bight. This important oceanographic feature strongly influences the distribution of fish and planktonic organisms and trophic interactions in the region. NMFS (2020) reviewed available research on the hydrodynamic effects of WTG foundations to assess potential indirect effects on marine mammals from the much larger Vineyard Wind energy facility. NOAA concludes the following:

> Relative to the southern New England region and Mid-Atlantic Bight as a whole… the proposed (Vineyard Wind) Project (no more than 100 turbines) and the small footprint of the [wind development area] WDA… is small. Based on the available information, we do not expect the scope of hydrodynamic effects to be large enough to influence regional

> conditions that could affect the distribution of prey, mainly zooplankton, or conditions that aggregate prey in the local southern New England region or broader Mid-Atlantic Bight. This is because any effects to hydrodynamics that could result in disruptions to the distribution of zooplankton are expected to be limited to an area within a few hundred meters of individual turbines… (L)ocalized changes (within) the WDA and waters within a few hundred meters downcurrent of the foundations of the wind turbines could result in localized changes in zooplankton distribution and abundance. Based on the spacing of the turbines, these areas will not interact or overlap. Thus, the disruption of zooplankton distribution will be limited spatially and will be patchy throughout the project footprint. This disruption in distribution will not result in a reduction in overall abundance of zooplankton in the project area. Thus, we do not anticipate any higher trophic level impacts; that is, we do not anticipate any reductions in gelatinous organisms, pelagic fish, or benthic invertebrates that depend on zooplankton as forage. (NMFS 2020:249)

The logic supporting these conclusions for the Vineyard Wind project would also apply to the Proposed Action, which has similar monopile foundation spacing but a smaller number of foundations overall (16 versus 100). On this basis, BOEM concludes that the Proposed Action would have negligible to minor direct effects on marine mammal movement and migration, and negligible indirect effects on the distribution, abundance, and availability of marine mammal prey and forage resources.

Intermittent non-impulsive noise: Offshore WTGs produce audible underwater noise mostly in lower frequency bands. Typical noise levels range from 110 root mean square decibels (dB_{RMS}) to 130 dB_{RMS}, sometimes louder under extreme operating conditions (Betke et al. 2004; Jansen and de Jong 2016; Marmo et al. 2013; Nedwell and Howell 2004; Tougaard et al. 2009). Operational noise increases with ambient wind and wave noise and generally remains indistinguishable from background within a few hundred feet from the source. Operational noise could interfere with communication and echolocation, reducing feeding efficiency in the areas within a few hundred feet of the monopiles under some conditions. Any such effects would likely be dependent on hearing sensitivity and the ability to adapt to low-intensity changes in the noise environment. For example, based on known hearing sensitivity (Johnson 1967; NOAA 2018), mid-frequency cetaceans like dolphins are likely to be insensitive to the low-frequency sounds generated by operational WTGs. Dolphins vocalize in low frequencies, suggesting the possibility of masking effects, but these species are also known to shift vocalization frequencies to adapt to natural and anthropogenic conditions (David 2006; Quntana-Rizzo 2006). In contrast, although high-frequency cetaceans could be relatively insensitive to low-frequency sounds generated by WTGs, harbor porpoise have demonstrated long-term avoidance of formerly occupied habitats following the development of large windfarms in the Baltic Sea. The cause of this behavior (operational noise, presence of the structures, other species interactions, etc.) was unclear, but the authors note that harbor porpoises were starting to use the affected habitats again after a decade of avoidance (Tielmann and Carstensen 2012).

On balance, any operational noise effects from the SFWF are likely to be of low intensity and highly localized. Jansen and de Jong (2016) and Tougaard et al. (2009) concluded that marine mammals would be able to detect operational noise within a few thousand feet of WTGs but the effects would have no significant impacts on individual survival, population viability, distribution, or behavior. Newer generation WTGs use direct drive motors that produce less noise and vibration than the models considered in the currently available research, indicating that the effects of the Project would be lower still. On this basis, the effects of operational noise on marine mammals would be negligible.

The O&M facility would require annual maintenance dredging to maintain CTV berths. Dredging would be completed with the use of a barge-mounted crane or excavator fitted with a clamshell bucket. Seals would likely avoid the area during dredging activities as a result of underwater noise. Montauk Harbor is periodically dredged to maintain navigational access (USACE 2019), meaning that this form of disturbance already commonly occurs. Because underwater and airborne noise would not differ from background noise from existing vessel traffic and harbor maintenance activities, noise and disturbance associated with maintenance dredging noise is not expected to have a meaningful impact on marine mammals; therefore, the effects to marine mammals would be negligible.

Project conceptual decommissioning would require the use of construction vessels of similar number and class as used during construction. Decommissioning activities would produce similar short-term effects on marine mammals to those described above for Project construction, including short-term displacement, behavioral alteration, and elevated TSS exposure. Underwater noise and disturbance levels generated during conceptual 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 effects of Project conceptual decommissioning on marine mammals would therefore range from negligible to minor.

Water quality degradation: Annual maintenance dredging activities at the O&M facility would temporarily elevate TSS levels in the area surrounding the dredge footprint. However, these effects would be short term (lasting only a few tide cycles) due to the low mobility of sediments (primarily sand) in the proposed dredge area (Stantec 2020). Therefore, the resulting adverse impacts to marine mammals would be negligible because these species are mobile and forage over large areas and their ability to feed would not be measurably affected by short-term and limited TSS effects.

Artificial lighting: The SFWF would introduce stationary artificial light sources to the analysis area. Orr et al. (2013) summarized available research on potential operational lighting effects from offshore wind energy facilities. They concluded that the operational lighting effects to marine mammal distribution, behavior, and habitat use were negligible if recommended design and operating practices are implemented.

EMF: Exponent Engineering, P.C. (2018) modeled EMF levels that could be generated by the SFEC and inter-array cable. They estimated induced magnetic field levels ranging from 13.7 to 76.6 mG on the bed surface above the buried and exposed SFEC cable, and 9.1 to 65.3 mG above the inter-array cable, respectively. Induced field strength would decrease effectively to 0 mG within 25 feet of each cable. By comparison, the earth's natural magnetic field in the analysis area is more than five times the maximum potential EMF effect from the Project (see Figure F-7 in Appendix F). Background magnetic field conditions would fluctuate by 1 to 10 mG from the natural field effects produced by waves and currents. The maximum induced electrical field experienced by any organism close to the exposed cable would be no greater than 0.48 mV/m (Exponent Engineering, P.C. 2018). BOEM has conducted literature reviews and analyses of potential EMF effects from offshore renewable energy projects conducted (CSA Ocean Sciences Inc. 2019; Inspire Environmental 2019; Normandeau et al. 2011). These and other available reviews and studies (Gill et al. 2005; Kilfoyle et al. 2018) suggest that most marine species cannot sense very low-intensity electric or magnetic fields at the typical AC power transmission frequencies associated with offshore renewable energy projects. Normandeau et al. (2011) reviewed the potential effects of EMF from offshore wind energy projects on marine mammals and other species. They concluded that marine mammals are unlikely to detect magnetic field intensities below 50 mG, suggesting that these species would be insensitive to EMF effects from Project electrical cables. Project-related EMF would be below this threshold and therefore indistinguishable from natural variability in the analysis area, except in a few locations where the cable lies on the bed surface. The areas with potentially detectable EMF would be small, extending only a few feet from the cable. The likelihood of marine mammals encountering those areas is low and the EMF levels over the majority of cable length are below detectable limits, therefore EMF effects to marine mammals would be negligible.

Vessel traffic: DWSF has estimated that Project O&M would involve up to seven vessel trips per month, or between 2,500 and 2,600 vessel trips over the lifetime of the Project. Most of the vessel trips (2,500) would originate from the Montauk O&M facility, with rare vessel trips (< 1 month) originating from New London, Connecticut, or unspecified ports in Europe on an as-needed basis. Most of the vessel trips would involve crew transfer boats less than 65 feet in length, with larger vessels making less frequent trips to remove entangled fishing gear, repair scour protection, or to replace damaged WTGs.

As described in the previous section, NMFS (2020) evaluated marine mammal collision risk from the construction and operation of the much larger Vineyard Wind project. They concluded that the vessel collision risk posed by O&M for that project would be negligible when planned mitigation measures are considered. The Project would involve a smaller number of O&M vessels and vessel trips than those proposed for the Vineyard Wind project and would employ a similar suite of mitigation measures. On this basis, BOEM concludes that collision-related effects on marine mammal species from O&M vessel operation would be negligible.

Cumulative Impacts

Accidental releases and discharges: The Proposed Action could result in accidental releases of contaminants, trash/debris, or invasive species that could incrementally add to releases from other reasonably foreseeable projects. BOEM estimates that the Project would result in a negligible 2% incremental increase in total chemical usage over the No Action alternative. When combined with other offshore wind projects, up to approximately 850,000 gallons of coolants and 10.5 million gallons of oils and lubricants that could cumulatively be stored within WTG foundations and the OSS within the geographic analysis area (see Section 3.3.2.2.3 [Proposed Action Alternative] for quantities and details). Compliance with USCG regulations would minimize the risk of accidental release of trash or debris from vessels. Additionally, as discussed in Section 3.4.4.2.2 No Action Alternative, 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, the Proposed Action when combined with past, present, and reasonably foreseeable activities would also result in negligible cumulative effects on marine mammals.

EMF: The Proposed Action would result in negligible incremental impacts to marine mammals from EMF exposure via the addition of 82.5–86.9 miles of cable (1%) within the geographic analysis area. Submarine power cables would be installed with appropriate shielding and burial depth to reduce potential EMF at the substrate surface. The SFEC and inter-array cables would maintain a minimum separation of at least 330 feet from other known cables, ensuring that there are no additive EMF effects from adjacent cables. Additionally, EMF detectable to marine mammals would only occur along small portions of cables, representing a miniscule portion of the habitats used by migrating marine mammals, and any changes in swimming direction or altered migration routes would not be biologically significant.

BOEM estimates a cumulative total of 5,866 miles of cable for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. 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 represent a long-term negligible impact on marine mammals.

New cable emplacement/maintenance: The Proposed Action would result in localized, temporary negligible incremental impacts to marine mammals through an estimated 913 acres of cabling-related seabed disturbance and associated increased suspended sedimentation within the geographic analysis area. BOEM estimates a cumulative total of 8,864 acres of seabed disturbance for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. No population-level effects on marine mammals are expected from reduced water quality. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in negligible cumulative effects on marine mammals.

Noise: The Proposed Action would result in localized, temporary negligible to minor incremental impacts to marine mammals through the generation of impulsive and non-impulsive underwater noise associated with offshore wind construction activities. The Proposed Action would be implemented in conjunction with the potential construction and operation of 16 other offshore wind projects in the geographic analysis area from 2022 to 2030 (see Appendix E, Attachment 4). Construction of these projects, most notably pile driving, would generate airborne and underwater noise with the potential to affect marine mammals. Other sources of noise from wind projects include G&G surveys, aircraft used for construction and facility monitoring, crew transportation, WTG operation, and construction and O&M vessel traffic. These noise sources could incrementally add to the ambient noise environment under the No Action alternative if noise sources overlap temporally or geographically. As described in Section 3.4.4.2.2 (No Action Alternative), the potential effects of airborne and underwater noise exposure include low-level behavioral effects; noise interference with communication, foraging, mating, predator avoidance, and navigation; and sublethal injury. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in negligible to moderate cumulative impacts on marine mammals, varying by species.

Specific cumulative analyses are provided for impulsive and non-impulsive noise sources below.

Impulsive noise: G&G surveys have been conducted for the Project. However, additional G&G surveys could be required before or after installation to inspect cables and foundation. Given that HRG and geotechnical surveys associated with offshore wind do not result in large ensonified areas, and G&G surveys with the potential to result in impacts would typically be conducted in accordance with an approved incidental harassment authorization, the Project's incremental effect would be localized and temporary and unlikely to impact recruitment or survival of marine mammals and are therefore considered negligible.

During construction, impacts may be moderate for all mysticetes within the ensonified area because the lower frequency of sound emitted from vessels overlaps in their hearing range of mysticetes and may affect mysticetes over larger areas compared to the other marine mammals. These impacts would be temporary, limited to construction months within the Lease Area, and not expected to have stock or population-level effects. The COP also proposes several EPMs (see Table G-1 in Appendix G) to avoid and minimize effects on marine mammals during pile-driving activities. These include an in-water construction window of May 1 to December 31 to avoid potential noise impacts on NARW; mitigation measures, such as soft start and attenuation devices; and monitoring of exclusion areas by trained PSOs with the authority to halt pile-driving activities if marine mammals are sighted. Timing restrictions would avoid pile-driving impacts during periods of peak NARW abundance. BOEM therefore anticipates Project incremental impacts to NARW would be limited to be minor and temporary behavioral disturbances. Impacts to other marine mammals would range from negligible to moderate, depending on the species. Moderate effects may result from potential PTS injury to individual harbor porpoises and to fin, humpback, and minke whales.

No significant cumulative effects on marine mammals are anticipated for airborne pile-driving noise based on the rationale presented in Section 3.4.4.2.2 (No Action Alternative). The only marine mammal behavioral threshold for airborne noise sources is the 90-dBA threshold established for seals and other pinnipeds (NOAA 2019). Marine mammals would be able to detect and avoid underwater noise exceeding behavioral thresholds at far greater distance than airborne pile-driving noise that exceeds this threshold. Therefore, the Project's incremental effects of airborne pile-driving noise on marine mammals would be negligible.

Intermittent non-impulsive noise: Underwater noise generated by vessel engines and other human activity is a significant factor affecting the wellbeing of marine mammal populations around the globe (Pirotta et al. 2018). Intermittent underwater noise from vessel traffic can mask communication, interfere with the ability to detect predators and prey, and cause physiological stress (Rolland et al. 2012; Tsujii et al. 2018; Wisniewska et al. 2018). The marine mammal geographic analysis area has high baseline levels of anthropogenic noise from large marine vessel traffic. The construction and operation of the Proposed Action would generate additional non-impulsive underwater noise with the potential to contribute to additional cumulative effects. However, these effects must be considered relative to existing conditions in the environment.

Helicopters and fixed-wing aircraft may be used during marine mammal monitoring during construction, crew transportation, and facility monitoring. As discussed in Sections 3.4.4.2.2 No Action Alternative and 3.4.4.2.3 Proposed Action Alternative, aircraft associated with the Project would operate at greater altitudes except when flying low to inspect WTGs or to take off and land on the service operations vessel. Low-altitude helicopter operations would occur within the area of probable behavioral avoidance created by the service vessel and would therefore not significantly add to existing levels of disturbance. During airborne monitoring activities, aircraft would be expected to comply with altitude recommendations in BOEM (2019) guidance. Aircraft operations at these altitudes have not been associated with observable behavioral effects on marine mammals. For this reason, helicopter and aircraft noise associated with the Proposed Action is not likely to contribute to biologically significant cumulative effects, such as recruitment and survival, on marine mammals. BOEM expects any Project incremental impacts to be short term, temporary, and negligible.

Vessel noise from the construction operation of the Proposed Action may contribute to minor and short-term behavioral noise effects of marine mammals. Construction and O&M vessel noise would be similar to baseline noise levels produced by existing large vessel traffic in the vicinity, although it may occur in different locations where baseline noise levels are lower. Intermittent vessel noise effects from Project O&M would occur over the lifetime of the Project. Vessel noise effects on marine mammals would be mitigated by timing and speed restrictions and other EPMs (see Table G-1 in Appendix G). As stated in Section 3.4.4.2.2 No Action Alternative, BOEM anticipates that vessel noise effects from all offshore wind projects would be intermittent and negligible under the No Action alternative. Based on this rationale, the Project's incremental effect would be negligible relative to existing effects from the baseline level of anthropogenic noise present in the environment.

The Proposed Action would incrementally increase underwater noise in the area immediately surrounding each WTG foundation, but the resulting noise effects would not be biologically significant based on the rationale presented in the previous section. Therefore, the Project's incremental effect would be negligible and not significantly increase the magnitude and extent of underwater noise currently experienced by marine mammals in the geographic analysis area.

Construction and maintenance dredging of the O&M facility would generate periodic underwater noise within Montauk Harbor. As stated earlier, the harbor is routinely dredged to maintain navigation and berthing access, so these activities would not significantly alter baseline conditions. Therefore, the Project's incremental effect would be negligible and not significantly increase the magnitude and extent of underwater noise currently experienced by marine mammals in the geographic analysis area.

Noise produced by jet plows would be short term and of lesser magnitude than the associated vessel noise. This noise source is unlikely to result in significant effects on marine mammals beyond the minor short-term behavioral effects associated with construction vessel noise. BOEM anticipates some temporary behavioral effects from cable vessel noise, with marine mammal populations fully recovering following cable installation.

As detailed in Section 3.4.4.2.2 (No Action Alternative), BOEM expects the operation of planned offshore wind energy facilities is unlikely to result in biologically significant cumulative effects on most marine mammal species. Harbor porpoise may be an exception because this species has demonstrated long-term behavioral displacement from and gradual reoccupation of wind energy facilities in Europe (Teilmann and Carstensen 2012). Therefore, the Project's cumulative effect (when combined with past, present, and reasonably foreseeable activities) would be negligible to minor, depending on species.

Port utilization: Although dredging or in-water work for the Port of Montauk could be required for the Proposed Action, these actions would occur within heavily modified habitats. BOEM expect impacts to marine mammals due to the incremental increase in port expansion resulting from the Proposed Action to be negligible. 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 represent a negligible impact to marine mammals.

Presence of structures: The Proposed Action would result in long-term negligible to minor beneficial impacts to marine mammals through the installation of 16 structures (15 WTGs and one OSS) to conditions under the No Action alternative. As described in Section 3.4.4.2.2 (No Action Alternative), structures associated with offshore wind farms are expected to provide some level of reef effect and may result in long-term beneficial impacts on seal and small odontocete foraging. With respect to reef effect and foraging opportunities, the addition of new offshore structures in the geographic analysis area could increase marine mammal prey availability by creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014 as cited in English et al. 2017). Increased fish biomass around the structures could attract commercial and recreational fishing activity, creating the potential for lost gear accumulating on the monopile foundations. The structures could also capture drifting derelict gear. This presents a potential increased risk of injury or death from gear entanglement and ingestion of debris. Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARWs and may be a limiting factor in the species recovery (Knowlton et al. 2012). Johnson et al. (2005) report that 72% of NARWs show evidence of past entanglements. DWSF would routinely inspect the monopile foundations and remove entangling gear to minimize this potential risk.

Some displacement of marine mammals out of the Lease Area and into areas with a higher potential for interactions with ships or fishing gear could also occur, particularly during construction phases when elevated underwater noise levels occur. Potential long-term, intermittent impacts would persist until conceptual decommissioning is complete and structures are removed.

BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. For similar reasons as described above, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in negligible to minor impacts to marine mammals, with potentially beneficial effects for some species.

Light: The Proposed Action would result in negligible incremental impacts to marine mammals through the installation of 16 lighted structures (15 WTGs and one OSS). This represents less than a 1% increase to conditions under the No Action alternative. BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities to marine mammal distribution, behavior, and habitat use were uncertain but likely negligible when recommended design and operating practices are implemented. For the same reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would also represent a negligible impact on marine mammals.

Traffic: The Proposed Action would result in negligible incremental impacts to marine mammals through an additional 13 construction vessels within the geographic analysis area. Construction and O&M vessels would comply with NOAA guidelines for avoiding marine mammal strikes, including adhering with voluntary and required vessel speed restrictions. All personnel working offshore would receive training on marine mammal awareness to ensure EPM compliance (see Table G-1 in Appendix G).

BOEM estimates a peak of 207 vessels due to offshore wind project construction over a 10-year time frame, of which five to nine would result from the Proposed Action alone. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be minor; however, BOEM does not expect the viability of marine mammal populations to be affected.

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. This difference may not be measurable but would be expected to help reduce climate change impacts, resulting in negligible to moderate incremental impacts. When combined with other past, present, and reasonably foreseeable actions, the Proposed Action would result in moderate impacts.

Conclusions

Project construction and installation and conceptual decommissioning would physically disturb the water column and seabed, as well as generate impulsive and non-impulsive noise, increase collision, entanglement, and spill exposure risk, and generate artificial light. Similar impacts from Project O&M would occur, although at a lesser extent and duration. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**. Therefore, BOEM expects the overall impact on marine mammals from the Proposed Action alone to be **moderate**, as the overall effect would be notable, but the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate**, depending on the species. 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 **moderate** impacts to marine mammals. BOEM made this call because the overall effect would be notable, but the resource would be expected to recover completely.

3.4.4.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would lead to the same types of impacts on marine mammals from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, construction of this alternative would install fewer WTGs and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period.

Fewer WTGs would result in a smaller area of seabed and water column disturbance and include a shorter duration of associated water quality degradation. Fewer vessels and/or vessel trips would be expected, which would reduce the risk of discharges, fuel spills, and trash in the area, and decrease the risk of colliding with marine mammals. The duration of noise associated with pile driving would decrease. However, the sound levels resulting from construction activities at each WTG would remain unchanged: marine mammal injury and behavioral-level effects thresholds described in the Proposed Action would similarly apply to this alternative but over a shorter construction time period.

Operational impacts of the Transit alternative on marine mammals would be minimally decreased because of the fewer number of WTGs and subsequent smaller area of impact. Less habitat would be altered and impacted by operational noise, artificial lighting, and EMF from the inter-array cable. However, near the SFWF, effects would not be measurably different than the Proposed Action. Annual maintenance dredging and resulting water quality impacts at the O&M facility would not be measurably different than the Proposed Action. Conceptual decommissioning effects would be similar in magnitude to the Proposed Action.

Overall, the effects of the Transit alternative would be limited to same negligible to minor behavioral impacts as those described for the Proposed Action.

Cumulative Impacts

As noted above, the Transit alternative would result in incremental impacts to marine mammals at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative when combined with past, present, and reasonably foreseeable activities would range from negligible to moderate.

If the Transit alternative is implemented, proposed WTGs could need to be relocated or eliminated within offshore wind lease areas to accommodate the proposed transit lanes. Reductions in WTGs and establishing transit lanes in their place would result in cumulative impacts to marine mammals similar to impacts that described under the Proposed Action but to a lesser degree and with a slightly decreased wind farm footprint.

If the Transit alternative reduced the number of WTGs, associated risks to marine mammals, particularly related to pile-driving noise, would subsequently decrease. However, noise associated with additional vessel traffic in addition to the risk of vessel collision or disturbance would be slightly elevated compared to impacts of the Proposed Action. Therefore, the effects of the Transit alternative would be limited to same negligible to minor behavioral impacts as those described for the Proposed Action.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in risks to marine mammals, particularly related to pile-driving noise, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

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

3.4.4.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would lead to the same types of impacts on marine mammals from construction and installation, O&M, and conceptual decommissioning activities as those described for the Proposed Action. However, fewer monopiles could be constructed and the location of installed structures could shift in order to avoid impacts on complex fisheries habitat (see Section 3.4.2.2.5). The duration of pile-driving noise during construction could also be shorter if the number of monopiles is reduced. Therefore, the Habitat alternative is anticipated to result in mostly negligible effects on marine mammals with some potential for minor behavioral effects from construction-related disturbance.

Cumulative Impacts

The Habitat alternative is similar to the Proposed Action except for a slightly smaller construction and operational footprint. Therefore, the Habitat alternative would result in incremental impacts to marine mammals at quantities and durations similar to, or slightly reduced from, the Proposed Action, resulting in negligible to moderate cumulative impacts when combined with past, present, and reasonably foreseeable activities.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated risks to marine mammals, particularly related to pile-driving noise, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

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

3.4.4.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that marine mammal impacts would range from **negligible** to **moderate** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor**, with the potential for **moderate** effects on four species. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**, as the overall effect would be notable, but the resource would be expected to recover completely.

3.4.4.4 Mitigation

Time-of-year restrictions, time-of-day restrictions, exclusion zone protocols, visibility and weather restrictions, daily pre-construction surveys, vessel strike avoidance measures, and vessel speed requirements would further reduce the expected negligible to minor impacts to marine mammals by allowing observers to visually establish required exclusion zones and identify/avoid impacts to any individuals that could be affected by Project actions or vessel interactions. Crew training, vessel observer requirements, and educational awareness would also reduce impacts by increasing the effectiveness of mitigation and monitoring measures. Pile-driving sound source verification, data collection and reporting efforts, and monitoring plans would not reduce pile-driving or other Project-related impacts, but they would ensure that the deployed noise reduction technologies and other employed mitigations are effective. Likewise, injury reporting would ensure that the amount of take that potentially occurs does not exceed the exempted take under the ESA and MMPA. Additionally, the data gathered could be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR 585.633(b)). See Table G-2 in Appendix G for details.

3.4.5 Other Terrestrial and Coastal Habitats and Fauna

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to other terrestrial and coastal habitats and fauna from implementation of the Proposed Action and other considered alternatives.

3.4.6 Sea Turtles

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to sea turtles from implementation of the Proposed Action and other considered alternatives.

3.4.7 Wetlands and Other Waters of the United States

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to wetlands and other WOTUS from implementation of the Proposed Action and other considered alternatives.

3.5 SOCIOECONOMIC AND CULTURAL RESOURCES

3.5.1 Commercial Fisheries and For-Hire Recreational Fishing

3.5.1.1 Affected Environment

3.5.1.1.1 COMMERCIAL FISHERIES

The following analysis focuses on commercial fisheries in the SFWF and offshore SFEC. NMFS provided two primary sources of data used to document fishery activities: Vessel Trip Report (VTR) data and Vessel Monitoring System (VMS) data. Federal VTR data were the primary source of catch estimates by fishing location (with confidential information redacted) provided by NMFS.[8] These data were processed following methods described in Kirkpatrick et al. (2017). NMFS calculated the revenue associated with these catch estimates using price data drawn from commercial fisheries dealer reports. In addition, VMS data were generated from automated transmissions from transponders that are required to be on board and operating whenever permitted vessels are fishing or transiting with the intent to harvest fish or shellfish.[9] Although VMS is only required for vessels fishing for some species of fish and shellfish, from 2017 through 2019, vessels with VMS accounted for a substantial portion (70% or greater) of landings in several federally permitted fisheries in the Mid-Atlantic and New England regions, including the Sea Scallop, Mackerel/Squid/Butterfish, Monkfish, Atlantic herring, Skate, Summer Flounder/Scup/Black Sea Bass, Surfclam/Ocean Quahog, and Northeast Multispecies (large- and small-mesh) FMP fisheries. Additional information on the data sources used in this analysis is presented in Appendix F.

[8] VTR location information is only an approximation of fishing activity, particularly with respect to use of mobile gear, because fishermen self-report only one set of coordinates for a fishing trip, despite the fact that one trip may include multiple tows that take place in many different locations across a much wider area. On the other hand, VTR instructions require that fishermen record the haulback position where most of the fishing occurred (Livermore 2017).

Another limitation of VTR data is that a fisherman with a vessel with a federal lobster permit is only required to fill out a VTR if he or she has another federal permit. Approximately 63% of the lobster fleet fishing in statistical area 537, which encompasses most of the RI-MA WEA, reports through VTRs (ASMFC 2018).

[9] VMS data are transmitted once every 60 minutes for all FMPs except sea scallops, which are transmitted once every 30 minutes. Each transmission includes the current directional bearing and vessel speed as well as the average bearing and vessel speed since the last transmission. Using the average vessel speed, NMFS uses an algorithm to assign an assumed activity (either fishing or transiting) to each transmission.

To understand the relative importance of the SFWF and offshore SFEC to regional fisheries, the commercial fishing revenue sourced from each area is compared to the total commercial fishing revenue reported by the NMFS Greater Atlantic Regional Fisheries Office for federally permitted commercial fishing activity in the New England and Mid-Atlantic regions. These two regions include all coastal states from Maine to North Carolina. To the extent that data are available, the commercial fishing described here includes federally permitted fishing activity in both state and federal waters. Data on the average annual revenue of federally permitted vessels by FMP fishery, gear type, and port of landing are summarized in the tables below and in the figures in Appendix C. In general, the data presented focuses on those FMP fisheries, gear types, and ports that are relevant to commercial fishing activity in the SFWF and offshore SFEC. Additional details on the data and methodology used to develop the tables and figures are provided in Appendix F.

Regional Setting

Commercial fisheries operating in federal waters off the Mid-Atlantic and New England regions are known for large catches of a variety of species, including Atlantic herring, clams, squid, sea scallops, skates, summer flounder, groundfish, monkfish, lobster, and Jonah crab (*Cancer borealis*). These fishery resources are harvested with a broad assortment of fishing gear, including mobile gear (e.g., bottom trawl, dredge, midwater trawl) and fixed gear (e.g., gillnet, pot, bottom longline, seine, hand line). The fishery resources are managed under several FMPs, including the Sea Scallop FMP, Monkfish FMP, Northeast Multispecies (large- and small-mesh) FMP,[10] Skate FMP, and Red Crab FMP (NEFMC 2019); Surfclam/Ocean Quahog FMP, Mackerel/Squid/Butterfish FMP, Spiny Dogfish FMP, Bluefish FMP, Golden and Blueline Tilefish FMP, and River Herring FMP (MAFMC 2019); Highly Migratory Species FMP (NMFS 2020a); and Lobster FMP, Jonah Crab FMP, Atlantic Herring FMP, and Summer Flounder/Scup/Black Sea Bass FMP (ASMFC 2019).[11] These FMP fisheries are referred to frequently throughout the EIS, and therefore the author-date citations are provided here at first mention only.

One way that fishery resources contribute to regional economies is through direct ex-vessel revenue or through revenue generated when a commercial fishing boat lands or unloads a catch. Table 3.5.1-1 shows the average annual revenue by FMP fishery during 2008–2018, the time period for which the most recent data are available. Although there is substantial variability in the year-to-year harvest of various species, on average, federally permitted commercial fishing activity generated approximately $956.0 million in revenue annually from 2008 to 2018, with the Sea Scallop FMP accounting for slightly more than half of the total and the Surfclam/Ocean Quahog FMP, Northeast Multispecies (large-mesh) FMP, and Lobster FMP each accounting for 6% to 10%.

[10] The Northeast Multispecies (large-mesh) fishery is composed of the following species: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice (*Hippoglossoides platessoides*), Atlantic halibut (*Hippoglossus hippoglossus*), redfish (*Sebastes fasciatus*), ocean pout, and white hake (*Urophycis tenuis*). The Northeast Multispecies small-mesh fishery is composed of five stocks of three species of hakes: northern silver hake and southern silver hake (*Merluccius bilinearis*), northern red hake and southern red hake (*Urophycis chuss*), and offshore hake (*Merluccius albidus*). Southern silver hake and offshore hake are often grouped together and collectively referred to as “southern whiting.”

[11] The regional setting includes the jurisdictions of two regional fishery management councils created under the Magnuson-Stevens Fishery Conservation and Management Act: the MAFMC manages fisheries in federal waters off the coasts of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina, and the NEFMC manages fisheries in federal waters off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. The two councils manage species with many FMPs that are frequently updated, revised, and amended, and they coordinate with each other to jointly manage species across jurisdictional boundaries. Some of the managed fisheries of each council extend into state waters. Therefore, the councils work with the ASMFC, which comprises the 15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states’ marine waters. In addition, the lobster and Jonah crab fisheries are cooperatively managed by the states and the NMFS under the framework of the ASMFC (ASMFC 2019).

Table 3.5.1-1. Commercial Fishing Revenue of Federally Permitted Vessels in Mid-Atlantic and New England Fisheries by FMP Fishery (2008–2018)

FMP Fishery	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)
American Lobster	$117,251.0	$93,690.7
Atlantic Herring	$32,856.3	$27,438.1
Bluefish	$1,820.4	$1,320.9
Golden and Blueline Tilefish	$6,583.4	$5,561.7
Highly Migratory Species	$4,008.4	$2,269.3
Jonah Crab	$17,082.7	$9,464.9
Mackerel, Squid, and Butterfish	$69,260.2	$49,851.3
Monkfish	$28,943.7	$21,357.7
Northeast Multispecies (large-mesh)	$105,418.2	$75,501.3
Sea Scallop	$661,233.7	$515,687.0
Skates	$10,217.1	$7,636.3
Northeast Multispecies (small-mesh)	$13,499.5	$11,520.4
Spiny Dogfish	$5,237.2	$3,044.4
Summer Flounder, Scup, Black Sea Bass	$45,205.7	$40,137.8
Non-disclosed and non-FMP fisheries*	97,291.6	$91,602.2
All FMP and non-FMP fisheries	**$1,135,221.4**	**$956,084.1**

Source: Developed using NMFS (2020b).

Note: Revenue is adjusted for inflation to 2019 dollars.

* Includes revenue from the Surfclam/Ocean Quahog, Red Crab, and River Herring FMP fisheries and species that are not included in the fisheries listed in the table, but which are harvested by federally permitted vessels.

Table 3.5.1-2 shows the average annual revenue by gear type for the 2008–2018 period. Scallop dredge gear accounted for 46% of the revenue generated by all gear in the New England and Mid-Atlantic regions. Bottom trawl gear and pot-other gear (including pot gear used in the Lobster FMP fishery) also each generated over $100 million in annual average revenue.

Table 3.5.1-2. Commercial Fishing Revenue of Federally Permitted Vessels in Mid-Atlantic and New England Fisheries by Gear Type (2008–2018)

Gear Type	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)
Dredge-clam	$61,937.2	$56,669.7
Dredge-scallop	$537,264.9	$439,970.3
Gillnet-sink	$37,453.7	$28,030.0
Handline	$4,365.2	$3,696.3
Pot-other	$137,442.0	$100,498.5
Trawl-bottom	$190,143.2	$160,581.1
Trawl-midwater	$22,495.1	$17,392.0
All other gear*	$94,809.2	$149,246.2
All gear types	**$1,023,973.4**	**$956,084.1**

Source: Developed using NMFS (2020b).

Note: Revenue is adjusted for inflation to 2019 dollars.

* Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear.

Commercial fishing fleets are important to coastal communities in the Mid-Atlantic and New England regions by generating employment and income for vessel owners and crews, as well as by creating demand for shoreside products and services to maintain vessels and process seafood products. In 2017, the most recent year for which economic statistics have been collected, the seafood industries (without imports) in Massachusetts, Rhode Island, Connecticut, and New York created a total of approximately 69.4 thousand jobs, generated $3.1 billion in sales, and contributed $1.6 billion in value added (NMFS 2020c).

Table 3.5.1-3 shows the average annual revenue by port of landing for the 2008–2018 period. New Bedford accounted for approximately 39% of the total commercial fishing revenue in the New England and Mid-Atlantic regions, and Cape May and Narragansett/Point Judith accounted for 8% and 5%, respectively.

Table 3.5.1-3. Commercial Fishing Revenue of Federally Permitted Vessels in Mid-Atlantic and New England Fisheries by Port (2008–2018)

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)
Chilmark/Menemsha, MA	$656.1	$476.1
Fairhaven, MA	$17,395.3	$12,078.2
New Bedford, MA	$458,246.8	$373,253.3
Fall River, MA	$5,123.6	$1,248.1
Westport, MA	$1,905.8	$1,355.8
New Shoreham, RI	$303.7	$106.9
Tiverton, RI	$1,603.1	$1,188.9
Little Compton, RI	$3,007.4	$2,007.6
Newport, RI	$16,111.1	$9,127.3
Point Judith, RI	$58,530.9	$45,010.0
New London, CT	$11,117.1	$6,907.8
Stonington, CT	$11,946.4	$10,418.1
Montauk, NY	$24,549.9	$18,933.2
Shinnecock/Hampton Bays, NY	$8,642.8	$6,960.7
Cape May, NJ	$122,692.9	$80,655.7
Point Pleasant, NJ	$37,321.9	$31,355.0
Hampton, VA	$19,482.0	$12,790.7
Newport News, VA	$34,666.8	$22,615.0
Beaufort, NC	$5,210.8	$3,112.0
All other RI-MA WEA ports*	**$92,565.8**	**$44,227.8**
Other New England/Mid-Atlantic ports†	**Not available**	**$272,256.0**
All New England/Mid-Atlantic ports	**$1,135,221.4**	**$956,084.1**

Source: Developed using NMFS (2020b).

Note: Revenue is adjusted for inflation to 2019 dollars.

* Includes other ports that had reported landings from federally permitted vessels fishing in the RI-MA WEAs or offshore SFEC in five or fewer of the 11 years for the 2008–2018 period.

† Includes all other ports that had landings from federally permitted vessels fishing in the New England and Mid-Atlantic regions.

RI-MA WEAs

The SFWF is located in the RI-MA WEAs. Table 3.5.1-4 shows the average annual revenue in the RI-MA WEAs by FMP fishery for the 2008–2018 period. On average, federally permitted commercial fishing activity in the RI-MA WEAs annually generated $4.2 million in revenue, with the Monkfish FMP fishery accounting for 15% of the total, while the Sea Scallop FMP and Lobster FMP fisheries accounting for 13% and 11%, respectively. The Mackerel, Squid, and Butterfish FMP, Skate FMP, Northeast Multispecies (large-mesh) FMP, and Summer Flounder, Scup, Black Sea Bass FMP fisheries also accounted for a between 7% and 9% of the revenue. Table 3.5.1-4 also shows the percentage of each FMP fishery's total revenue in the Mid-Atlantic and New England regions that came from the RI-MA WEAs during the 2008–2018 period. The areas accounted for about 3.6% of the Skate FMP fishery's total revenue, and around 2.2% of the Monkfish FMP fishery's total revenue. In total, the RI-MA WEAs accounted for approximately 0.3% of the total revenue across all FMP fisheries in the Mid-Atlantic and New England regions (see Table 3.5.1-1).

Table 3.5.1-4. Commercial Fishing Revenue of Federally Permitted Vessels in the RI-MA WEAs by FMP Fishery (2008–2018)

FMP Fishery	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
American Lobster	$553.4	$353.6	0.38%
Atlantic Herring	$217.0	$72.5	0.26%
Bluefish	$9.8	$5.8	0.44%
Golden and Blueline Tilefish	$5.1	$2.0	0.04%
Highly Migratory Species	$19.0	$5.2	0.23%
Jonah Crab	$114.5	$48.5	0.51%
Mackerel, Squid, and Butterfish	$630.8	$204.1	0.41%
Monkfish	$728.6	$464.4	2.17%
Northeast Multispecies (large-mesh)	$407.8	$207.3	0.27%
Sea Scallop	$991.8	$412.8	0.08%
Skates	$468.4	$277.9	3.64%
Northeast Multispecies (small-mesh)	$257.1	$121.6	1.06%
Spiny Dogfish	$48.8	$23.9	0.78%
Summer Flounder, Scup, Black Sea Bass	$406.3	$262.8	0.65%
Non-disclosed and non-FMP fisheries*	$1,860.7	$665.5	NA
All FMP and non-FMP fisheries	**$4,206.5**	**$3,128.2**	**0.33%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from the Surfclam/Ocean Quahog, Red Crab, and River Herring FMP fisheries and species that are not included in the fisheries listed in the table, but which are harvested by federally permitted vessels.

Table 3.5.1-5 shows the average annual revenue in the RI-MA WEAs by gear type for the 2008–2018 period. Together, bottom trawl gear and clam and scallop dredge gear accounted for approximately 50% of the revenue generated by commercial fishing activity in the RI-MA WEAs. The areas also accounted for about 2.5% of sink gillnet gear total revenue in the Mid-Atlantic and New England regions.

Table 3.5.1-5. Commercial Fishing Revenue of Federally Permitted Vessels in the RI-MA WEAs by Gear Type (2008–2018)

Gear Type	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Dredge-clam	*$607.3*	*$489.0*	*0.86%*
Dredge-scallop	$931.4	$362.8	0.08%
Gillnet-sink	$1,135.9	$704.0	2.51%
Handline	$40.5	$10.4	0.28%
Pot-other	$613.6	$456.7	0.45%
Trawl-bottom	$1,454.2	$836.6	0.52%
Trawl-midwater	$193.5	$62.0	0.36%
All other gear*	$1,875.7	$433.5	0.29%
All gear types	**$6,244.8**	**$3,355.0**	**0.35%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Gear types shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates.

* Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear, as well as listed gear, for years when they cannot be disclosed.

Table 3.5.1-6 shows the ports at which fish and shellfish caught in the RI-MA WEAs during the 2008–2018 period were landed. Together, New Bedford and Port Judith accounted for approximately 66% of the revenue generated by commercial fishing activity in the RI-MA WEAs. Little Compton and Westport were the ports most dependent on the RI-MA WEAs, with 16.6% and 8.2%, respectively, of their total commercial fishing revenue in the Mid-Atlantic and New England regions derived from the areas.

Table 3.5.1-6. Commercial Fishing Revenue of Federally Permitted Vessels in the RI-MA WEAs by Port (2008–2018)

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Chilmark/Menemsha, MA	$52.5	$26.9	5.66%
Fairhaven, MA	*$96.0*	*$37.6*	*0.31%*
New Bedford, MA	$2,311.0	$1,152.5	0.31%
Fall River, MA	*$12.3*	*$8.9*	*0.71%*
Westport, MA	$179.9	$110.9	8.18%
New Shoreham, RI	$2.6	$1.2	1.11%
Tiverton, RI	$156.4	$46.0	3.87%
Little Compton, RI	$575.7	$332.5	16.56%
Newport, RI	$337.5	$211.5	2.32%
Point Judith, RI	$1,444.2	$925.9	2.06%
New London, CT	*$39.6*	*$16.1*	*0.23%*
Stonington, CT	$89.7	$26.0	0.25%
Montauk, NY	$105.0	$56.5	0.30%

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Shinnecock/Hampton Bays, NY	ND	ND	ND
Cape May, NJ	ND	ND	ND
Point Pleasant, NJ	*$24.2*	*$7.4*	*0.02%*
Hampton, VA	*$30.9*	*$11.7*	*0.09%*
Newport News, VA	ND	ND	ND
Beaufort, NC	*$12.6*	*$6.3*	*0.20%*
Other ports*	$410.9	$182.3	NA
All ports	**$4,221.7**	**$3,160.3**	**0.43%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Ports shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes ports with ND in the table and other unlisted ports that had landings from federally permitted vessels fishing in the RI-MA WEAs during the 2008–2018 period.

In 2010, during the first stage of the public process for BOEM's call for nominations and information to establish the WEA that would eventually become the RI-MA WEAs, all of Cox Ledge was included in the area considered for leasing (i.e., call area). However, BOEM held a lengthy stakeholder and scientific review process that identified "high-value" fishing grounds and excluded those areas from the RI-MA WEAs (BOEM 2012a; Smythe et al. 2016). Over the 2007–2018 period, the excluded area accounted for approximately 21% of the revenue generated by all fisheries in the call area. It accounted for 32% of the Sea Scallop FMP fishery revenue and 26% of the Monkfish FMP fishery revenue in the call area (BOEM 2020). For the Sea Scallop and Monkfish FMP fisheries combined, the revenue per square mile in the excluded area was approximately 50% higher than that in the RI-MA WEAs in 2007–2018.

The NMFS VMS data are a good source for understanding the spatial distribution of fishing vessels in the RI-MA WEAs. As mentioned above, from 2017 through 2019, vessels with VMS accounted for a substantial portion (70% or greater) of landings in several federally permitted fisheries in the Mid-Atlantic and New England regions, including the Sea Scallop, Mackerel/Squid/Butterfish, Monkfish, Atlantic herring, Northeast Multispecies (large- and small-mesh), Skate, Summer Flounder/Scup/Black Sea Bass, and Surfclam/Ocean Quahog FMP fisheries. VMS-enabled vessels represented less than 10% of landings in the Lobster and Jonah Crab FMP fisheries (NMFS 2019). During the 2017–2019 period, an average of 340 VMS-enabled vessels operated in Atlantic WEAs. Of these vessels, an average of 101 (30%) fished in the RI-MA WEAs, including an average of two vessels fishing for Atlantic herring; 10 vessels fishing for monkfish; 22 vessels fishing for multispecies (groundfish); and 22 vessels fishing for sea scallops.

Based on data provided by NMFS (2019), polar histograms (Figure 3.5.1-1 and Figure 3.5.1-2) showing the directionality of VMS-enabled vessels fishing in the RI-MA WEAs were developed using the information conveyed in individual position reports (pings) over the January 2014–August 2019 period. Vessels moving at speeds less than 5 knots were assumed to be actively fishing. The larger bars in the polar histograms represent a greater number of position reports showing fishing vessels moving in a certain direction within the RI-MA WEAs. The polar histograms differ with respect to their scales.

Figure 3.5.1-1 shows most of the 307 unique vessels operating in the RI-MA WEAs followed a slightly northeast–southwest fishing pattern.

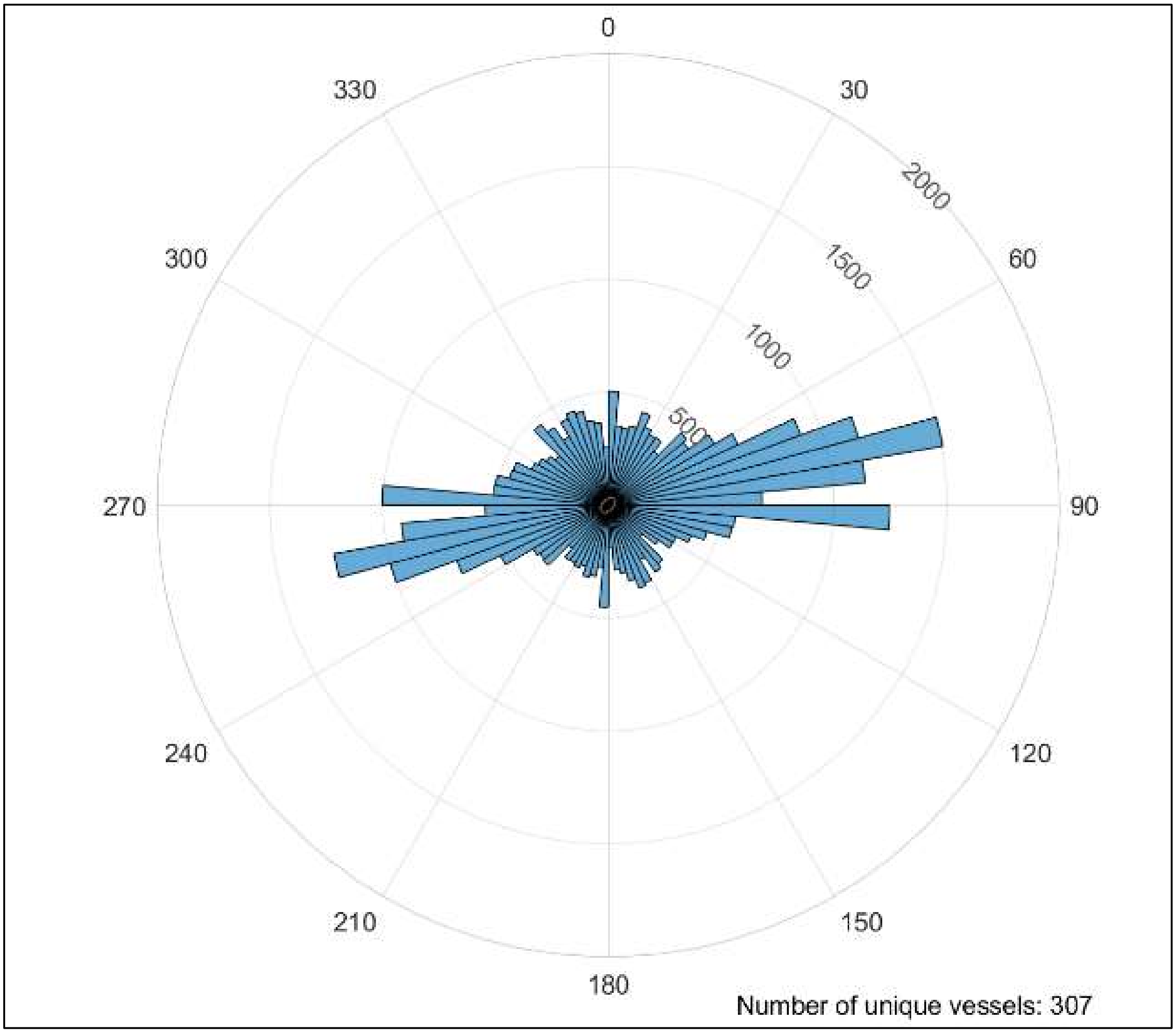
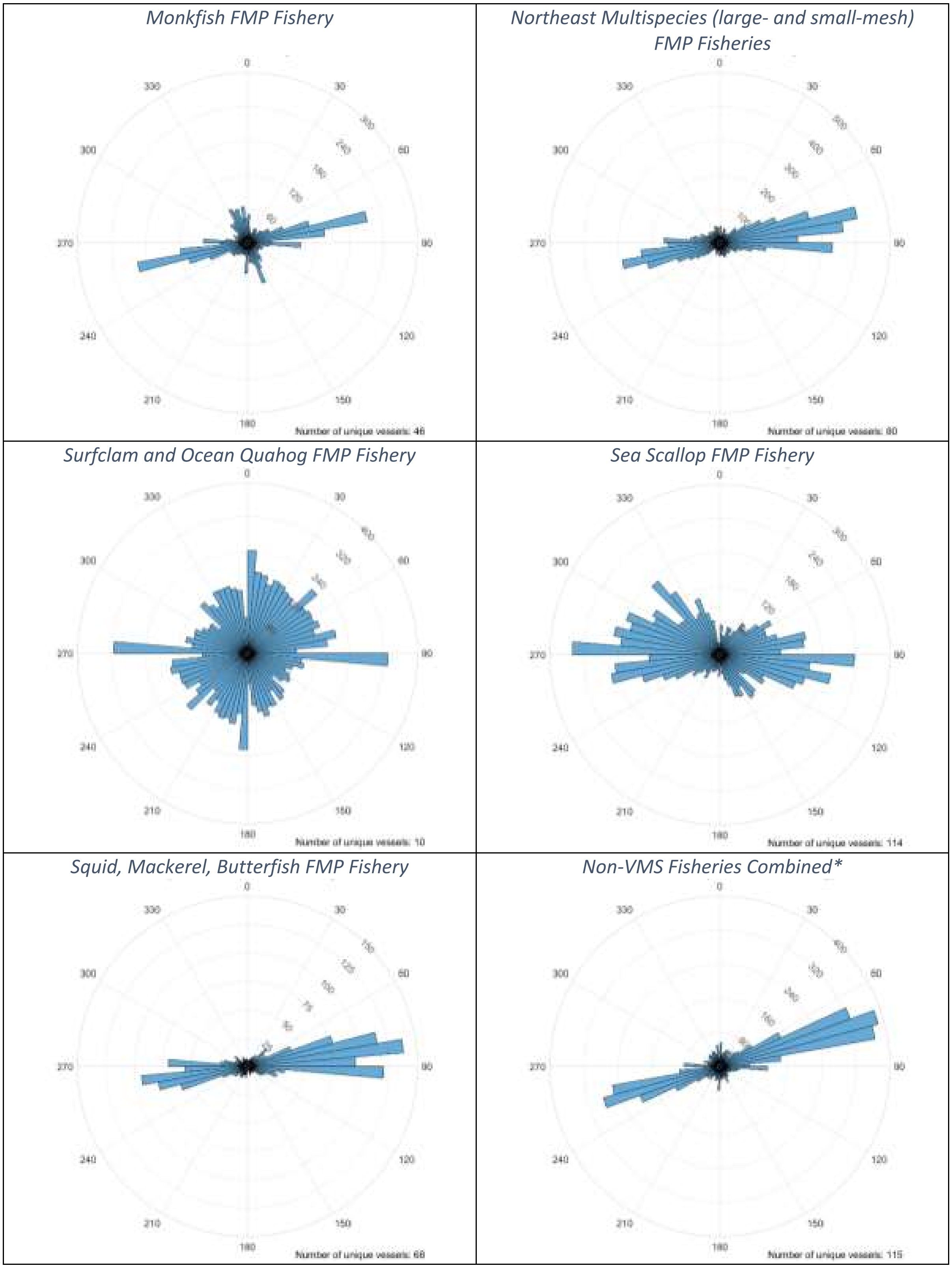


Figure 3.5.1-1. VMS bearings of vessels actively fishing within the RI-MA WEAs, all FMP fisheries combined, January 2014–August 2019.

Figure 3.5.1-2 shows that the orientation of vessels fishing within the RI-MA WEAs varied somewhat by FMP fishery, but in most fisheries, vessels followed a slightly northeast–southwest fishing pattern.



** These are fishing vessels that are transmitting VMS data after having declared themselves as participating in a non-VMS fishery—(e.g. Lobster, Jonah Crab, River Herring, etc.).*

Figure 3.5.1-2. VMS bearings of vessels actively fishing within the RI-MA WEAs by FMP fishery, January 2014–August 2019.

SFWF Lease Area and Offshore SFEC

The commercial fisheries that are most active in the Lease Area and offshore SFEC encompass a wide range of FMP fisheries, gears, and landing ports (Table 3.5.1-7 though Table 3.5.1-12). GIS data available for the 2007–2018 (BOEM 2020) period suggest that most fisheries do not have a high intensity of revenue within the SFWF compared with nearby waters (Figures C-6 to C-28).

Table 3.5.1-7 provides the average annual revenue in the Lease Area by FMP fishery for the 2008–2018 period. On average, federally permitted commercial fishing activity in the Lease Area annually generated $192.0 thousand in revenue, with the Monkfish FMP fishery accounting for 17% of the total. The Sea Scallop FMP fishery and Lobster FMP fishery both accounted for 14% of the total revenue. In terms of the percentage of each FMP fishery's total revenue in the Mid-Atlantic and New England regions that came from the Lease Area during the 2008–2018 period, the area accounted for about 0.23% of the Skate FMP fishery's total revenue and around 0.15% of the Monkfish FMP fishery's total revenue. In total, the Lease Area accounted for approximately 0.02% of the total revenue across all FMP fisheries in the Mid-Atlantic and New England regions (see Table 3.5.1-1).

Table 3.5.1-7 also shows the catch revenue in the SFWF MWA, which encompasses the Lease Area and also includes all anchoring and mooring areas that could be used during the construction of the SFWF. Due to the larger size of the MWA, the catch revenue in the area is estimated to be $228.9 thousand, 119% of that for the Lease Area alone. The increase in revenue between the two areas is highest for the Sea Scallop FMP fishery.

Table 3.5.1-7. Commercial Fishing Revenue of Federally Permitted Vessels in the SFWF Lease Area and MWA by FMP Fishery (2008–2018)

FMP Fishery	SFWF Lease Area					MWA Average Annual Revenue ($1,000s)
	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	Average Number of Vessels	Average Annual Revenue per Vessel	
American Lobster	$48.2	$26.4	0.03%	88	$301	$31.8
Atlantic Herring	$12.8	$5.1	0.02%	16	$319	$6.1
Bluefish	$0.6	$0.3	0.02%	98	$3	$0.4
Golden and Blueline Tilefish	$0.3	$0.1	0.00%	27	$5	$0.1
Highly Migratory Species	*$12.6*	*$2.9*	*0.13%*	*5*	*$536*	*$3.2*
Jonah Crab	$7.3	$2.7	0.03%	44	$62	$3.3
Mackerel, Squid, and Butterfish	$32.5	$11.7	0.02%	103	$114	$14.3
Monkfish	$79.9	$32.2	0.15%	143	$226	$36.3
Northeast Multispecies (large-mesh)	$29.9	$14.0	0.02%	81	$173	$16.7
Sea Scallop	$87.0	$27.7	0.01%	52	$537	$37.0
Skates	$33.2	$17.5	0.23%	108	$163	$20.4
Northeast Multispecies (small-mesh)	$10.2	$6.3	0.05%	88	$72	$7.7
Spiny Dogfish	$3.4	$1.4	0.04%	39	$35	$1.6

FMP Fishery	SFWF Lease Area					MWA Average Annual Revenue ($1,000s)
	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	Average Number of Vessels	Average Annual Revenue per Vessel	
Summer Flounder, Scup, Black Sea Bass	$27.7	$15.7	0.04%	156	$101	$18.5
Non-disclosed and non-FMP fisheries*	$109.6	$27.8	NA	NA	NA	$31.4
All FMP and non-FMP fisheries	**$292.3**	**$192.0**	**0.02%**	**NA**	**NA**	**$228.9**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. FMPs shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. NA indicates that the number cannot be calculated with the available data.

* Includes revenue from the Surfclam/Ocean Quahog, Red Crab, and River Herring FMP fisheries and species that are not included in the fisheries listed in the table, but which are harvested by federally permitted vessels.

With respect to the importance of the Lease Area/MWA to individual commercial fishing vessels, NMFS (2020d) determined, for each federally permitted commercial fishing vessel that fished in the SFWF MWA during the 2008–2018 period, the percentage of the vessel's total fishing revenue that came from within the area. Over the 11 years, an average of 257 vessels per year fished in the MWA, with a high of 292 vessels in 2008 and a low of 222 vessels in 2018. A total of 75% of the vessels that fished in the MWA derived less than 0.2% of their total annual revenue from the area. However, the MWA accounted for a substantial amount of the annual revenue of a small number of vessels. The highest percentage of total annual revenue derived from the MWA by one these outliers varied widely from year to year during the 2008–2018 period.[12] In 2016, there were nine vessels considered to be outliers, and the maximum revenue percentage of any one vessel was 38%. In 2012, there were five outliers, and the maximum revenue percentage was about 5%. Over the 2008–2018 period, the maximum revenue percentage among these outliers averaged around 24%. In short, most vessels fishing in the MWA derived a small percentage of their total annual revenue from the area, but some vessels fished heavily in the area.

Table 3.5.1-8 provides the average annual revenue in the Lease Area and MWA by gear type for the 2008–2018 period. Together, sink gillnet, bottom trawl, and pot-other gear accounted for approximately 69% of the revenue generated by commercial fishing activity in the Lease Area. The area accounted for about 0.18% of the sink gillnet gear's total revenue in the Mid-Atlantic and New England regions.

Table 3.5.1-8. Commercial Fishing Revenue of Federally Permitted Vessels in the SFWF Lease Area and MWA by Gear Type (2008–2018)

Gear Type	SFWF Lease Area			MWA Average Annual Revenue ($1,000s)
	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	
Dredge-clam	ND	ND	ND	*$14.6*
Dredge-scallop	$87.6	$26.2	0.01%	$35.2
Gillnet-sink	$98.0	$49.7	0.18%	$56.5
Handline	$10.8	$1.7	0.04%	$1.9

[12] In the context of this analysis, an outlier is a fishing vessel that derived an exceptionally high proportion of its annual revenue from the MWA in comparison to other vessels that fished in the area. Technically, an outlier in a boxplot distribution is an observation that is more than 1.5 times the length of the box away from either the lower quartile (Q1) or upper quartile (Q3). Specifically, if an observation is less than Q1 – (1.5 × IQR) or greater than Q3 + (1.5 × IQR), it is an outlier; where IQR = interquartile range = Q3 – Q1.

Gear Type	SFWF Lease Area			MWA Average Annual Revenue ($1,000s)
	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	
Pot-other	$111.7	$41.7	0.04%	$49.2
Trawl-bottom	$72.7	$45.1	0.03%	$54.4
Trawl-midwater	*$12.2*	*$4.5*	*0.03%*	*$4.9*
All other gear*	$47.3	$29.9	NA	**$34.1**
All gear types	**$440.3**	**$198.8**	**0.02%**	$236.2

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Gear types shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear, as well as listed gear, for years when they cannot be disclosed.

Table 3.5.1-9 shows the ports at which fish and shellfish caught in the Lease Area and MWA during the 2008–2018 period were landed. Together, Point Judith, New Bedford, Little Compton, and Newport accounted for approximately 76% of the revenue generated by commercial fishing activity in the Lease Area. Little Compton and Westport were the ports most dependent on the Lease Area, with 1.3% and 0.8%, respectively, of their total commercial fishing revenue in the Mid-Atlantic and New England regions derived from the area.

Table 3.5.1-9. Commercial Fishing Revenue of Federally Permitted Vessels in the SFWF Lease Area and MWA by Port (2008–2018)

Port and State	SFWF Lease Area			MWA Average Annual Revenue ($1,000s)
	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	
Chilmark/Menemsha, MA	$3.8	$0.9	0.19%	$1.2
Fairhaven, MA	*$4.9*	*$1.5*	*0.01%*	*$1.8*
New Bedford, MA	$68.1	$43.3	0.01%	$52.7
Fall River, MA	ND	ND	ND	ND
Westport, MA	$19.6	$10.4	0.77%	$13.3
New Shoreham, RI	*$0.1*	*$0.1*	*0.07%*	*$0.1*
Tiverton, RI	*$6.5*	*$4.0*	*0.34%*	*$3.4*
Little Compton, RI	$53.9	$26.7	1.33%	$30.9
Newport, RI	$34.4	$17.4	0.19%	$19.0
Point Judith, RI	$100.3	$60.8	0.14%	$75.1
New London, CT	*$3.0*	*$1.2*	*0.02%*	*$1.4*
Stonington, CT	*$2.9*	*$1.1*	*0.01%*	*$1.3*
Montauk, NY	$13.2	$5.0	0.03%	$5.5
Shinnecock/Hampton Bays, NY	ND	ND	ND	ND
Cape May, NJ	ND	ND	ND	ND
Point Pleasant, NJ	*$1.6*	*$0.5*	*0.00%*	*$0.6*
Hampton, VA	*$1.9*	*$0.7*	*0.01%*	*$0.8*

Port and State	**SFWF Lease Area**			**MWA Average Annual Revenue ($1,000s)**
	Peak Revenue ($1,000s)	**Average Annual Revenue ($1,000s)**	**Percentage of Total Revenue from the Mid-Atlantic and New England Regions**	
Newport News, VA	ND	ND	ND	ND
Beaufort, NC	*$0.9*	*$0.4*	*0.01%*	*$0.5*
Other ports*	$93.7	$20.6	NA	$23.1
All New England/Mid-Atlantic ports	**$292.8**	**$194.5**	**0.03%**	**$230.7**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Ports shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes ports with ND in the table and other unlisted ports that had landings from federally permitted vessels fishing from these areas in 2008–2018.

As in the RI-MA WEAs, the NMFS VMS data are a good source for understanding the spatial distribution of fishing vessels in the MWA. During the 2017–2019 period, an average of 16 (5%) of the 340 VMS-enabled vessels operating in Atlantic WEAs fished in the MWA, including an average of two vessels fishing for monkfish; one vessel fishing for multispecies (groundfish); and two vessels fishing for sea scallops (NMFS 2019).

Polar histograms (Figure 3.5.1-3 and Figure 3.5.1-4) showing the directionality of VMS-enabled fishing vessels operating in the MWA were developed using the same methodology described above. Figure 3.5.1-3 shows most the 81 unique vessels operating in the Lease Area followed a slightly northwest–southeast fishing pattern.

Figure 3.5.1-4 shows that the orientation of vessels fishing within the MWA varied by FMP fishery, but in most fisheries, vessels followed a northwest–southeast fishing pattern.

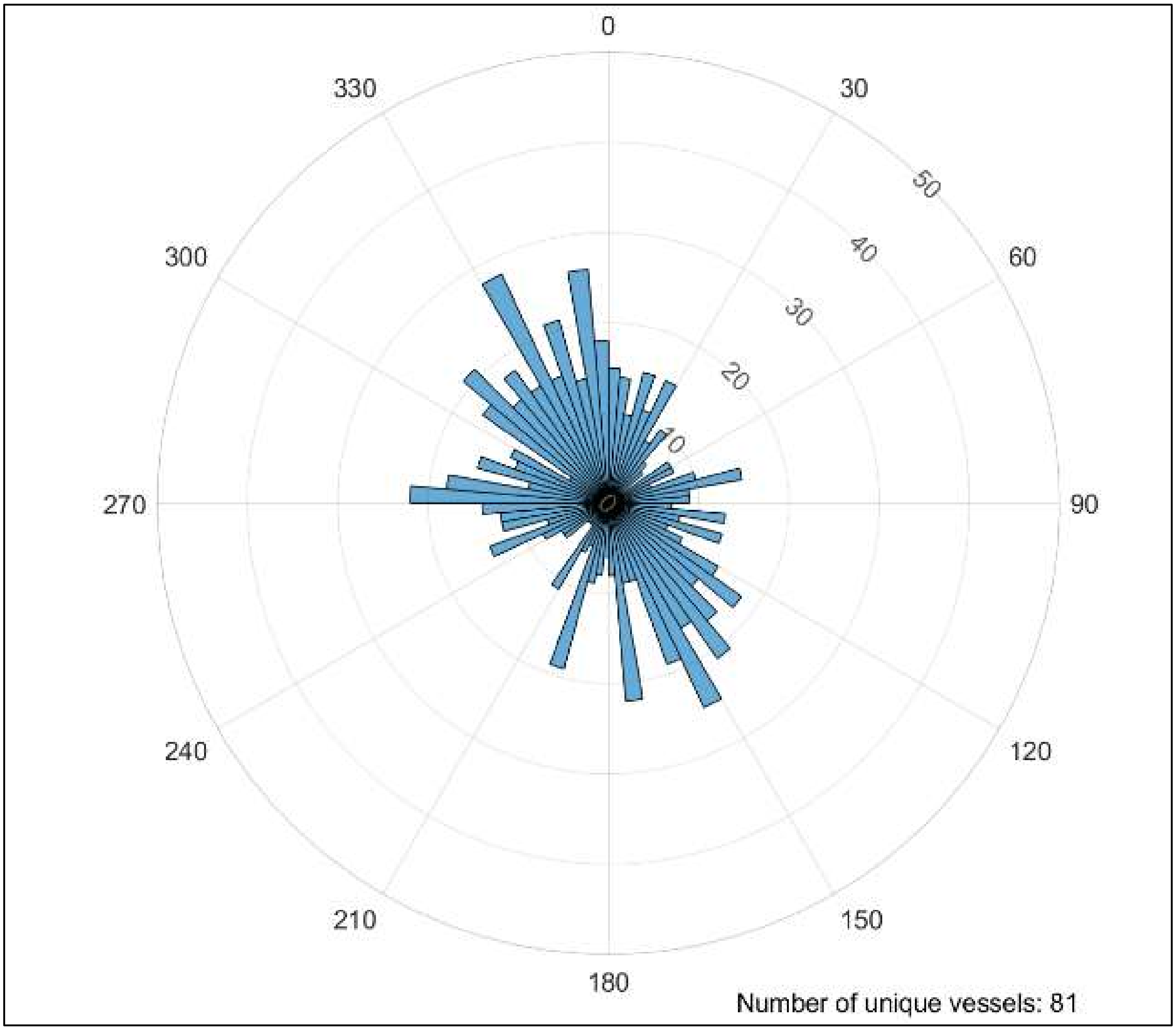
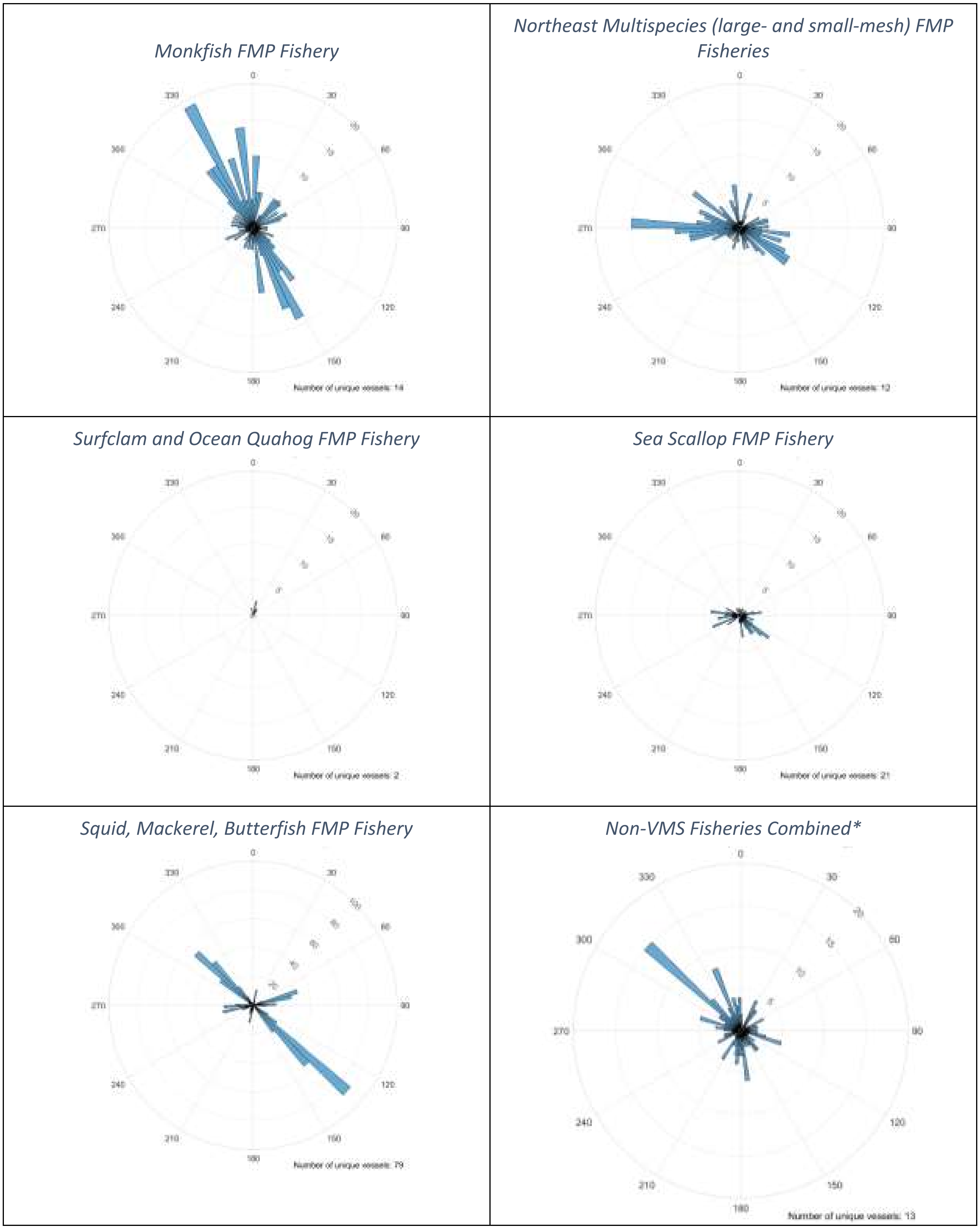


Figure 3.5.1-3. VMS bearings of vessels actively fishing within the MWA, all FMP fisheries combined, January 2014–August 2019.



** These are fishing vessels that are transmitting VMS data after having declared themselves as participating in a non-VMS fishery—e.g. lobster, Jonah crab, river herring, etc.*

Figure 3.5.1-4. VMS bearings of vessels actively fishing within the MWA by FMP fishery, January 2014–August 2019.

Table 3.5.1-10 presents the average annual revenue in the 2-km zone around the offshore SFEC by FMP fishery for the 2008–2018 period, assuming the SFEC would come ashore at Beach Lane. The Beach Lane route is the longer of the two SFEC options; based on data from BOEM (2020), the average annual catch revenue for the Hither Hills route was estimated to be about 90% of that for the Beach Lane route. The available data suggest that the offshore SFEC crosses an area of relatively high intensity of revenue from sea scallop fishing (see Figure C-7). On average, federally permitted commercial fishing activity in the offshore SFEC area annually generated $1,260.1 thousand in revenue, with the Sea Scallop FMP fishery accounting for 30% of the total. The Summer Flounder, Scup, Black Sea Bass FMP fishery accounted for 17% of the total while the Monkfish FMP and Northeast Multispecies (large-mesh) FMP fisheries each accounted for 12% of the total revenue. In terms of the percentage of each FMP fishery's total revenue in the Mid-Atlantic and New England regions that came from the offshore SFEC area during the 2008–2018 period, the area accounted for about 1.01% of the Skate FMP fishery's total revenue, 0.75% of the Bluefish FMP fishery's total revenue, and 0.60% of the Monkfish FMP fishery's total revenue. In total, the offshore SFEC area accounted for approximately 0.13% of the total revenue across all FMP fisheries in the Mid-Atlantic and New England regions (see Table 3.5.1-1).

Table 3.5.1-10. Commercial Fishing Revenue of Federally Permitted Vessels in the Offshore SFEC with Beach Lane Landing Site by FMP Fishery (2008–2018)

FMP Fishery	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions	Average Number of Vessels	Average Annual Revenue per Vessel
American Lobster	$71,583	$36.4	0.04%	111	$301
Atlantic Herring	$89,683	$34.9	0.13%	38	$319
Bluefish	$26,355	$9.9	0.75%	200	$3
Golden and Blueline Tilefish	$36,312	$10.7	0.19%	35	$5
Highly Migratory Species	$1,085	$0.4	0.02%	15	$536
Jonah Crab	$9,490	$5.1	0.05%	55	$62
Mackerel, Squid, and Butterfish	$250,905	$95.9	0.19%	155	$114
Monkfish	$192,133	$128.3	0.60%	222	$226
Northeast Multispecies (large-mesh)	$196,324	$124.6	0.16%	126	$173
Sea Scallop	$899,057	$379.3	0.07%	118	$537
Skates	$115,566	$77.0	1.01%	156	$163
Northeast Multispecies (small-mesh)	$47,443	$24.3	0.21%	129	$72
Spiny Dogfish	$10,129	$3.7	0.12%	69	$35
Summer Flounder, Scup, Black Sea Bass	$258,348	$192.5	0.48%	264	$101
Non-disclosed and non-FMP fisheries*	$327.9	$137.0	NA	NA	NA
All FMP and non-FMP fisheries	**$1,765.4**	**$1,260.1**	**0.13**	**NA**	**NA**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from the Surfclam/Ocean Quahog, Red Crab and River Herring FMP fisheries and species that are not included in the fisheries listed in the table, but which are harvested by federally permitted vessels.

Table 3.5.1-11 provides the average annual revenue in the offshore SFEC area by gear type for the 2008–2018 period. Together, bottom trawl, scallop dredge, and sink gillnet gear types accounted for approximately 81% of the revenue generated by commercial fishing activity in the offshore SFEC area. The area accounted for about 0.67% of sink gillnet gear total revenue in the Mid-Atlantic and New England regions, and 0.44% of handline gear total revenue.

Table 3.5.1-11. Commercial Fishing Revenue of Federally Permitted Vessels in the Offshore SFEC with Beach Lane Landing Site by Gear Type (2008–2018)

Gear Type	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Dredge-clam	*$277.0*	*$82.2*	*0.14%*
Dredge-scallop	$860.7	$361.2	0.08%
Gillnet-sink	$255.2	$186.9	0.67%
Handline	$21.6	$16.1	0.44%
Pot-other	$85.8	$57.7	0.06%
Trawl-bottom	$734.5	$489.5	0.30%
Trawl-midwater	*$103.6*	*$27.1*	*0.16%*
All other gear*	$247.7	$64.9	NA
All gear types	**$1,765.9**	**$1,285.6**	**0.13%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Gear types shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear, as well as listed gear, for years when they cannot be disclosed.

Table 3.5.1-12 shows the ports at which fish and shellfish caught in the 2-km zone around the offshore SFEC during the 2008–2018 period were landed, assuming the SFEC came ashore at Beach Lane. Together, Point Judith, New Bedford, and Montauk accounted for approximately 73% of the revenue generated by commercial fishing activity in the offshore SFEC area. New Shoreham and Tiverton were the ports most dependent on the offshore SFEC area, with 3.3% and 1.9%, respectively, of their total commercial fishing revenue in the Mid-Atlantic and New England regions derived from the area.

Table 3.5.1-12. Commercial Fishing Revenue of Federally Permitted Vessels in Offshore SFEC with Beach Lane Landing Site by Port (2008–2012)

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Chilmark/Menemsha, MA	*$0.4*	*$0.1*	*0.02%*
Fairhaven, MA	*$33.0*	*$9.3*	*0.08%*
New Bedford, MA	$565.3	$304.8	0.08%
Fall River, MA	*$4.5*	*$2.3*	*0.19%*
Westport, MA	$6.6	$1.9	0.14%
New Shoreham, RI	$9.7	$3.5	3.31%
Tiverton, RI	$42.0	$22.7	1.91%
Little Compton, RI	$69.0	$24.2	1.21%
Newport, RI	$74.1	$49.7	0.54%
Point Judith, RI	$534.6	$396.8	0.88%

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
New London, CT	$91.7	$32.7	0.47%
Stonington, CT	$55.7	$30.4	0.29%
Montauk, NY	$354.9	$267.2	1.41%
Shinnecock/Hampton Bays, NY	$85.0	$49.8	0.72%
Cape May, NJ	*$29.1*	*$8.8*	*0.01%*
Point Pleasant, NJ	$46.1	$17.1	0.05%
Hampton, VA	*$6.4*	*$3.5*	*0.03%*
Newport News, VA	*$1.9*	*$1.0*	*0.00%*
Beaufort, NC	*$3.7*	*$1.6*	*0.05%*
Other ports*	$142.9	$101.6	NA
All New England/Mid-Atlantic ports	**$1,824.9**	**$1,329.2**	**0.19%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Ports shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes unlisted that had landings from federally permitted vessels fishing in the offshore SFEC in the period 2008–2018.

VTR data describe most commercial fishing activity in both state and federal waters by vessels that have a federal permit or a state and federal fishing permit. However, those vessels with only state permits are not included in the VTR data set. Nevertheless, state permit holders must report their catch to state agencies, including the statistical area within which fishing occurred. Based on commercial fishing data collected by the NYSDEC, CH2M HILL (2018) estimated catches of New York State–permitted fishermen in statistical areas 167 and 168. These two areas encompass the state fishery fishing grounds that could be affected by the offshore SFEC. Together, the two statistical areas represent important state fishing grounds for a variety of species. The greatest average pounds landed for the years 2007 to 2016 in these statistical areas included striped bass (total approximately 205,000 pounds), longfin inshore squid (approximately 43,000 pounds), skate (approximately 26,000 pounds), bluefish (about 23,000 pounds), and lobster (approximately 13,000 pounds). The top ports where fishermen landed their catch after fishing in the two areas were Moriches, Shinnecock Indian Reservation, and Montauk, New York (CH2M HILL 2018).

Figure 3.5.1-5 shows that there was considerable interannual variability in commercial fishing revenue in the SFWF MWA and offshore SFEC in the period 2008–2018.

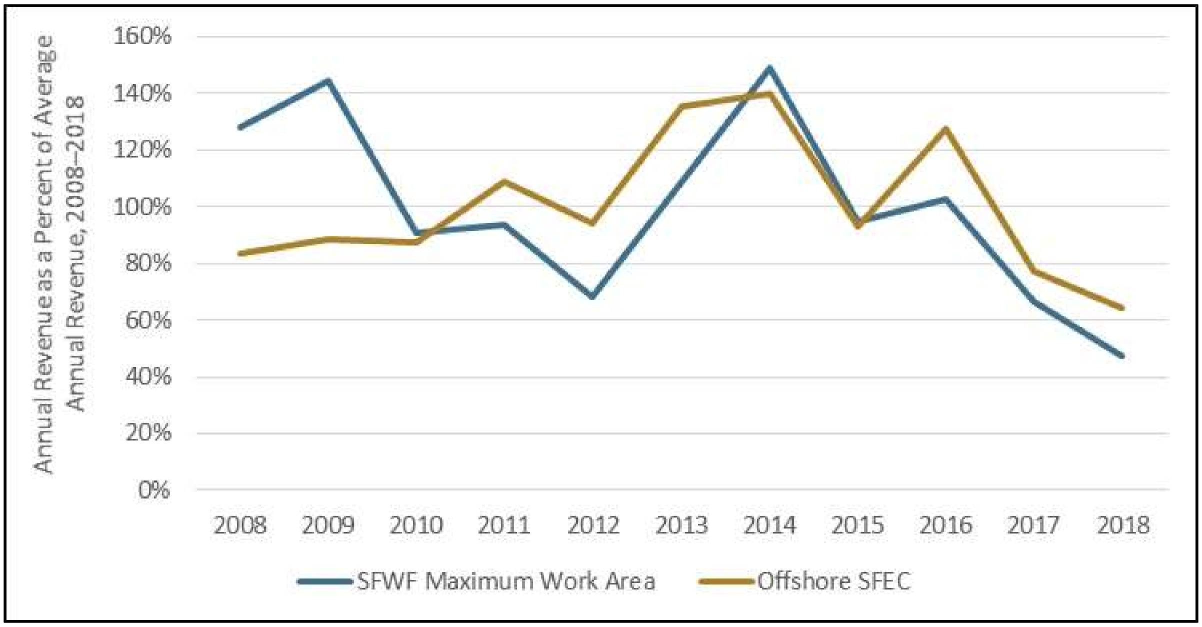


Figure 3.5.1-5. Interannual variability of commercial fishing revenue of federally permitted vessels in the SFWF MWA and offshore SFEC, 2008–2018.

Source: NMFS (2020b).

3.5.1.1.2 FOR-HIRE RECREATIONAL FISHING

For-hire recreational fishing boats are operated by licensed captains for businesses that sell recreational fishing trips to anglers. A comprehensive list of species that are targeted by for-hire boats within the Rhode Island Ocean Special Management Plan area was developed through an iterative process, using catch data and correspondence with recreational charter boat captains (State of Rhode Island Coastal Resources Management Council 2010). As shown in Table 3.5.1-13, for-hire boats target a wide range of pelagic, highly migratory, and demersal species.

Table 3.5.1-13. Species Targeted by For-Hire Recreational Fishing Boats in the Rhode Island Ocean Special Management Plan Area

Atlantic bonito	False albacore	Blue shark	Tautog
Atlantic cod	Pollock	Thresher shark	Bluefin tuna
Black sea bass	Scup	Striped bass	Yellowfin tuna
Bluefish	Shortfin mako	Summer flounder	Winter flounder

Source: State of Rhode Island Coastal Resources Management Council (2010).

Recreational fishing in the region occurs year-round but is most intensive from April through November (Tetra Tech 2016). Early in spring, most of the Rhode Island–based party and charter boats target the migratory stocks of the Mid-Atlantic such as striped bass, summer flounder, and black sea bass. During late spring, party and charter boats are almost exclusively targeting cod, with most of the cod fishing occurring on Cox Ledge and south of Block Island (State of Rhode Island Coastal Resources Management Council 2010). Cod fishing on Cox Ledge is also popular in the summer as the water warms and cod start to congregate on the ledge (Plaia 2009). However, most summer recreational fishing is focused on striped bass and bluefish, with some boats targeting summer flounder closer to shore. Later in the summer, some of the boats move farther offshore to target sharks, which are generally caught anywhere from 20 to 50 miles offshore. Sharks targeted include blue, mako, and thresher sharks, with most shark fishing being catch and release. Some tuna fishing also takes place in an area east of Block Island and northwest of Cox Ledge known as the Mud Hole or Deep Hole. Starting in September, much of the fishing switches to sea bass and scup around Block Island or to striped bass closer to shore (State of Rhode Island Coastal Resources Management Council 2010).

As shown in Figure C-6, which presents spatial data indicating the relative intensity of charter fishing activity, the number of charter fishing trips is fairly low in the RI-MA WEAs but comparatively high along much of the SFEC route (BOEM 2012b).

Most for-hire boats fishing near the RI-MA WEAs are based in Rhode Island. However, party and charter boats from New York, Connecticut, and Massachusetts also regularly fish in or near the RI-MA WEAs. For-hire recreational fishing is an integral part of each of these states' coastal tourism industries. During the 2007–2012 period, annual for-hire boat revenue averaged $15.6 million in Rhode Island, $86.2 million in New York, $14.5 million in Connecticut, and $62.4 million in Massachusetts. However, of the 16,569 average annual for-hire boat trips that left from ports in the four states each year during the 2007–2012 period, only 0.9% occurred in or near the RI-MA WEAs (Kirkpatrick et al. 2017).

The 70 square miles of Cox Ledge excluded from the RI-MA WEAs is important to for-hire recreational fishing as well as commercial fisheries. Table 3.5.1-14 presents data on party/charter recreational fishing reported on Cox Ledge during various time periods. The data suggest that a small number of for-hire recreational fishing businesses fish relatively intensively on Cox Ledge, with each individual business generating on the order of $9,400/year in the area. The revenue reported on Cox Ledge is consistently high across all time periods studied (NEFMC and NMFS 2016).

Table 3.5.1-14. For-Hire Recreational Fishing Activity on the Portion of Cox Ledge Excluded from Wind Energy Development by Time Period

Time Period	Average Annual Revenue	Average Revenue Per Trip	Average Annual Number of Permit Holders	Average Annual Number of Anglers
2006–2014	$95,911	$2,385	10	887
2010–2014	$88,928	$2,257	9	816
2012–2014	$64,696	$2,521	6	587

Source: NEFMC and NMFS (2016).

3.5.1.2 Environmental Consequences

3.5.1.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.1-15 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.5.1-15. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Commercial Fisheries and For-Hire Recreational Fishing

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Port access</td><td>Vessel traffic congestion and reduced access to high-demand port services</td><td rowspan="4">Negligible: No measurable impacts would occur.
Minor: Adverse impacts to the affected activity or community could be avoided with EPMs and impacts would not disrupt the normal or routine functions of the affected activity or community. Once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects.
Moderate: Impacts to the affected activity or community are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if proper remedial action is taken.
Major: The affected activity or community would experience substantial disruptions, and, once the impacting agent is eliminated, the affected activity or community could retain measurable effects indefinitely, even if remedial action is taken.</td></tr>
<tr><td>Fishing access</td><td>Increased operating costs (e.g., additional fuel to arrive at more distant locations); lower revenue (e.g., less-productive area; less-valuable species); increased conflict among fishermen; avoidance of area by fishermen because of safety concerns</td></tr>
<tr><td>Loss of or damage to fishing gear</td><td>Costs of gear repair or replacement; lost fishing revenue while gear is being repaired or replaced</td></tr>
<tr><td>Change in catch of target species</td><td>Change in revenue due to change in catch</td></tr>
</table>

3.5.1.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing commercial fisheries and for-hire recreational fishing trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated commercial fisheries and for-hire recreational fishing impacts. Future non-Project actions include offshore wind development activities, tidal energy projects, dredging and port improvement projects, [see Appendix E]) and future marine transportation and fisheries use and management. Attachment 3 in Appendix E also discloses future non-offshore wind activities and associated commercial fisheries and for-hire recreational fishing impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Future offshore wind facilities in the New England and Mid-Atlantic regions could also increase the magnitude, geographic extent, duration, and frequency of the impacts to commercial fisheries and for-hire recreational fishing caused by ongoing and future non-offshore wind activities. Two sources of assumptions are used with respect to future offshore wind development: Table A-4 in Appendix E is used for forecasts of project footprint acres and lengths of inter-array and export cables, and Table E-4 in Appendix E provides updated forecasts of numbers of wind turbine foundations.

Port utilization and traffic: Construction of offshore wind energy projects would require port facilities for staging and installation vessels, including crew transfer, dredging, cable lay, pile driving, survey vessels, and, potentially, feeder lift barges and heavy lift barges. All of these vessels would add traffic to port facilities and would require berthing. The additional vessel volume in construction ports could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-demand port services (e.g., fueling and provisioning) by existing port users, including commercial fishing vessels. These potential adverse impacts could cause some vessel operators to change routes or use an alternative port.

The installation of offshore components for offshore wind energy projects and the presence of construction vessels could also temporarily restrict fishing vessel movement and thus transit and harvesting activities within lease areas. To safeguard mariners from the hazards associated with installation of these offshore components, it is expected that most, if not all, offshore wind energy projects would create safety zones around construction areas. When safety zones are in effect, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that chose to relocate could incur increased operating costs (e.g., additional fuel to arrive at more distant locations) and/or lower revenue (e.g., less-productive area; less-valuable species). In addition, if the fishing effort is shifted to areas not routinely fished, conflict with existing users could increase as other areas are encroached. The competition would be higher for fishermen engaged in fisheries that have regulations that constrain where fishermen can fish, such as the lobster fishery. The potential for conflict due to fishing displacement is lower among fishermen targeting mobile species such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish. However, future offshore wind projects are expected to result in only a small incremental increase in vessel traffic, with a peak of 207 vessels during Project construction over a 10-year time frame (see Section 3.5.6.2.2 [No Action Alternative] for additional details).

Anchoring: BOEM estimates approximately 262 acres of seabed would be disturbed by anchoring associated with offshore wind activities. Anchoring vessels used in the construction of offshore wind energy projects would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of anchored vessel) and temporary (hours to days). Although anchoring impacts would occur primarily during Project construction, some impacts could also occur during O&M and decommissioning.

Presence of structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through allisions, entanglement or gear loss/damage, fish aggregation, habitat conversion, navigation hazards (including transmission cable infrastructure), and space use conflicts. These impacts may arise from buoys, met towers, foundations, scour/cable protection, and transmission cable infrastructure. Using the assumptions in Appendix E Attachment 4, future offshore wind energy projects under the No Action alternative would include 2,050 foundations, 1,709 acres (6.9 km^2) of seabed disturbance due to foundation and scour protection, and 1,159 acres (4.7 km^2) of new hard protection atop cables. Projects may also install more buoys and met towers. BOEM anticipates that structures would be added intermittently over an assumed 10-year period and that they would remain until decommissioning of each facility is complete.

The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which in turn would reduce the habitat for target species that prefer soft-bottom habitat (e.g., squid, summer flounder, and surfclams) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, and cod). Where WTG foundations and associated scour protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species, thereby contributing toward increased catches in for-hire recreational fisheries (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). Overall, localized adverse or beneficial impacts on target species populations from habitat alteration would have a negligible to minor effect on the catch per unit of fishing effort (CPUE) or total catch of for-hire recreational and commercial fisheries.

The USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities during their operation (BOEM 2018). However, because of the height of wind turbines above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all structures would have appropriate markings and lighting in accordance with USCG and International Association of Marine Aids to Navigation and Lighthouse Authorities guidelines, and NOAA would chart wind turbine locations and could include a physical or virtual automatic identification system (AIS) at each turbine. Some fishing vessels operating in or near offshore wind facilities may experience radar clutter and shadowing. Most instances of interference can be mitigated through the proper use of radar gain controls.

Notwithstanding these safety measures, some fishermen have commented that because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017). Moreover, mechanical problems, such as loss of steerage, could result in an allision with a WTG as the vessel drifts during repair (DNV-GL 2018). Aside from these potential navigational issues, some commercial fishermen may avoid the SFWF if large numbers of recreational fishermen are drawn to the area by the prospect of higher catches. According to the study Perceptions of Commercial and Recreational Fishers on the Potential Ecological Impacts of the BIWF conducted by ten Brink and Dalton (2018), the influx of recreational fishermen into the BIWF caused some commercial fishermen to cease fishing in the area because of vessel congestion and gear conflict concerns.

In addition, a potential effect of the presence of the offshore cables and wind turbines associated with offshore wind energy development is the entanglement and damage or loss of commercial and recreational fishing gear. Economic impacts to fishing operations associated with gear damage or loss include the costs of gear repair or replacement, together with the fishing revenue lost while gear is being repaired or replaced.

Fishing vessel operators unwilling or unable to travel through areas where offshore wind facilities are located or deploy fishing gear in those areas may be able to find suitable alternative fishing locations and continue to earn revenue. This could result in increased operating costs (e.g., additional fuel to arrive at more distant locations) and/or lower revenue (e.g., fishing in a less-productive area or for a less-valuable species). However, if, at times, a fishery resource is only available within the wind facility, some fishermen, primarily those using mobile gear, may lose the revenue from that resource for the time the resource is inaccessible. These impacts could remain until decommissioning of each facility is complete, although the magnitude of the impacts would diminish over time if fishing practices adapt to the presence of structures.

An accurate assessment of the extent of the effects of planned offshore wind energy projects on commercial fisheries and for-hire recreational fishing would depend on project-specific information that is unknown at this time, such as the actual location of offshore activities with lease areas and the arrangement of WTGs. However, it is possible to estimate the amount of commercial fishing revenue that would be “exposed” as a result of offshore wind energy development. Estimates of revenue exposure quantify the value of fishing that occurs in the footprint areas of individual offshore wind farms. Therefore, these estimates represent the fishing revenue that would be foregone if fishing vessel operators opt to no longer fish in these areas and cannot capture that revenue in a different location. Revenue exposure estimates should not be interpreted as measures of actual economic impact. Actual economic impact would depend on many factors—foremost, the potential for continued fishing to occur within the footprint of the wind farm, together with the ecological impact on target species residing within the project areas. Economic impacts also depend on a vessel’s ability to adapt to changing where it fishes. For example, if alternative fishing grounds are available nearby and could be fished at no additional cost, the economic impact would be lower. In addition, it is important to note that there may be cultural and traditional values to fishermen from fishing in certain areas that go beyond expected profit. For example, some fishermen may gain utility from being able to fish in locations that are known to them and also fished by their peers; the presence of other boats in the area can contribute to the fishermen’s sense of safety.

Table 3.5.1-16 shows the annual commercial fishing revenue exposed to offshore wind energy development in the New England and Mid-Atlantic regions by FMP fishery from 2020 through 2030. The amount of revenue at risk increases as proposed offshore wind energy projects are constructed and come online according to the timeline set forth in Table E-3 of Appendix E. The largest impacts in terms of exposed revenue are expected to be in the Sea Scallop, Surfclam/Ocean Quahog, and Mackerel/Squid/Butterfish FMP fisheries. The total average annual exposed revenue over the 2020–2030 period represents around 0.8% of the total average annual revenue of the FMP fisheries in the New England and Mid-Atlantic regions during the 2008–2018 period (see Table 3.5.1-1). The maximum exposed revenue, which occurs beginning in 2028 when construction on the last of the proposed projects begins, represents about 1.4% of the total regional revenue. Figure E-9 shows the relative intensity of reported commercial fishing ex-vessel revenues in Northeast and Mid-Atlantic region commercial fisheries relative to the locations of lease areas for current and planned offshore wind energy facilities. In general, fisheries do not have high relative revenue intensity within the lease areas compared with nearby waters because lease areas were chosen to reduce potential use conflicts between the wind energy industry and fishermen (Ecology and Environment, Inc. 2013).

Table 3.5.1-16. Annual Commercial Fishing Revenue Exposed to Offshore Wind Energy Development in the New England and Mid-Atlantic Regions under the No Action Alternative by FMP Fishery

FMP Fishery ($1,000s)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
American Lobster	–	$14	$323	$376	$398	$533	$552	$601	$608	$608	$608
Atlantic Herring	–	$7	$66	$95	$104	$140	$143	$162	$163	$163	$163
Bluefish	$0	$1	$7	$9	$10	$14	$18	$19	$19	$19	$19
Golden and Blueline Tilefish	–	$1	$3	$20	$27	$48	$55	$58	$58	$58	$58
Highly Migratory Species	–	–	–	$0	$0	$0	$1	$1	$1	$1	$1
Jonah Crab	–	$14	$57	$125	$160	$297	$335	$379	$381	$381	$381
Mackerel, Squid, and Butterfish	$0	$220	$407	$621	$679	$1,083	$1,144	$1,237	$1,249	$1,249	$1,249
Monkfish	–	$19	$422	$497	$507	$672	$697	$823	$837	$837	$837
Northeast Multispecies (large-mesh)	–	$10	$184	$204	$204	$259	$260	$307	$307	$307	$307
Sea Scallop	–	$10	$492	$1,374	$2,224	$3,298	$3,675	$3,766	$3,872	$3,872	$3,872
Skates	–	$16	$255	$298	$300	$400	$413	$492	$496	$496	$496
Northeast Multispecies (small-mesh)	–	$36	$137	$216	$218	$361	$369	$400	$400	$400	$400
Spiny Dogfish	–	$1	$27	$29	$37	$43	$47	$49	$50	$50	$50
Summer Flounder, Scup, Black Sea Bass	$0	$53	$335	$484	$548	$800	$869	$980	$1,006	$1,006	$1,006
Surfclam/Ocean Quahog	–	–	$161	$188	$199	$241	$1,522	$1,522	$1,587	$1,587	$1,587
Non-disclosed and non-FMP species*	$1	$81	$782	$898	$993	$1,483	$1,595	$1,797	$2,006	$2,006	$2,006
All revenues of federally permitted vessels	**$1**	**$483**	**$3,661**	**$5,434**	**$6,607**	**$9,673**	**$11,693**	**$12,594**	**$13,040**	**$13,040**	**$13,040**

Sources: Developed using data from Table E-3 in Appendix E and data from NMFS (2020b, 2020e).

Notes: Revenue is adjusted for inflation to 2019 dollars. "–" indicates the value is zero; "$0" indicates the value is positive but less than $500.

* Includes revenues from all FMPs that did not have more than 5 years of data in the period (2008–2018) within a given WEA. Also includes all species not assigned to an FMP, as listed in the table.

With respect to impacts to individual fishing operations, those vessels that derive a small percentage of their total revenue from areas where offshore wind facilities would be located or are able to find suitable alternative fishing locations would likely experience long-term, minor adverse impacts. For those fishing vessels that derive a large percentage of their total revenue from areas where offshore wind facilities would be located, choose to avoid these areas once the facilities become operational, and are unable to find suitable alternative fishing locations, the adverse impacts would be long-term and moderate to major. NMFS (2020d) determined for each federally permitted commercial fishing vessel that fished in New England/Mid-Atlantic offshore wind energy development lease areas the percentage of the vessel's total fishing revenue that came from within each area during the 2008–2018 period. According to the data presented, in each lease area there was one or more vessels that earned a substantial (>3%) portion of their revenue from fishing in the area. Some vessels derived more than half of their revenue from fishing in a particular lease area. However, 75% of the vessels fishing in any given lease area derived less than 0.9% of their total revenue from the area. Given that a majority of fishing vessels derive a small percentage of their total revenue from any one lease area or would be able to relocate to other fishing locations, the overall adverse impact of offshore wind energy development on fishing access by commercial fishing vessels is expected to be long-term and moderate.

New cable emplacement/maintenance: BOEM estimated that offshore export and inter-array cable emplacements for offshore wind facilities could result in temporary displacement of fishing vessels and disruption of fishing activities in up to 7,951 acres (see Appendix E Attachment 4). Installation of offshore cables for each offshore wind energy facility would require temporary rerouting of all vessels, including commercial and for-hire recreational fishing vessels, away from areas of active construction.

Construction activities related to offshore wind energy development that disturb the seabed, together with activities that reduce water quality, increase underwater noise, or introduce artificial lighting, could result in a behavioral response from some target species. In turn, these responses could decrease catchability for a fishery, such as fish not biting at hooks or changed swim height. For any given offshore wind energy project, the impacts of behavioral responses on target species catch in commercial and for-hire recreational fisheries are expected to be confined to a small area, and they are expected to end shortly after construction activities end. Details regarding potential lighting and noise impacts to finfish, invertebrates, and EFH are described in 3.4.2.3.2 (No Action Alternative).

Fishermen have raised concerns regarding the behavioral impacts of EMF generated by submarine cables on target fish and invertebrates. In particular, there is apprehension that EMF could slow or deviate migratory species from their intended routes, with subsequent potential problems for populations if they do not reach essential feeding, spawning, or nursery grounds (Kirkpatrick et al. 2017). To date, however, effects on representative sensitive species indicate that although some marine species are observed to respond to EMF, the responses have not risen to the level at which critical impacts on marine organism behavior are reported (BOEM 2018) (see also Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). There is no evidence to indicate that EMF from undersea AC power cables adversely affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences Inc. and Exponent 2019).

Regulated fishing effort: The geographic analysis area includes the jurisdictions of two regional fishery management councils created under the Magnuson-Stevens Fishery Conservation and Management Act. The FMPs of the councils and the ASMFC were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the New England and the Mid-Atlantic regions.

Climate change: Additional impacts on commercial fisheries and for-hire recreational fishing are expected to result from climate change events such as increased magnitude or frequency of storms, shoreline changes, and water temperature changes. Risks to fisheries associated with these events include habitat/distribution shifts, disease incidence, and risk of invasive species. The catch potential for the temperate Northeast Atlantic is projected to decrease between now and the 2050s (Barange et al. 2018). Hare et al. (2016) predict that climate change would affect northeast fishery species differently. For approximately half of the 82 species assessed, the authors report that overall climate vulnerability is high to very high; diadromous fish and benthic invertebrate species exhibit the greatest vulnerability. In addition, most species included in the assessment have a high potential for a change in distribution in response to projected changes in climate. Adverse effects of climate change are expected for approximately half of the species assessed, but some species are expected to be beneficially affected (e.g., increase in abundance). The intensity of the impacts of climate change to commercial fisheries and for-hire recreational fishing is anticipated to qualify as moderate for those fishing operations targeting species adversely affected by climate change, and the beneficial impacts are anticipated to qualify as moderate for those fishing operations targeting species beneficially affected by climate change.

Because future offshore wind facilities would produce less GHG emissions than fossil fuel–powered generating facilities with similar capacities, the reduction in GHG emissions from the Proposed Action when combined with other future offshore wind projects (or avoidance of increased GHG emissions from equivalent fossil fuel–powered energy production) would result in long-term beneficial impacts to fishing operations that target species adversely affected by climate change. However, the benefits would not be measurable. Section 3.3.1 (Air Quality) describes the expected contribution of offshore wind to climate change.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on commercial fisheries and for-hire recreational fishing associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on commercial fisheries and for-hire recreational fishing, primarily through climate change, fisheries management, other offshore development and vessel activity, and port use.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**, depending on the IPF of offshore wind energy projects. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **moderate,** depending on the activity.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts because some commercial fisheries and for-hire recreational fishing would have to adjust somewhat to account for disruptions due to impacts.

3.5.1.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Potential Impacts to Port Access

Several port facilities located in New York, Rhode Island, Massachusetts, and Connecticut are considered for offshore Project construction, staging, and fabrication as well as crew transfer and logistics support. Construction of the Project would require a range of vessels, including vessels for transferring crew, transporting heavy cargo, and conducting heavy lifts as well as multipurpose vessels and barges (Jacobs 2020). Although final port selection has not been determined at this time, the list of affected commercial ports could include ports used by commercial fishing vessels and for-hire recreational fishing vessels. For example, fishing ports that could be used during construction, O&M, or conceptual decommissioning of the SFWF or offshore SFEC include Montauk, New London, Point Judith, and New Bedford (Jacobs 2020). During the facility design report phase, DWSF would finalize commercial ports to be used to support offshore installation activities for the SFWF and offshore SFEC.

The use of multiple ports to support Project construction activities would reduce the related congestion impacts in any one port. Moreover, DWSF would establish a marine coordination center to harmonize Project vessel movements with non-Project vessels and implement communication protocols to minimize adverse impacts on other users of a construction port. As a result, the adverse impact on commercial fisheries and for-hire recreational fishing would be temporary and minor.

Anchoring vessels used in the construction of the Project would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of an anchored vessel) and temporary (hours to days). While anchoring impacts would occur primarily during Project construction, some impacts could also occur during O&M and decommissioning. Anchoring would lead to temporary and minor impacts to commercial fisheries and for-hire recreational fishing.

Potential Impacts to Fishing Access

The installation of offshore Project components and the presence of construction vessels could temporarily restrict vessel movement and thus transit and harvesting activities in the SFWF and along the offshore SFEC. To safeguard mariners from the hazards associated with construction of the Project, DWSF would work establish any necessary safety zones during construction around each location where the WTG towers and subsea cables would be installed in navigable waters via consultation under the navigational risk assessment (see Table G-1 in DEIS Appendix G). Non-construction vessels would be prohibited from entering into, transiting through, mooring in, or anchoring within the safety zones while construction vessels and associated equipment are working on-site. Non-construction vessels would be able to safely transit around these safety zones. The safety zones implementation dates are pending and would depend on the SFWF Project schedule and duration of the expected construction phase. To allow fishing vessels to alter their plans if needed to avoid impacted areas, DWSF would publicize safety zones in advance via a local notice to mariners. In addition, DWSF would communicate in advance where and when construction activities are scheduled to take place.

When safety zones are in effect, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that chose to relocate could incur increased operating costs (e.g., additional fuel to arrive at more distant locations) and/or lower revenue (e.g., less-productive area, less-valuable species). In addition, if the fishing effort is shifted to areas not routinely fished, conflict with existing users could increase as other areas are encroached. The competition would be higher for fishermen engaged in fisheries with regulations that constrain where fishermen can fish, such as the lobster fishery. The potential for conflict due to fishing displacement is lower among fishermen targeting mobile species such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish. In a given year, however, it is possible that the center of the exploitable biomass, or the portion of a fish population available to fishing gear, of one or more of these species would occur within the SFWF or along the offshore SFEC during construction. During these occurrences, fishermen could be adversely impacted because of restricted access to the available fish population within the Project construction area. Given the small size of the offshore areas affected during construction, the likelihood of this co-occurrence in time and space is low, as is the likelihood of increased conflict and competition from a temporary displacement of fishing activities.

Based on data presented in Table 3.5.1-7 through Table 3.5.1-12, it is possible to calculate the amount of commercial fishing revenue that would be exposed as a result of construction activities in the SFWF MWA and along the offshore SFEC, assuming that it would come ashore at Beach Lane (the longer of the two SFEC options). As discussed in Section 3.5.1.2.2 (No Action Alternative), estimates of revenue exposure represent the fishing revenue that would be foregone if fishing vessel operators cannot capture that revenue in a different location. Table 3.5.1-17 and Table 3.5.1-18 show the annual revenue at risk in the SFWF MWA and along the offshore SFEC during each year of the 2-year (2021–2022) Project construction phase by FMP fishery and gear type, respectively. The largest impacts in terms of exposed revenue as a percentage of total revenue in the New England and Mid-Atlantic regions would be in the Skate, Bluefish, and Monkfish FMP fisheries. Sink gillnet, handline, and bottom trawl gear would be the gear types most affected in terms of exposed revenue as a percentage of total revenue in the New England and Mid-Atlantic regions. The annual exposed revenue represents about 0.16% of the total average annual revenue of the FMP fisheries in the New England and Mid-Atlantic regions during the 2008–2018 period (see Table 3.5.1-1). Combining data from BOEM (2020) and NFMS (2020b), the amount of commercial fishing revenue that would be exposed assuming the offshore SFEC comes ashore at Hither Hills was estimated to be $1.36 million across all FMP fisheries, or 8.6% lower than under the Beach Lane option.

Table 3.5.1-17. Annual Commercial Fishing Revenue Exposed in the MWA and Offshore SFEC during Project Construction by FMP Fishery

FMP Fishery	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
American Lobster	$129,003	$68.3	0.07%
Atlantic Herring	$102,500	$41.0	0.15%
Bluefish	$26,614	$10.3	0.78%
Golden and Blueline Tilefish	$36,467	$10.9	0.20%
Highly Migratory Species	$14,350	$2.4	0.11%
Jonah Crab	$15,128	$8.3	0.09%
Mackerel, Squid, and Butterfish	$290,559	$110.2	0.22%
Monkfish	$244,776	$164.6	0.77%
Northeast Multispecies (large-mesh)	$233,511	$141.3	0.19%
Sea Scallop	$932,978	$416.3	0.08%
Skates	$154,404	$97.3	1.27%
Northeast Multispecies (small-mesh)	$54,502	$32.0	0.28%
Spiny Dogfish	$12,334	$5.4	0.18%

FMP Fishery	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Summer Flounder, Scup, Black Sea Bass	$273,818	$211.1	0.53%
Non-disclosed and non-FMP fisheries*	**$341.4**	**$168.4**	NA
All FMP and non-FMP fisheries	$2,106.2	$1,487.8	**0.16%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from the Surfclam/Ocean Quahog, Red Crab, and River Herring FMP fisheries and species that are not included in the fisheries listed in the table, but which are harvested by federally permitted vessels.

Table 3.5.1-18. Annual Commercial Fishing Revenue Exposed in the MWA and Offshore SFEC during Project Construction by Gear

Gear Type	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Dredge-clam	*$289.6*	*$91.3*	*0.16%*
Dredge-scallop	$894.1	$396.4	0.09%
Gillnet-sink	$311.2	$243.5	0.87%
Handline	$26.0	$18.0	0.49%
Pot-other	$183.1	$107.0	0.11%
Trawl-bottom	$813.2	$543.8	0.34%
Trawl-midwater	*$117.9*	*$32.0*	*0.18%*
All other gear*	$351.5	$111.3	NA
All gear types	**$2,107.2**	**$1,543.3**	**0.16%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Gear types shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes revenue from federally permitted vessels using longline gear, seine gear, other gillnet gear, and unspecified gear, as well as listed gear, for years when they cannot be disclosed.

Table 3.5.1-19 shows the annual revenue at risk in the SFWF MWA and along the offshore SFEC (with the Beach Lane landing) during the Project construction phase by port based on data presented in Tables Table 3.5.1-9 through Table 3.5.1-12. The largest impacts in terms of exposed revenue as a percentage of total commercial fishing revenue in the Mid-Atlantic and New England regions would be in the ports of New Shoreham (3.4%), Little Compton (2.7%), and Tiverton (2.2%).

Table 3.5.1-19. Annual Commercial Fishing Revenue Exposed in the MWA and Offshore SFEC during Project Construction by Port

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
Chilmark/Menemsha, MA	$5.5	$1.3	0.28%
Fairhaven, MA	*$38.3*	*$11.1*	*0.09%*
New Bedford, MA	$641.1	$357.4	0.10%
Fall River, MA	*$5.5*	*$2.3*	*0.19%*
Westport, MA	$28.4	$15.2	1.12%

Port and State	Peak Revenue ($1,000s)	Average Annual Revenue ($1,000s)	Percentage of Total Revenue from the Mid-Atlantic and New England Regions
New Shoreham, RI	$9.8	$3.6	3.39%
Tiverton, RI	$42.0	$26.2	2.20%
Little Compton, RI	$97.4	$55.1	2.74%
Newport, RI	$108.1	$68.7	0.75%
Point Judith, RI	$634.9	$471.9	1.05%
New London, CT	$95.2	$34.1	0.49%
Stonington, CT	$55.7	$31.8	0.30%
Montauk, NY	$358.1	$272.6	1.44%
Shinnecock/Hampton Bays, NY	$85.0	$49.8	0.72%
Cape May, NJ	*$29.1*	*$8.8*	*0.01%*
Point Pleasant, NJ	$48.0	$17.7	0.06%
Hampton, VA	*$7.1*	*$4.4*	*0.03%*
Newport News, VA	*$3.5*	*$1.0*	*0.00%*
Beaufort, NC	*$4.8*	*$2.1*	*0.07%*
Other ports*	$232.9	$124.7	NA
All New England/Mid-Atlantic ports	**$2,166.3**	**$1,559.9**	**0.22%**

Source: Developed using NMFS (2020b).

Notes: Revenue is adjusted for inflation to 2019 dollars. Ports shown in *italics* indicate that fewer than 11 years of data, but more than 5 years of data, were used to calculate the estimates. ND = not disclosed; NA indicates that the number cannot be calculated with the available data.

* Includes unlisted ports that had landings and data from non-disclosed years from listed ports harvested by federally permitted vessels fishing in the offshore SFEC or in the MWA.

Revenue exposure estimates should not be interpreted as measures of actual economic impact. Actual economic impact would depend on many factors—foremost, the ability of vessels to adapt to changing where they fish, together with the ecological impact on target species residing within the project areas (see Potential Impacts to Target Species Catch below). Fishing vessel operators may be able to find suitable alternative fishing locations and continue to earn revenue. However, this shift in the fishing effort could result in increased operating costs (e.g., additional fuel to arrive at more distant locations) and/or lower revenue (e.g., fishing in a less-productive area or for a less-valuable species). As described in Section 3.5.1.2.2 (No Action Alternative), it is also important to note that there may be cultural and traditional values to fishermen from fishing in certain areas that go beyond expected profit. For instance, some fishermen may gain utility from being able to fish in locations that are known to them and also fished by their peers; the presence of other boats in the area can contribute to the fishermen's sense of safety.

The amount of fishing activity that could be affected during Project construction as a result of reduced fishing access is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole. As described above, the annual exposed revenue represents about 0.16% of the total average annual revenue of the FMP fisheries in the New England and Mid-Atlantic regions during the 2008–2018 period. Nevertheless, some individual operators of commercial fishing or for-hire recreational fishing businesses could experience adverse economic impacts as a result of reduced fishing access. For those fishing vessels that choose to avoid areas closed by safety zones during Project construction, historically derived a large percentage of their total revenue from these areas, and are unable to find suitable alternative fishing locations the adverse impacts on any given fishing operation would be temporary and major. While a small number of commercial fishing vessels fish heavily in the Lease Area, about 75% of the vessels fishing in the area derived less than 0.2% of their total revenue from the area during the 2008–2018 period (see description of SFWF Lease Area and Offshore SFEC in Section 3.5.1.1.1). Those fishing vessels that derive a small percentage of their total revenue from areas where safety zones would be in effect or are able to relocate to other fishing locations and continue to earn revenue would experience temporary, minor adverse impacts. Given that these vessels would likely constitute a large majority of affected vessels, the overall adverse impact on fishing access by commercial fishing vessels during Project construction would be temporary and moderate. Considering the small amount of fishing activity that could be affected during Project construction, the impacts to other fishing industry sectors, including seafood processors and distributors and shoreside support services, are expected to be temporary and minor.

Potential Impacts to Fishing Gear

As discussed above, non-construction vessels would be prohibited from entering into, transiting through, mooring in, or anchoring within the safety zones while construction vessels and associated equipment are working on-site. DWSF has developed a financial compensation policy to be used when interactions between the fishing industries and Project activities or infrastructure cause undue interference with fishing access, transit, or fishing gear (CH2M HILL 2018). The use of this policy for qualifying gear interactions that may occur during construction is considered part of the Proposed Action and would reduce any adverse impacts to temporary, negligible to minor.

Potential Impacts to Target Species Catch

During Project construction, temporary or permanent habitat alterations could occur, but the impact of these alterations on invertebrate and fish populations would be negligible to minor (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). Construction activities that disturb the seabed could result in the injury or mortality of sedentary species such as sea scallops and surfclams. Given that the area affected by seafloor disturbance would be a small fraction of the available habitat, the impact to sedentary species habitat would not be measurably altered compared to the environmental baseline. Therefore, the number of individual organisms affected would also be limited. Moreover, the populations of these species are expected to recover quickly through migration and recolonization from adjacent, undisturbed habitat. Therefore, the adverse impacts to fisheries that target these species would be negligible to minor.

Construction activities that disturb the seabed, together with activities that reduce water quality, increase underwater noise, or introduce artificial lighting, could result in a behavioral response from some target species (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). In turn, these responses could decrease catchability for a fishery, such as fish not biting at hooks or changing swimming behaviors. The impacts of these behavioral responses on target species catch are expected to be confined to a small area, and they are expected to end shortly after construction activities end. Other impacts, such as vessel and pile-driving noise, could cause some target species to temporarily move away from the source and disperse to other areas. These species are expected to return to the area after the construction phase. Given the short-term impact and relatively small area involved, behavioral responses that could change target species catchability are expected to have a minor adverse impact on commercial fisheries and for-hire recreational fishing.

Construction activities could overlap with the spawning habitat and/or spawning season of a number of target species, leading to potential short-term impacts to the productivity/recruitment success of these species. However, the temporary, localized impacts of construction activities are not expected to have a measurable effect on the long-term abundance of any given population (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). Therefore, the impact on the CPUE and total catch of commercial and for-hire recreational fisheries would be temporary and negligible to minor.

Operations and Maintenance

Potential Impacts to Port Access

In comparison to the construction phase, the O&M of the Project would require a more limited number of vessels (approximately six) (Jacobs 2020), with most vessels used for routine O&M. Given the relatively low number of Project vessel trips anticipated during operations, the increase in vessel traffic in ports during operation would be small. Therefore, the adverse impacts on the accessibility of port facilities by commercial fishing vessels and for-hire recreational fishing vessels would be long-term but negligible.

Potential Impacts to Fishing Access

Under current regulations, the USCG is responsible for determining any type of safety or exclusionary zone around any structure placed in the open ocean. The USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities, with the exception of safety zones during construction and conceptual decommissioning (BOEM 2018). However, the presence of the SFWF WTGs could result in de facto exclusion if fishing vessel operators are not—or perceive that they are not—able to safely navigate the area around the wind turbines.

The navigational safety risk assessment prepared for the Project indicates that it is technically possible to fish and transit through the SFWF (DNV-GL 2018). The WTG layout at the SFWF is designed to provide at least 1 nm of sea room between WTGs which provides sufficient room for most vessels to transit through and safely maneuver within the SFWF (DNV-GL 2018). However, BOEM is cognizant that maneuverability within the SFWF may vary depending on factors such as vessel size, fishing gear or method used, and/or environmental conditions.

Because of the height of wind turbines above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all structures would have appropriate markings and lighting in accordance with USCG and International Association of Marine Aids to Navigation and Lighthouse Authorities guidelines, and wind turbine locations would be charted by NOAA and could include physical or virtual AIS at each turbine. Some fishing vessels operating in or near the SFWF may experience radar clutter and shadowing. Most instances of interference can be mitigated through the proper use of radar gain controls.

Notwithstanding these safety measures, some fishermen have commented that because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017). Moreover, mechanical problems, such as loss of steerage, could result in an allision with a WTG as the vessel drifts during repair (DNV-GL 2018). Aside from these potential navigational issues, some commercial fishermen may avoid the SFWF if large numbers of recreational fishermen are drawn to the area by the prospect of higher catches. According to ten Brink and Dalton (2018), the influx of recreational fishermen into the BIWF caused some commercial fishermen to cease fishing in the area because of vessel congestion and gear conflict concerns.

It is also important to note that there are also cultural and traditional values to fishermen from fishing that go beyond expected profit. Fishermen gain utility from being able to fish in locations that are known to them and also fished by their peers; the presence of other boats in the area can contribute to the fishermen's sense of safety.

Based on data presented in Table 3.5.1-7 through Table 3.5.1-9, it is possible to calculate the amount of commercial fishing revenue that would be exposed as a result of O&M activities in the SFWF. The impacts to fishing access in the offshore SFEC area during O&M are expected to be negligible. The largest impacts in terms of exposed revenue as a percentage of total revenue in the New England and Mid-Atlantic regions would be in the Skate FMP and Monkfish FMP fisheries. The annual exposed revenue represents about 0.02% of the total average annual revenue of the FMP fisheries in the New England and Mid-Atlantic regions during the 2008–2018 period (see Table 3.5.1-1). Sink gillnet gear would be the gear type most affected in terms of exposed revenue as a percentage of total revenue in the New England and Mid-Atlantic regions. With respect to ports, the largest impacts in terms of exposed revenue as a percentage of total commercial fishing revenue in the Mid-Atlantic and New England regions would be in the ports of Little Compton (1.3%) and Westport (0.8%). As discussed above, revenue exposure estimates should not be interpreted as measures of actual economic impact. The actual economic impact to commercial fisheries during Project O&M would depend on many factors—foremost, the potential for continued fishing to occur in the SFWF. Fishing vessel operators unwilling or unable to travel through the SFWF or deploy fishing gear in the area may be able to find suitable alternative fishing locations and continue to earn revenue. However, this shift in fishing effort could result in increased operating costs (e.g., additional fuel to arrive at more distant locations) and/or lower revenue (e.g., fishing in a less-productive area or for a less-valuable species).

As described above, the amount of fishing activity that could be affected during Project O&M is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole. However, for those fishing vessels who choose to avoid the SFWF, historically derived a large percentage of their total revenue from the area, and are unable to find suitable alternative fishing locations, the adverse impacts would be long-term and major. While a small number of commercial fishing vessels fish heavily in the Lease Area, about 75% of the vessels fishing in the area derived less than 0.2% of their total revenue from the area during the 2008–2018 period (see description of SFWF Lease Area and Offshore SFEC in Section 3.5.1.1.1). Given that these vessels would likely constitute a large majority of affected vessels, the overall adverse impact on fishing access by commercial fishing vessels during Project O&M would be long-term and moderate. Considering the small amount of fishing activity that would be affected during Project O&M, the impacts to other fishing industry sectors, including seafood processors and distributors and shoreside support services, would be negligible to minor.

Potential Impacts to Fishing Gear

A potential effect of the offshore cables and wind turbines is the entanglement and damage or loss of commercial and recreational fishing gear. Economic impacts to fishing operations associated with gear damage or loss include the costs of gear repair or replacement, together with the fishing revenue lost while gear is being repaired or replaced.

The Project would result in the installation of 139 miles (224 km) of offshore export cable and 28 miles (45 km) of inter-array cable. DWSF would reduce the occurrence of accidental snagging of fishing gear by burying all cables to a target depth of 4 to 6 feet beneath the seabed (Jacobs 2020:3-36). In areas where seabed conditions might not allow for cable burial, other methods of cable protection would be employed, such as articulated concrete mattresses or rock placement. This additional cable protection would be used for up to 2% of the offshore SFEC, where burial depth may be less than 4 feet, and for seven locations where the offshore SFEC would cross utility crossings (Jacobs 2020). Although it is possible that cables could become uncovered during extreme storm events or other natural occurrences, burial to target depth would minimize the risk of exposure and potential damage. DWSF would also conduct remote surveys of cable placements to confirm cables remain buried and that rock placement and concrete mattresses remain secured and undamaged. Surveys would be conducted by DWSF annually along all cable placements for the first 3 years and biennially thereafter. This survey would identify the need for any remedial action by DWSF to re-secure cables. DWSF would provide BOEM with cable monitoring reports within 45 calendar days following inspection as well as after major storm events.

Long-term, minor to moderate adverse impacts to some commercial fishing operations—in particular, operations that employ mobile bottom-tending gear (such as bottom trawl or dredge)—are expected because of the potential for gear damage or loss from the Project. Given the small offshore footprint of the SFWF and offshore SFEC, the number of adversely affected fishing operations would be small. Additionally, the WTGs would be laid out in rows that run from east to west in order to 1) avoid gear conflict between fishermen who use mobile gear and those who use fixed gear (NEFMC 1996) and 2) create predictable lanes within which boats with mobile gear can fish. DWSF has also developed a financial compensation policy for use when interactions between the fishing industries and Project activities or infrastructure cause undue interference with gear (Jacobs 2020). The use of this financial compensation program for damage to or loss of fishing gear during operation would reduce any moderate impacts to negligible or minor levels.

Potential Impacts to Target Species Catch

During Project O&M, temporary or permanent habitat alterations could occur (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which in turn would reduce the habitat for target species that prefer soft-bottom habitat (e.g., squid, summer flounder, and surfclams). In total, the Project would result in an estimated 203 acres (0.82 km^2) of seabed disturbance as a result of the addition of scour protection and installation of offshore export and inter-array cables. Given the small footprint of the SFWF and offshore SFEC, any localized adverse impacts on target species populations from habitat alteration would have a negligible to minor effect on the CPUE or total catch of for-hire recreational and commercial fisheries.

The WTG foundations and associated scour protection could also produce an artificial reef effect and attract finfish and invertebrates. Considering the addition of scour protection, the maximum footprint of each foundation would be approximately 49,087 square feet (Jacobs 2020). Although the effects of artificial reefs on species abundance are uncertain, aggregation of species could increase the catchability of target species, thereby contributing toward increased CPUE in for-hire recreational fisheries (Kirkpatrick et al. 2017). This reef effect would have long-term, negligible to minor beneficial impacts to for-hire recreational fishing, depending on the extent to which the foundations attract targeted species. Additionally, species may alter their migratory behaviors due to the presence of food or shelter associated with the structures. The potential for disruption of inshore to offshore migratory patterns of important species like lobster and black sea bass has been identified as a topic of concern (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). This potential effect would have long-term, negligible to minor adverse impacts to commercial fisheries and for-hire recreational fishing, depending on the extent to which the foundations alter the migratory behaviors of targeted species.

Fishermen have raised concerns regarding the behavioral impacts of EMF generated by submarine cables on target fish and invertebrates. In particular, there is apprehension that EMF could slow or deviate migratory species from their intended routes, with subsequent potential problems for populations if they do not reach essential feeding, spawning, or nursery grounds (Kirkpatrick et al. 2017). To date, however, effects on representative sensitive species indicate that although some marine species are observed to respond to EMF, the responses have not risen to the level at which critical impacts on marine organism behavior are reported (BOEM 2018). No evidence indicates that EMF from undersea AC power cables adversely affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences Inc. and Exponent 2019). To mitigate any possible effects on target fish and invertebrates, all cables would be wrapped in a sheath that eliminates direct electric fields and reduces magnetic and induced-electric fields (Jacobs 2020). Consequently, EMF from Project cables are expected to have long-term negligible to minor impacts on commercial and for-hire recreational fisheries (see also Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]).

Noise caused by vessels during SFWF maintenance could have temporary and minor adverse impacts on commercial fisheries and for-hire recreational fishing similar to the noise effects described for the construction phase.

Conceptual Decommissioning

Conceptual decommissioning of the SFWF and offshore SFEC would have similar impacts on commercial fisheries and for-hire recreational fishing as construction. Within 2 years of cancellation, expiration, or other termination of the Lease, the lessee would remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seabed of all obstructions created by activities on the leased area (Jacobs 2020:1-19). Any cut and cleared cables would typically have the exposed ends weighted with clump anchors so that the cables cannot be snagged by fishing gear. Removal of structures that produce an artificial reef effect would result in loss of any beneficial fishing impacts that could have occurred during O&M.

Cumulative Impacts

Port utilization and traffic: The Project would add vessel traffic in ports and resulting delays or restrictions in access to ports due to increased vessel use to conditions under the No Action alternative. This would result in localized, short-term, minor incremental impacts on commercial fisheries and for-hire recreational fisheries. BOEM estimates a peak of 207 vessels due to offshore wind project construction over a 10-year time frame, of which 13 construction vessels would result from the Proposed Action alone. However, future offshore wind projects would result in only a small increase in vessel traffic and the risk of vessel collisions is expected to remain low. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be minor.

Impacts associated with noise and fish populations are discussed in Section 3.4.2.2.3 (Proposed Action Alternative).

Anchoring: The Proposed Action would incrementally add 821 acres of anchoring/mooring to conditions under the No Action alternative. This would result in localized, temporary, minor incremental impacts on commercial fisheries and for-hire recreational fisheries. BOEM estimates a total of 1,083 acres of anchoring and mooring-related disturbance for the Proposed Action plus all other future offshore wind projects. All impacts would be localized (within a few hundred meters of an anchored vessel) and temporary (hours to days). Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable future activities would result in minor impacts to commercial fisheries and for-hire recreational fishing.

Presence of structures and new cable emplacement/maintenance: As summarized in Table A-4 in Appendix E and discussed in Section 3.5.1.2.2 (No Action Alternative), offshore wind energy development could result in the construction of 2,050 additional offshore foundations through 2029. The Project would account for 16 of these structures (15 WTGs and one OSS). In addition, up to 5,779 miles (7,951 acres of seabed disturbance) of offshore export and inter-array cables could be installed to support future offshore wind projects (see Appendix E Attachment 4). The Project would add an additional 82.5–86.9 miles of cable (913 acres) to this total. Installation of offshore cables would require temporary rerouting of all vessels, including commercial and for-hire recreational fishing vessels, away from areas of active construction.

As a result of the addition of these new structures and cables in the Lease Area and offshore SFEC, the Proposed Action could result in localized, temporary impacts to commercial fisheries and for-hire recreational fishing due to potential increased space use conflicts, navigational hazards, entanglement, and gear loss/damage.

Fishing revenue would be foregone if these impacts cause fishing vessel operators to no longer fish in these areas, and they cannot capture that revenue in a different location. If the Project is not included, the total commercial fishing revenue exposed at the end of the project development timeline for all planned offshore wind energy lease areas in the New England and Mid-Atlantic regions is estimated to be about

$13.04 million (Table 3.5.1-16). Based on the data in Table 3.5.1-7, the Proposed Action would increase the commercial fishing revenue at risk to $13.23 million, an increase of less than 1.5%, which represents a minor, incremental impact.

Construction activities that disturb the seabed, together with activities that reduce water quality, increase underwater noise, or introduce artificial lighting, could result in a behavioral response from some target species. In turn, these responses could decrease catchability for a fishery, such as fish not biting at hooks or changed swim height. For any given offshore wind energy project, the impacts of behavioral responses on target species catch in commercial and for-hire recreational fisheries are expected to be confined to a small area, and they are expected to end shortly after construction activities end.

Temporary or permanent habitat alterations could also occur during offshore wind farm operation. The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which in turn would reduce the habitat for target species that prefer soft-bottom habitat (e.g., squid, summer flounder, and surfclams) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, and cod). Where WTG foundations and associated scour protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species, thereby contributing toward increased catches in for-hire recreational fisheries (Kirkpatrick et al. 2017).

Regulated fishing effort: The cumulative impacts of regulation of fishing effort to commercial fisheries and for-hire recreational fishing would be the same as under the No Action alternative. The Proposed Action would not alter these impacts.

Climate change: The types of impacts from global climate change to commercial fisheries and for-hire recreational fishing 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. This difference may not be measurable, but would be expected to help reduce climate change impacts, resulting in a minor to moderate incremental impact. The intensity of the adverse impacts of climate change to commercial fisheries and for-hire recreational fishing under the Proposed Action and other past, present, and reasonably foreseeable actions, is uncertain, but the impacts are anticipated to qualify as moderate for those fishing operations targeting species adversely affected by climate change.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would alter port and fishing access, as well as affect transit and harvesting activities, fishing gear interactions, and target species catch. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate.** Therefore, BOEM expects the overall impact from the Proposed Action alone to be **moderate**, as mitigation would substantially reduce adverse impacts on commercial fisheries and for-hire recreational fishing during the life of the proposed Project; affected commercial fisheries and for-hire recreational fishing would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts of the Project; and once the impacting agent is gone, the affected commercial fisheries and for-hire recreational fishing would return to a condition with no measurable effects, when remedial or mitigating action is taken**.**

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible to moderate**. 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 **moderate** impacts to commercial fishing and for-hire recreation fishing. BOEM made this call because some commercial fisheries and for-hire recreational fishing would have to adjust somewhat to account for disruptions due to local or notable regional adverse impacts.

3.5.1.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The overall effect of elimination of WTGs within a 4-nm-wide vessel transit lane would be a lower estimated exposed commercial fishing revenue during Project construction and operations in comparison to the Proposed Action. Based on data from BOEM (2020), it is estimated that the revenue at risk under the Transit alternative across all FMP fisheries during the construction phase would be about 5% lower than under the Proposed Action. During O&M, the revenue at risk would be around 45% lower than under the Proposed Action.

Cumulative Impacts

If the Transit alternative is implemented, impacts related to allision and collision risk could be reduced throughout all lease areas. However, some commercial and recreational fishing and boating could still occur within the transit lanes, and recreational fishing vessels could congregate alongside the transit lanes, possibly increasing risks of collisions and allisions in these areas. Additionally, implementation of all recommended transit lanes could require offshore wind developers to alter their site plans to accommodate the six transit corridors, thereby potentially causing construction delays. These delays could create increased adverse cumulative effects to commercial fisheries and for-hire recreational fishing if they result in an increased level of overlapping construction activities. However, because the impacts to commercial fisheries and for-hire recreational fishing due to climate change and the presence of structures would not be measurably different under the Transit alternative, the cumulative impacts to commercial fisheries and for-hire recreational fishing would be similar to the Proposed Action: negligible to moderate.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

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

3.5.1.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Because it would reduce the number of WTG sites, the Habitat alternative would improve the ability of commercial fishing vessels to access the waters around the Lease Area relative to the Proposed Action. Consequently, the level of commercial fishing revenue exposed to offshore wind energy development would be less than under the Proposed Action.

The Habitat alternative is not anticipated to lead to a measurable change in impacts to invertebrates and finfish targeted by commercial fisheries and for-hire recreational fishing compared to impacts under the Proposed Action (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). A reduction in the number of WTGs would diminish the artificial reef effect of Project structures during O&M, but the decrease in these beneficial effects to for-hire recreational fishing would likely be negligible. Therefore, the impacts to commercial fisheries and for-hire recreational fishing would not be measurably different than under the Proposed Action: **negligible** to **moderate**.

Cumulative Impacts

As noted above, the Habitat alternative would result in incremental impacts to commercial fisheries and for-hire recreational fishing at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the cumulative impacts to commercial fisheries and for-hire recreational fishing would be similar: **negligible** to **moderate**.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

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

3.5.1.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that impacts would range from **negligible** to **moderate** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.5.1.4 Mitigation

Monitoring of the SFEC cable and cable protection, where applicable, would further reduce the expected negligible to moderate impacts on commercial fisheries by ensuring that the cable remains buried and that cable protection is intact, thereby reducing the potential for mobile fishing gear hangs. See Table G-2 in Appendix G for details.

3.5.2 Cultural Resources

The Cultural Resources section addresses marine and terrestrial archaeological and other visually sensitive cultural resources located within the viewshed of project elements, also referred to as viewshed resources. All other visual resources are addressed in the Visual Resources section (Section 3.5.9).

3.5.2.1 Affected Environment

3.5.2.1.1 MARINE RESOURCES

BOEM defines the area of potential effects (APE) for the marine resources geographic analysis area as the depth and breadth of the seabed potentially impacted by bottom-disturbing activities within the SFWF and associated MWA and the offshore SFEC corridor (Figure E-11). A phase I marine archaeological survey and assessment of the marine resources geographic analysis area was conducted between 2017 and 2020 (Gray & Pape 2020). The investigation included a high-resolution geophysical marine survey using magnetometer/gradiometer, side scan sonar, multibeam echo-sounder, and both shallow and medium penetration sub-bottom profilers and subsequent archaeological vibracoring and geoarchaeological analysis. The survey resulted in identifying four shipwreck archaeological sites within the SFWF MWA (Gray & Pape 2020; Table 3.5.2-1). No historic period marine archaeological resources were identified within the footprint of the SFEC. The survey additionally identified eight ancient submerged landform features (Table 3.5.2-2). Three of those features are located within the SFWF MWA and five are located within the SFEC.

These ancient submerged landform features are discrete and discontinuous locations that may contain preserved evidence of formerly terrestrial landscape features that have survived erosion during marine transgression. Although these features exhibit high archaeological potential; no evidence of human occupation associated with the ancient submerged landform features was identified in core samples taken during the submerged cultural resources investigation (Gray & Pape 2020:6-5). These features may derive their significance from reasons other than their archaeological potential, however, such as their potential contribution to a broader culturally significant landscape.

Table 3.5.2-1. Shipwreck Archaeological Sites Identified within the Geographic Analysis Area

Contact number	Location	Site dimensions	Description
Contact 28	SFWF APE	16 × 5.5 × 4.5	An apparent bow and wheelhouse area
Contact 32	SFWF APE	30 × 7.5 × 2.8	A well contained and articulated vessel
Contact 30	SFWF APE	33.6 × 22 × 1	Debris scatter with linear and rectangle components
Contact 112	SFWF APE	15.3 × 11.8 × 1.8	Apparent wreck scatter; “appears unnatural due to its linearity”

Source: Gray & Pape 2020:Table 5-1; Table 5-2; Table 6-1; pp. 5-10, 5-12, 6-1.

Table 3.5.2-2. Ancient Submerged Landform Features Identified within the Geographic Analysis Area

Designation	Location	Description
SFEC-CF-13	SFEC APE	Ancient submerged landform; “single paleo-stream valley”
SFEC-CF-9	SFEC APE	Ancient submerged landform; “single paleo-stream valley”
SFEC-CF-7	SFEC APE	Ancient submerged landform; “single paleo-stream valley”
SFEC-CF-5	SFEC APE	Ancient submerged landform; “two paleo-stream valleys”
SFEC-CF-3	SFEC APE	Ancient submerged landform; “two similar sized paleo-stream valleys”
SFWF-PL-1	SFWF APE	Ancient submerged landform; intact terrestrial surface underlying a marsh and or estuary deposit”
SFWF-PL-2	SFWF APE	Ancient submerged landform; intact terrestrial surface underlying a marsh and or estuary deposit
SFWF-PL-3	SFWF APE	Ancient submerged landform: “oxbow cut-off stream”

Source: Gray & Pape 2020:Table 5-7, Table 5-12; Table 5-15; Table 6-2; Table 6-3; Table 6-4; pp. 5-34, 5-35, 5-36, 5-37, 5-74, 5-75, 5-76, 5-77, 5-80, 6-3, 6-5, 6-7.

3.5.2.1.2 TERRESTRIAL RESOURCES

A phase I terrestrial archaeological survey was conducted within the footprint of the SFEC corridor, SFEC landfall locations and interconnection facility, while a Phase IA desktop assessment was completed for the O&M facility locations (EDR 2019a, 2019b; Jacobs 2020). BOEM defines the APE for the terrestrial resources analysis area by the depth and breadth of terrestrial areas potentially impacted by any ground-disturbing activities within the footprint of the export cable landings, SFEC onshore corridor, interconnection facility, and O&M facilities (see Table 2.1.1-1, Table 2.1.1-2, and Table 2.1.1-3).

The Phase I archaeological survey conducted for the onshore interconnection facility, SFEC corridor, and SFEC landfall locations resulted in the identification of no potential archaeological resources. The archaeological survey within the SFEC onshore corridor determined that portions of the analysis area that fall within the LIRR ROW were previously disturbed from railroad construction activities and landscape modification. Because of this, these areas are determined to have low archaeological potential and no additional investigations are recommended. Discrete portions of the SFEC onshore corridor within public road ROWs may have experienced minimal excavation during the roadway construction (EDR 2019b). As a result, a Phase IB supplemental archaeological survey for these discrete sections of paved road ROWs was completed by EDR in 2020, including hand excavation of shovel test pits within the grassy and unpaved portions of the road ROWs adjacent to the pavement (i.e., with no disturbance of roadways). EDR's approach included systematic shovel tests for a portion of Beach Lane – Route A and a portion of Hither Hills – Route B (as recommended by EDR 2019b). Additional systematic shovel tests were also conducted by EDR at the interconnection facility. None of the testing efforts resulted in the identification of any potential archaeological resources.

DWSF is considering three onshore sites for the proposed O&M facility: 1) two are at the Quonset Business Park/Quonset Point, North Kingston, Rhode Island, and 2) one is at Montauk Harbor, East Hampton, New York.

The Quonset Point O&M facility site falls within the Quonset Business Park, which includes a NRHP-eligible historic property within its property boundaries: the Quonset Point Naval Air Station. The Quonset Point Naval Air Station currently serves as a Rhode Island Air National Guard Base. The Air National Guard Base is an active military base with modern structures and equipment (EDR 2019a). As a result of land development since the mid-twentieth century, the Quonset Point O&M facility site possesses low potential for intact/undisturbed archaeological resources (EDR 2019a). The Quonset Business Park/Quonset Point site was intermittently settled until it was developed as a U.S. Naval Reservation and construction battalion center in the 1940s and 1950s, wherein the property was extensively disturbed and the shoreline was extended (human-made land) to create the pieces of land that are proposed for the O&M facility components (EDR 2019a). Therefore, although the proposed construction site falls within a known NRHP-eligible historic property, the potential for ground-disturbing activities to effect buried cultural resources is low because the area of proposed construction has been previously disturbed and/or is fill material.

The Montauk Harbor O&M facility site location has no previously identified archaeological resources within it (EDR 2019a). The Montauk Harbor site was developed in the mid-twentieth century as a working harbor and seafood operation and is currently occupied by a small commercial fishing and packing operation. As a result of use of dredge fill in some portions and land development from the mid- through late twentieth century overall, this site possesses low potential for archaeological resources, as does the adjacent seabed where additional dredging is proposed, therefore, no additional archaeological investigations are recommended (EDR 2019a).

3.5.2.1.3 VIEWSHED RESOURCES

This Cultural Resources Viewshed section addresses visually sensitive cultural resources located within the viewshed of Project elements, referred to as viewshed resources. All other visual resources are addressed in the Visual Resources section (Section 3.5.9).

BOEM defines the APE for visual impact analysis as the viewshed (i.e., geographic areas from which the various Project components, both offshore and onshore, could potentially be seen). This includes the viewsheds from which the onshore interconnection facility and O&M facilities could be visible, as delineated within a 1-mile radius of each facility, and the viewshed from which offshore Project components could be visible, as delineated within the extent of a 40-mile radius centered upon the area of planned WTG development (Figure E-10). The 1-mile and 40-mile radii represent the maximum limit of visibility for each respective Project component and the visual impact analysis area includes only those geographic areas with potential visibility while excluding areas with obstructed views of Project facilities within those respective limits, as determined through a viewshed analysis (COP Appendix V and Appendix W).

For the onshore Project components' viewshed, the historic architectural resources survey identified four historic architectural properties within the APE for visual impact analysis. These include three at the Montauk Harbor O&M facility site, one at the Quonset Business Park/Quonset Point O&M facility site, and none at the SFEC landfall locations and interconnection facility (EDR 2018, 2019c). It is important to note that the visual impact analysis is based on the 1-mile-diameter circle around proposed onshore facilities, and within that circle the APE is further derived from GIS modeling of the viewshed, which takes into account the true visibility of the Project (e.g., visual barriers such as topography, vegetation, and non-historic structures that obstruct the visibility of the Project (EDR 2018, 2019c).

- At the SFEC landfall locations and interconnection facility, no historic properties are identified within the APE for visual impact analysis.
- At the Montauk Harbor O&M facility site, the three historic properties in the APE for visual impact analysis include one that is NRHP-listed and two that are NRHP eligible.
- At the Quonset Business Park/Quonset Point O&M facility site, the one historic property within the APE for visual impact analysis is NRHP eligible.

The Historic Resources Visual Effects Analysis (HRVEA) for the WTGs and OSS identified 113 historic sites and districts in the APE for the visual impact analysis, which takes into account the true visibility of the Project (e.g., visual barriers such as topography, vegetation, and non-historic structures greatly reduce the "true" visibility of the Project from a particular vantage point (see Section 3.5.9 [Visual Resources] and EDR [2019d]). It is important to note that this analysis is based on the 40-mile-diameter circle, and within that circle the APE is further derived from GIS modeling of the maximum viewshed extent adjusted to be within the precision of the HRVEA (EDR 2019d). This modeling includes an analysis of the visibility of a WTG from the water level to the tip of an upright rotor blade at a height of 840 feet and takes into account how distance and curvature of the Earth affects visibility as space between the viewing point and WTGs increases.[13] Of the 113 historic sites and districts in the APE that could be susceptible to visual impacts from the Project, 39 are listed on the NRHP (seven of which are National Historic Landmarks). The remaining 74 are considered as eligible for listing on the NRHP and, of these, 33 are in Rhode Island and 41 are in Massachusetts. Examples of these include National Historic Landmarks like the Southeast Lighthouse National Historic Landmark, NRHP-listed properties like the Capt. Mark L. Potter House and Gay Head Light, and those considered NRHP eligible based on state-level documentation, like Aquinnah Shops. Additionally, three of the 74 are considered Traditional Cultural Properties (one in Rhode Island and two in Massachusetts) (EDR 2019d).

[13] The PDE presented in the COP indicates a maximum WTG height of 840 feet from sea level to blade tip for the Proposed Action. Additional cumulative visual simulations conducted by EDR for inclusion in the *Cumulative Historic Resources Visual Effects Analysis* (SWCA 2020) are based on WTG blade tip height of 873 feet to accommodate for potential future blade tip heights of reasonably foreseeable future offshore WTGs constructed in the geographic analysis area.

3.5.2.2 Environmental Consequences

3.5.2.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.2-3 lists the issues identified for this resource category and the indicators and significance criteria used to assess impacts for the DEIS. The DEIS incorporates the criteria for assessing adverse effects under Section 106 of the National Historic Preservation Act (NHPA). These criteria are listed and described in 36 CFR 800.5(a).

Table 3.5.2-3. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Cultural Resources

Issue	Impact Indicator	Significance Criteria
Seabed disturbance and potential marine cultural resource damage	Qualitative analysis of pre-contact sites/cultural materials impacted Qualitative analysis of known or potential shipwrecks impacted Qualitative analysis of landforms with high archaeological sensitivity impacted	Negligible: No significant impacts would occur (i.e., effects on historic properties pursuant to 36 CFR800 would not rise to the level of being adverse effects). Minor: Significant impacts to NRHP characteristics could be avoided with environmental protection measures (EPMs). Moderate: EPMs would minimize, but not fully resolve, significant impacts to NRHP characteristics. Major: Significant impacts to NHPA characteristics are unavoidable even with EPMs.
Terrestrial ground disturbance: potential damage to cultural resources	Qualitative discussion of potential for impacts to unknown resources	
Viewshed disturbance: potential impact to identified historic properties	Qualitative assessment of NRHP-listed/eligible sites (historic properties) within view of Project	
Nighttime lighting: potential impact to identified historic properties	Qualitative assessment of NRHP-listed/eligible sites (historic properties) within view of Project	

3.5.2.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing cultural resources trends due to past and present activities. Attachment 3 in Appendix E also provides additional information regarding past and present activities and associated cultural resource impacts. Future, non-Project actions include proposed offshore wind energy development activities, undersea transmission lines and pipelines, dredging and port improvements, and onshore wind energy developments. Attachment 3 also in Appendix E discloses future non-offshore wind activities and associated cultural resources impacts. Impacts associated with future onshore and future offshore wind activities are described below.

Future Activities

Marine Resources

Under the No Action alternative, construction and installation, O&M, and conceptual decommissioning activities of reasonably foreseeable offshore projects could adversely impact potentially significant submerged cultural resources. However, federal law requires that offshore energy developers submit archaeological survey results and assessment of seafloor impacts to potential submerged cultural resources when bottom-disturbing activities are planned (Evans 2009:44). Submerged cultural resource surveys identify significant resources and support a determination of their NRHP eligibility. Based on the results of those surveys and assessments, the Project could be designed to avoid impacting known submerged cultural resources or minimize impacts to varying degrees. If potentially significant submerged cultural resources cannot be avoided, other measures to mitigate impacts would be required. Under the No Action alternative, reasonably foreseeable future projects could result in minor to major adverse cumulative impacts to marine cultural resources.

Accidental releases: The accidental release of hazardous materials and any associated cleanup could impact submerged cultural resources. However, most releases would not measurably contribute to resource impacts because of the low probability of occurrence, low persistence time, and EMPs implemented to prevent releases (see Section 3.3.2.2.2 [No Action Alternative] for details). Although not expected, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale impacts on marine resources.

Anchoring: Anchoring, gear use, and dredging associated with ongoing commercial and/or recreational marine activities and development of offshore wind projects could cause adverse impacts on submerged cultural resources. BOEM estimates that up to 4 acres of anchoring could occur under the No Action alternative within the APE for marine cultural resources. Deploying and repositioning anchors and seafloor gear with associated wire rope, cable, and chain could impact the bottom surface and potentially disturb shipwrecks and other marine archaeological resources resulting in the irreversible loss of historical and archaeological data. Although BOEM would be able to add mitigation measures for future offshore wind projects, the potential for permanent, minor to major adverse impacts on submerged cultural resources to result from future commercial and/or recreational activities remains.

New cable emplacement/maintenance and presence of structures: New offshore cable placement could also occur, as described in Attachment 4 in Appendix E, resulting in up to 259 acres of seabed disturbance from cable trenching in the surrounding BOEM Lease Area OCS-A 0486. Reasonably foreseeable offshore wind projects located in BOEM Lease Area OCS-A 0486 would also add an estimated 90 in-water structures. As described in Section 3.5.2.1 and Appendix E, the Lease Area and the APE for marine cultural resources contain a number of shipwrecks, related debris fields, and ancient submerged landform features, which future offshore construction activities could impact. BOEM and relevant State Historic Preservation Officers would require projects to avoid known resources through the creation of avoidance buffers around identified shipwrecks and/or remote-sensing magnetic anomalies and/or acoustic targets that could represent shipwreck resources. These measures would avoid or minimize impacts to submerged cultural resources. However, in some cases, the number, extent, and dispersed character of ancient submerged landform features could make avoidance impossible. Consequently, offshore construction could result in permanent, minor to major adverse impacts on sensitive ancient submerged landform features, if present.

Climate change: Factors related to climate change, including sea level rise, increased storm severity/frequency, increased sedimentation and erosion, and ocean acidification, could also result in long-term and permanent impacts on cultural resources. Some archaeological sites on the OCS have already experienced the effects of climate change because they were inundated when the last ice age ended (BOEM 2012:3-423). Contemporary federal studies on the adverse effects of climate change on shallow water shipwrecks point to accelerated decomposition (National Ocean Service 2020). Conversely, the incremental contribution of offshore wind energy projects on slowing/arresting global warming and climate change–related impacts could help minimize these climate change impacts.

Terrestrial Resources

Under the No Action alternative, reasonably foreseeable onshore projects could impact two aboveground historic resources (the East Hampton Railroad Station and the Montauk Lighthouse) through physical disturbance that could affect the setting and/or character of a site that make it eligible for NRHP listing. Depending on the degree of disturbance, future onshore projects could result in negligible to moderate adverse impacts to aboveground historic resources.

Ground disturbance: Reasonably foreseeable onshore activities could physically disturb archaeological sites. However, surveys have identified no archaeological sites in the APE for terrestrial resources, and analysis shows that most of the APE for terrestrial resources has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits or previously unidentified cultural resources is low. For this reason, potential impacts from ground-disturbing activities would be limited to previously undocumented cultural resources, if present. Reasonably foreseeable projects that are subject to federal laws and regulations would also require the identification of cultural resources, an assessment of Project impacts, and the address of significant impacts (or adverse effects under 36 CFR 800) to historic properties before proceeding. Therefore, if BOEM selects the No Action alternative, reasonably foreseeable future projects could result in long-term and negligible (if no resources are present) to major (should adverse impacts to unidentified historic properties occur) cumulative impacts to terrestrial cultural resources—aboveground historic buildings or structures and unidentified archaeological sites.

Accidental releases: Construction of reasonably foreseeable onshore projects could result in the accidental release of hazardous materials or debris; however, releases would generally be short term, localized, and in limited amounts (see Section 3.3.2.2.2 [No Action Alternative]). Such an accidental release could result in impacts to terrestrial cultural resources associated with the cleanup of contaminated soils. Indirect physical impacts would be long term and negligible to major depending on the nature and size of the accidental release, its spatial relationship to the cultural resource impacted, and the extent and intensity of cleanup activities required. Archaeological resources are more likely to experience indirect physical impacts through damage to or destruction of cultural materials during the removal of contaminated soils than are aboveground standing structures. Other indirect but primarily short-term impacts could include noise, vibration, and dust as well as visual impacts associated with cleanup activity. These impacts are expected to be negligible to moderate and minimized or avoided through application of state and local laws and regulations regarding air quality (see Section 3.3.1.2.2 [No Action Alternative]). Noise levels would be consistent with existing ambient noise conditions. Overall, impacts to terrestrial cultural resources from construction-related activities would be expected to be limited because of the low probability of an accidental release occurrence, the low volumes of material typically released in individual incidents, EPMs used to prevent release, and the localized nature of such events (see Table G-1 in Appendix G).

Climate change: As noted in marine resources, climate change could result in long-term and permanent impacts on terrestrial resources. Sea level rise could lead to the inundation of historic standing structures and increased storm severity and frequency would be expected to increase the severity and frequency of damage to coastal historic standing structures. Increased erosion along coastlines could lead to the collapse of coastal historic architectural properties as erosion undermines structural integrity. Ocean acidification could impact traditional uses of the Nantucket Sounds and Chappaquiddick Island Traditional Cultural Properties. However, the incremental contribution of offshore wind energy projects on slowing or arresting global warming and climate change–related impacts could help minimize these potential adverse impacts. In addition, no known archaeological sites are present in the APE for terrestrial resources, which is also heavily disturbed, and therefore potential adverse impacts from climate change are unlikely and would be limited to previously undocumented resources.

Viewshed Resources

Light: Reasonably foreseeable future offshore wind projects would also have impacts to viewshed resources from navigational and aviation lighting. Impacts from lighting would be most visible at night and from cultural resources that are along shorelines or on elevated locations with unobstructed views. A limited number of cultural resources would be affected and would include those for which the nighttime sky is a contributing element to historical integrity, such as resources on the southerly shores of Martha's Vineyard, Newport Island, and Block Island. Those resources that are not accessible at night (e.g., historic buildings, lighthouses, and battlefields) and those resources that generate their own light (e.g., historic districts) would be excluded. Reasonably foreseeable offshore wind projects could locate WTGs a minimum of 12 miles from shore. The distance between resources and the nearest lighting sources would limit the intensity of lighting impacts as would atmospheric and environmental conditions such as clouds, fog, and waves that could partially or completely obscure or diffuse sources of light. Construction lighting and conceptual decommissioning lighting associated with both onshore and offshore wind facilities would have temporary, intermittent, and localized adverse impacts, whereas operations lighting would have longer term, continuous, and localized adverse impacts. Implementing EPMs could reduce impacts from lighting (see Table G-1 in Appendix G). Under the No Action alternative, reasonably foreseeable future projects would have negligible to moderate, short-term to long-term cumulative impacts on viewshed resources.

Presence of structures: For the onshore viewshed, if BOEM selects the No Action alternative, the construction and installation, operations and maintenance, and conceptual decommissioning of reasonably foreseeable onshore infrastructure would introduce new elements to the viewshed that could compromise the historic integrity of known historic properties (should they occur in the environs of the SFEC landfall locations and interconnection facility or the three potential O&M facility locations—the two Quonset Business Park/Quonset Point O&M facility sites and one Montauk Harbor O&M facility site under consideration).

For the offshore viewshed, if BOEM selects the No Action alternative, the construction and installation, operations and maintenance, and conceptual decommissioning of reasonably foreseeable offshore wind projects could locate WTGs beginning approximately 12 miles from shore, resulting in visual impacts to historic properties that would be long term, continuous from minor to major, and minimized with distance. The cumulative HRVEA estimates that the reasonably foreseeable future projects have the potential to develop up to 940 WTGs in the RI/MA WEA, resulting in the potential addition of over 98% more WTGs visible from affected historic properties in the Project APE for visual impact analysis than the SFWF alone would produce (see SWCA 2020). Even without the SFWF, the substantial increase of WTGs would result in long-term cumulative visual impacts to cultural resources where sea views that are important to the historic setting or feeling and NRHP eligibility of the historic property are significantly altered by WTGs.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, operations and maintenance, and conceptual decommissioning would not occur; and potential impacts on cultural resources associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on cultural resources, primarily through construction-related activities.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **major**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **major**.

Considering all the impact-producing factors (IPFs) together, BOEM anticipates that the impacts associated with future offshore wind activities in the APE combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** to **major** adverse impacts because if avoided the overall effect would be small, but if not avoided the overall effect would be large and the resource would not be recoverable.

3.5.2.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Marine Resources

If practicable, BOEM would require DWSF to avoid potential impacts to the four identified potential shipwreck archaeological resources, which DWSF has indicated may be feasible through Project design and engineering.[14] Based on the potential seabed-disturbing activities proposed, DWSF has indicated that it may not be feasible to avoid impacts to all of the identified ancient submerged landform features and DWSF is currently considering design and engineering options to avoid or minimize impacts to these resources.

Additionally, an unanticipated discovery plan would be required that would include stop-work and notification procedures to be followed if a cultural resource is encountered during construction and installation, operations and maintenance, and conceptual decommissioning.

The final impact level for marine resources may not be known until BOEM completes the Section 106 consultation process and the determination of impacts is dependent on avoidance, minimization, or mitigation of adverse effects determined through BOEM's Section 106 review process and included as conditions of approval of the COP. If all marine NRHP-eligible resources are reliably identified and avoided, then impacts during construction of the SFWF and SFEC could be long term and negligible to minor. If all marine NRHP-eligible cultural resources are reliably identified and not avoided, but instead effects are considered through completion of the Section 106 process (and any subsequent measures to avoid, minimize, or mitigate adverse effects are made a condition of COP approval by BOEM[15]), then impacts to marine cultural resources during construction of the SFWF and SFEC could be long term and negligible to minor. If Project construction results in the unanticipated discovery of previously unknown NRHP-eligible cultural resources requiring mitigation through the Section 106 consultation process, then the resultant physical impacts could be long term and negligible to major (MMS 2007).

Terrestrial Resources

Construction of onshore Project components (onshore SFEC, interconnection facility, and O&M facility) could affect cultural resources through physical disturbance.

The route selected for the SFEC onshore would minimize impacts to, or avoid, potential terrestrial archeological resources, to the extent practicable. Analysis shows that most of the SFEC onshore route has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits is minimized in these areas. Results of the additional Phase IB survey of potentially undisturbed, buried portions of the SFEC route and interconnection facility by EDR in 2020 resulted in the identification of no potential archaeological resources. Surveys conducted to date have not identified

[14] Specific to Section 106 consultation, BOEM's archaeological guidelines define the marine APE to include the following geographic areas:

- The depth and breadth of the seabed potentially impacted by any bottom-disturbing activities
- The depth and breadth of terrestrial areas potentially impacted by any ground disturbing activities
- The viewshed from which renewable energy structures, whether located offshore or onshore, would be visible
- Any temporary or permanent construction or staging areas, both onshore and offshore

For the purposes of the marine archaeological assessment, DWSF identified all areas of potential Project-related seabed disturbance to develop a preliminary APE for BOEM's consideration. In accordance with 36 CFR 800.4(a), BOEM would determine the APE for the Project following the agency's analyses and state historic preservation office consultations.

[15] Appendix A provides a discussion of BOEM's determination that the approval of the Project COP is subject to the Section 106 consultation process under the NHPA. Any mitigation measures identified through the Section 106 process would be required to be included as mitigation measures in the COP prior to its approval by BOEM. The Section 106 consultation process has been initiated and is ongoing at the time of this draft EIS.

subsurface or aboveground cultural resources within the onshore Project components. However, should Project construction result in the discovery of previously unidentified cultural resources requiring mitigation through the Section 106 consultation process, the resultant physical impacts could be long term and negligible to major (MMS 2007).

Construction of the O&M facility would not require the demolition or physical alteration of any aboveground historic properties (EDR 2019c) at either the Quonset Business Park/Quonset Point or Montauk O&M facility sites; however, construction would either replace existing buildings that are not historic properties or would introduce new buildings to the active commercial waterfront.

Ground-disturbing activities proposed for the Quonset Business Park/Quonset Point O&M facility are minor surface improvements for paving and parking lots. DWSF would construct slab-on-grade foundations for buildings and support structures. DWSF would use existing docks and proposes no in-water work (EDR 2019a). As a result, BOEM anticipates that the Quonset Business Park/Quonset Point O&M facility would result in long-term, negligible to minor impacts to any unknown buried cultural resources, should they be discovered.

Ground-disturbing activities proposed for the Montauk O&M facility are minor surface improvements for paving and parking lots, footers for the office space and storage structures (because of the poor quality of the soil, including beach or fill land/dredged material), quayside reinforcement/rehabilitation, and initial and maintenance dredging (EDR 2019a). Additionally, because of the previous site disturbance, unstable soils, the presence of significant fill/dredged materials, and the lack of reported shipwrecks or other archaeological resources within the proposed dredging areas (Gray & Pape 2020), no archaeological survey was recommended at the Montauk Harbor site. The Montauk Harbor site possesses relatively low sensitivity for the presence of archaeological resources and Project construction is anticipated to result in long-term, negligible impacts to buried cultural resources. Alternatively, if Project construction results in discovery of previously unidentified cultural resources requiring mitigation through the Section 106 process, then the resultant physical impacts could be long term and negligible to major (MMS 2007).

As noted in the COP, Native American tribes were involved, and would continue to be involved, in interpretation of the results. An unanticipated discovery plan would be implemented that would include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.

Viewshed Resources

Based on a field review of the viewshed analyses, the interconnection facility would not be expected to be visible from NRHP-listed or NRHP-eligible properties and districts because of the dense, mature evergreen and deciduous forest surrounding the site and the densely situated buildings and houses in the villages and surrounding area (EDR 2018). The COP EPMs note that the interconnection facility would be located adjacent to an existing substation on a land parcel zoned for commercial and industrial/utility use and that mature trees currently screen the land parcel. The COP EPMs also note that after construction, additional screening would be considered to further reduce potential visibility and visual impact (see Appendix G). When topography, vegetation, and structures are all included in the viewshed analysis, approximately 2% of the visual analysis area has possible visibility of the interconnection facility see (EDR 2018). Thus, visual impacts to NRHP-listed and NRHP-eligible resource settings during construction of the interconnection facility would be long term if visible and short term (if screened by vegetation), with the potential to be negligible (if fully shielded) to major (if obtrusively visible) (MMS 2007). COP analysis of field studies found no historic properties from which the interconnection could be viewed, and non-historic properties within viewing distance were found to be shielded from view. Additionally, the onshore SFEC would be buried, therefore eliminating potential visual impacts to aboveground historic properties.

The viewshed analysis for the Quonset Business Park/Quonset Point O&M facility indicates that the site would be located within, and visible within, the Quonset Business Park and Quonset Point Naval Air Station, which itself is a historic property (NRHP eligible). The Quonset Point Naval Air Station is an approximately 974-acre World War II–era naval training facility improved with industrial buildings and parking lots and currently serves as a Rhode Island Air National Guard Base (EDR 2019a). The new O&M facility would be in scale and character with the existing development and use of the property. As a result, the Quonset Business Park/Quonset Point O&M facility would not result in significant impacts on the NRHP-eligible Quonset Point Naval Air Station (EDR 2019a); the potential visual impacts to historic properties are anticipated to be long term but negligible.

The viewshed analysis for the Montauk Harbor O&M facility indicates that one NRHP-listed property (Caleb Bragg Estate) and two NRHP-eligible properties (Montauk USCG Station Building and Montauk USCG Engineering/Boat Maintenance Building) are located within the APE for visual impact analysis (EDR 2019c). However, the Caleb Bragg Estate is screened by vegetation from the proposed O&M facility and its integrity of setting beyond the historic property boundary is absent due to other existing non-historic development (EDR 2019c). Although Montauk USCG Station Building and Montauk USCG Engineering/Boat Maintenance Building would have direct views of the O&M facility, their integrities of setting beyond each historic property are also absent due to other existing non-historic development (EDR 2019c). As a result, the Montauk Harbor O&M facility would not have significant impacts on historic properties; the potential visual impacts to historic properties are anticipated to be long term but negligible.

The construction of the offshore Project components would also result in modification to the existing viewshed within the terrestrial resources analysis area because SFWF turbines would be visible on the horizon from the shore (see Section 3.5.9 Visual Resources for further discussion). Most of the historic properties situated within the visual impact analysis area would have limited views because of screening by topography, vegetation, and other buildings/structures and would be located approximately 18 miles to 34 miles away from the SFWF work area (EDR 2019d). The WTGs would have a uniform design, speed, height, and rotor diameter, which contribute to a homogeneous view of wind farms on the horizon. The color of the SFWF (less than 5% gray tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking the blade tips. As discussed in Section 3.5.9 Visual Resources, because of FAA and USCG WTG lighting guidelines, adverse impacts to the seaward viewing experience would be potentially greater in nighttime than in daytime. For historic properties located on the waterfront, the WTGs would be a new feature in the visual setting. Because of their scale and form, WTGs are expected to begin to attract viewer attention under ideal lighting and atmospheric distances beginning under 18 miles from a historic property (EDR 2019d; Sullivan et al. 2012). Based on visual simulations of the Project, WTGs would be visible in the distant background only on clear days (EDR 2019e; Jacobs 2020), beginning at 19 miles and ranging to 35 miles from historic properties (EDR 2019d). Of the 113 historic properties located within the visual impact analysis area with potential views of the Project, and therefore determined to be in the APE for the Project, four are anticipated to experience visual impacts from the WTGs or OSS that would rise to the level of significant impacts to these historic properties: the Southeast Lighthouse National Historic Landmark and the Capt. Mark L. Potter House on Block Island, Rhode Island, and the Gay Head Light and Aquinnah Shops on Martha's Vineyard, Massachusetts. Also, the potential for additional traditional cultural properties exists in the APE for the visual impact analysis area (EDR 2019d), and BOEM remains in consultation with Native American tribes and other consulting parties under NHPA Section 106 to determine if the Project could result in adverse effects on historic properties (per 36 CFR 800).

Operations and Maintenance and Conceptual Decommissioning

Marine Resources

Offshore, O&M of the SFWF and offshore SFEC could impact unknown submerged marine cultural resources. For example, vessels conducting operations and maintenance activities could damage avoidance-buffered or unknown resources. However, DWSF could conduct operations and maintenance activities on equipment in areas that previously experienced disturbance during construction. Therefore, impacts to confirmed submerged cultural resources and identified ancient submerged landform features during O&M could be long term but negligible. During conceptual decommissioning activities impacts to confirmed submerged cultural resources and identified ancient submerged landform features could be temporary and negligible to minor so long as they are avoided. For example, seafloor disturbance associated with future anchoring/mooring and jack-up vessels could be relatively similar to impacts identified for construction activities.

Terrestrial Resources

Onshore, based on surveys conducted, Project O&M would have no physical impacts to terrestrial resources. DWSF could remove the onshore cables during conceptual decommissioning. Conceptual decommissioning of the SFWF and offshore SFEC would result in similar, or potentially reduced impacts, as those discussed above in construction. If conceptual decommissioning activities disturb an area larger than the area originally disturbed during construction, these activities could impact previously unknown archaeological resources. However, the likelihood of this would be low, and therefore impacts would be long term and negligible to minor.

Viewshed Resources

As discussed above, any viewshed changes associated with the onshore facilities (the interconnection and the O&M facility) would persist for the duration of the Project but result in negligible visual impacts to viewshed resources.

For offshore WTGS, if BOEM requires DWSF to install Aircraft Detection Lighting System (ADLS) technology, nighttime visual impacts (and, to a lesser degree, daytime visual impacts) to historic properties would be reduced although not eliminated, adding negligible to minor, long-term impacts during O&M. Daytime visual impacts from WTGs on historic properties in the visual impact analysis area would remain negligible to major for the duration of the Project depending on the significance of viewshed in their historical setting and character and the scale of impact (MMS 2007). O&M would not add further to these impacts; however, conceptual decommissioning would provide a remedy to previous visual impacts created by WTG construction.

Cumulative Impacts

Marine Resources

Offshore impacts would predominately be associated with changes in anchoring, cabling, structures, and accidental spills.

<u>Accidental releases</u>: The Proposed Action could incrementally contribute accidental releases of fuel, fluids, or hazardous material; sediment; and/or trash and debris to conditions under the No Action alternative. The risk would be increased primarily during construction but also would be present during operations and conceptual decommissioning. The contribution from the Proposed Action would be a low percentage of the overall spill risk from ongoing and future activities, as described in detail in Section

3.3.2.2. All vessels would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects resulting from the release of debris, fuel, hazardous material or waste on marine cultural resources (BOEM 2012). Additionally, required training and awareness of best management practices proposed for waste management and mitigation of marine debris for SFWF Project personnel would reduce the likelihood of occurrence to a very low risk. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time, and for this reason, BOEM expects localized and temporary negligible Project impacts on cultural resources. Cumulatively, the Proposed Action when combined with past, present, and reasonably foreseeable activities would have minor, short-term adverse impacts to marine resources.

Anchoring, new cable emplacement/maintenance, and presence of structures: Seafloor disturbance activities (temporary and long term) proposed for the Project include clearing/leveling of the seafloor, pile driving, monopile foundation (and associated cable protection) construction, vessel anchoring/mooring, export cable installation, and inter-array cable installation (preparation, trenching, burial, maintenance, replacement, etc.). Project anchoring and cable installation would add 821 acres and 913 acres of seabed disturbance to the 4 acres and 259 acres of disturbance, respectively, under the No Action alternative. WTG and OSS installation would also add 16 structures to the 90 in-water structures estimated to be present in the adjacent BOEM Lease Area OCS-A 0486 for the No Action alternative.

DWSF may also elect to use a mechanical cutter, mechanical plow, and/or jet plow to install cable at the target burial depth; those methods would reduce the amount of seabed impact relative to mechanical dredging. As a result, the cumulative impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities on historic and prehistoric marine cultural resources would be long term, localized, and minor adverse, unless previously undiscovered resources or ancient submerged landform features are identified and cannot be avoided and then they would be long term, localized and major adverse.

For any unavoidable ancient submerged landform features corresponding to the time of human occupation, BOEM may require additional investigations or other measures to resolve adverse effects and, as required, mitigations to be stipulated in a Memorandum of Agreement (MOA) prepared pursuant to the Section 106 consultation process (36 CFR 800). The MOA would contain measures to reduce, avoid or mitigate adverse effects on unavoidable ancient submerged landform features. Implementation of an MOA and subsequent treatment plan, agreed to by all consulting parties participating under the Section 106 consultation process, would be expected to reduce the magnitude of impacts on ancient submerged landform features from moderate or major to minor or moderate impacts.

Climate change: The cumulative impacts from global climate change for the Proposed Action would be the same as those described for the No Action alternative. The overall magnitude of potential impacts resulting from climate change are uncertain but are anticipated to qualify as negligible to minor adverse and long term.

Terrestrial Resources

Onshore impacts would predominately be associated with changes in ground disturbance.

Onshore construction associated with the Proposed Action would incrementally add to land disturbance when compared to No Action alternative through the removal of 2.4 acres of undeveloped land for the interconnection facility and a small area (0.1 acre) of developed land at the selected O&M facility. These onshore activities could incrementally add to the physical disturbance of archaeological sites that could occur under the No Action alternative, should unanticipated discoveries of archaeological resources result from the Project during onshore construction. Otherwise, terrestrial surveys for the Project have identified no archaeological sites, and analysis shows that most of the APE for terrestrial resources has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits or previously undocumented cultural resources is negligible.

As described under marine resources, the Proposed Action could incrementally contribute construction-related accidental releases of fuel, fluids, or hazardous material; sediment; and/or trash and debris to conditions under the No Action alternative. The contribution from the Proposed Action would be a low percentage of the overall spill risk from ongoing and future activities, as described in detail in Section 3.3.2.2. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time, and for this reason, BOEM expects localized and temporary, negligible Project impacts on cultural resources.

Based on above findings, the Proposed Action when combined with reasonably foreseeable onshore projects could result in short term negligible to minor cumulative adverse impacts to terrestrial resources from construction and O&M land-based activities.

Climate change: See marine resources for analysis.

Viewshed Resources

Offshore impacts would predominately be associated with changes in in-water structures.

Light: The Proposed Action would incrementally add offshore lighting impacts from navigational and aviation hazard lighting systems on the WTGs and OSS. The incremental addition would include up to 15 WTGs with red aviation hazard flashing lights and up to 15 WTGs and 1 OSS with marine navigation lighting consisting of flashing yellow lights compared to a future potential of up to 955 WTGs in the RI/MA WEA (including SFWF). Of the potential 955 WTGs, only 546 WTG locations were determined through visual simulations analysis to be visible from the nearest affected historic property in the Project APE under the No Action alternative due to screening by topography, vegetation, other buildings/structures, and distance from shore (SWCA 2020). For this reason, BOEM expects incremental lighting impacts from the Proposed Action to be long term, intermittent but negligible (at a potential increase of 3%). Cumulatively, the Proposed Action when combined with past, present, and reasonably foreseeable activities could have intermittent, short term to long-term, negligible to moderate adverse impacts on the viewshed.

Presence of structures: The Proposed Action would add up to 15 additional WTGs and one OSS to the condition of the No Action alternative within the visual impact analysis area. The Project would introduce new elements to the viewshed that could compromise the historic integrity of known historic properties. However, the Proposed Action would account for 3% (15 of 546 WTGs) of the total future RI/MA WEA WTG locations potentially visible from the nearest affected historic property in the Project APE. Proportionately, 97% of the total WTGs in the APE for visual impact analysis would be associated with other future offshore wind development and the Proposed Action WTGs would make 3% (EDR 2020). Additionally, the Proposed Action would locate WTGs no closer than approximately 12 miles from shore and over 19 miles from the nearest known historic properties where setting and feeling are important to their NRHP eligibility. Incremental visual impacts to sensitive receptors from the Project would be long term and negligible to major, and minimized with distance and obstructions. Cumulatively, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term, negligible to moderate adverse cumulative impacts on historic properties in the viewshed. Specifically, the Southeast Lighthouse National Historic Landmark, Capt. Mark L. Potter House, Gay Head Light, and Aquinnah Shops would receive moderate visual impacts to their historic settings (SWCA 2020).

Conclusions

Under the Proposed Action, the construction and installation of offshore components, as well as their operation and maintenance, would have **negligible** to **major** impacts on cultural resources. Major impacts would be limited to the portions of ancient submerged landform features that DWSF is unable to avoid and are disturbed by Proposed Action activities. The final magnitude of these impacts would depend on the measures agreed to by DWSF, BOEM, and the NHPA Section 106 consulting parties to avoid, minimize, and/or mitigate adverse effects on cultural resources. The construction and installation of offshore components, as well as their operation and maintenance, would have **minor** to **moderate** impacts to the viewshed, depending on whether impacts could affect the setting and/or character of a site, as at the Southeast Lighthouse National Historic Landmark, the Capt. Mark L. Potter House, Gay Head Light, and Aquinnah Shops.

Therefore, BOEM expects the overall impact on cultural resources from the Proposed Action alone to be **moderate**, as the overall effect would vary and can depend on whether resources are discovered or the viewshed is interrupted. Cultural resources, if adversely affected, would be mitigated through the Section 106 process.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **major**. 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 **negligible** to **moderate** impacts to cultural resources. BOEM made this determination because overall adverse effects to cultural resources could be mitigated through the Section 106 process.

3.5.2.2.4 VESSEL TRANSIT LANE ALTERNATIVE

Marine Resources

The Transit alternative would not change the types or numbers of submerged historic and prehistoric resources potentially affected by the Project activities of the Proposed Action. However, the Transit alternative could decrease the risk of marine resource damage or destruction to unknown submerged cultural resources because the number of constructed turbine foundations would be reduced and associated inter-array cable trenching could also decrease. Therefore, the construction and installation of offshore components, as well as their operation and maintenance, would have negligible to major impacts on cultural resources.

Terrestrial Resources

The onshore activities proposed under the Transit alternative are the same as those of the Proposed Action. Therefore, impacts to terrestrial cultural resources would be the same as those of the Proposed Action: negligible to major.

Viewshed Resources

The Transit alternative could decrease visual impacts because the number of constructed turbines would be reduced. In all other areas, the layout modification and construction activities proposed under this alternative do not represent a substantial change from the Proposed Action. Therefore, the construction and installation of offshore components, as well as their operation and maintenance, would have negligible to major impacts to viewshed, depending on whether impacts could affect the setting and/or character of a site.

Cumulative Impacts

Marine Resources

The layout modification and construction activities proposed under the Transit alternative do not represent a substantial change from the Proposed Action. As a result, the cumulative impacts associated with the Transit alternative when combined with past, present, and reasonably foreseeable activities could be short to long term, localized, and negligible to major.

Terrestrial Resources

The Transit alternative would not affect Project onshore activities; therefore, the Transit alternative when combined with past, present, and reasonably foreseeable activities would be the same as the Proposed Action and result in negligible to major impacts.

Viewshed Resources

The layout modification and construction activities proposed under the Transit alternative do not represent a substantial change from the Proposed Action. As a result, the cumulative visual impacts on historic properties in the APE for visual impact analysis and associated with the Transit alternative when combined with past, present, and reasonably foreseeable activities would be long term and negligible to major.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in seabed disturbance, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **major**. The construction and installation of offshore components, as well as their operation and maintenance, would have **negligible** to **major** impacts to cultural resources.

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

3.5.2.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Marine Resources

This alternative would not change the types or numbers of submerged historic and prehistoric resources potentially affected by Project activities of the Proposed Action. However, the Habitat alternative could decrease the risk of marine resource damage or destruction to unknown submerged cultural resources because the number of constructed turbines would be reduced and associated inter-array cable trenching could also decrease. Therefore, the construction and installation of offshore components, as well as their operation and maintenance, would have negligible to major impacts on cultural resources.

Terrestrial Resources

The onshore activities proposed under the Habitat alternative would be the same as those of the Proposed Action. Therefore, impacts to terrestrial cultural resources would be the same as those of the Proposed Action: negligible to major.

Viewshed Resources

The Habitat alternative could decrease visual impacts because the number of constructed turbines would be reduced. In all other areas, the layout modification and construction activities proposed under this alternative do not represent a substantial change from the Proposed Action. Therefore, the construction and installation of offshore components, as well as their operation and maintenance, would have negligible to major impacts to viewshed, depending on whether impacts could affect the setting and/or character of a site.

Cumulative Impacts

Marine Resources

The layout modification and construction activities proposed under the Habitat alternative do not represent a substantial change from the Proposed Action. As a result, the cumulative impacts associated with the Habitat alternative when combined with past, present, and reasonably foreseeable activities would be short to long term, localized, and negligible to major.

Terrestrial Resources

The Habitat alternative would not affect Project onshore activities; therefore, cumulative impacts would be the same as the Proposed Action: negligible to major.

Viewshed Resources

The layout modification and construction activities proposed under the Habitat alternative do not represent a substantial change from the Proposed Action. As a result, the cumulative impacts associated with the Habitat alternative when combined with past, present, and reasonably foreseeable activities would be long term and negligible to major.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in seabed and visual disturbance, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to m**ajor**. The construction and installation of offshore components, as well as their operation and maintenance, would have **negligible** to **major** impacts to cultural resources.

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

3.5.2.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that cultural resources impacts would range from **negligible** to **major** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **major**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **negligible** to **moderate.**

3.5.2.4 Mitigation

BOEM could reduce potential impacts to cultural resources from construction and installation, O&M, and conceptual decommissioning activities by requiring the following conditions of COP approval:

- Avoidance of potential physical impacts to marine cultural resources and identified historic properties through implementation of a required avoidance area around each.
- If a resource is discovered after COP approval or is a marine cultural resource that cannot be avoided by DWSF, requirement of additional investigation for the purpose of determining eligibility of the resource for listing in the NRHP.
- If impacts on cultural resources determined eligible for listing in the NRHP cannot be avoided, additional mitigation measures will be developed through execution of an MOA by BOEM and required signatories to resolve adverse effects under Section 106 of the NHPA to be implemented by DWSF.
- Requirement of a post-review discovery plan that DWSF would implement during Project construction to ensure that impacts to unanticipated cultural resources are considered.

If BOEM requires the avoidance and mitigation measures outlined above for cultural resources, then significant impacts to cultural resources would be further reduced; although, the range of potential impacts would still be identified as negligible to major.

Additionally, if BOEM requires the installation of ADLS technology on WTGs, then long-term negligible to moderate visual impacts to historic properties would be further reduced by reducing the amount of time WTGs would be visible at night. The short-duration synchronized flashing of the ADLS would have effectively less visual impact at night than the standard continuous, medium-intensity red strobe light aircraft warning systems.

3.5.3 Demographics, Employment, and Economics

3.5.3.1 Affected Environment

In the COP, DWSF does not indicate that any single state or county would be the primary recipient of the Project's economic impacts, adverse or beneficial. DWSF indicates that as many as 12 regional ports could be used for fabrication, assembly, storage, or deployment of materials and crew during development, construction, and conceptual decommissioning of the Project. Table 3.5.3-1. documents the ports, communities, counties, and states that could be directly or indirectly affected by the Project. The list includes ports/communities that the COP indicates could be used for 1) fabrication, assembly, and deployment; 2) crew transfers, logistics, and storage; or 3) landing sites and the interconnection facility. The table also lists the ports that are cited in Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing) as deriving a substantial amount of commercial fishing revenue from the Lease Area or along the offshore SFEC (see Table 3.5.1-9 and Table 3.5.1-11.).

Table 3.5.3-1. Cities/Towns, Counties, and States in the Analysis Area

Port/Facility Name/ Place Name	City/Town	County, State	Fabrication, Assembly, Deployment	Crew Transfer, Logistics, Storage	SFEC Site	Commercial Fishing	For-Hire Recreational Fishing
Port of New London	New London	New London, CT	X	X		X	
Stonington	Stonington	New London, CT				X	X
New Bedford Marine Terminal	New Bedford	Bristol, MA	X	X		X	
Westport	Westport	Bristol, MA				X	
Sparrow’s Point	Edgemere	Baltimore, MD	X				
Paulsboro Marine Terminal	Paulsboro	Gloucester, NJ	X				
East Hampton	East Hampton	Suffolk, NY			X		
Port of Montauk	Montauk	Suffolk, NY		X	X	X	X
Shinnecock Fishing Dock	Hampton Bays	Suffolk, NY		X			X
Greenport Harbor	Greenport	Suffolk, NY		X			X
Port of Providence	Providence	Providence, RI	X				
Port of Galilee/Point Judith	Narragansett	Washington, RI		X		X	X
Old and New Harbor	New Shoreham	Washington, RI		X			X
Port of Davisville and Quonset Point	North Kingstown	Washington, RI	X	X			X
Newport	Newport	Newport, RI				X	X
Tiverton	Tiverton	Newport, RI				X	X
Little Compton	Little Compton	Newport, RI				X	X
Norfolk International Terminal	Norfolk	Norfolk City, VA	X				

Note: CT = Connecticut, MA = Massachusetts, MD = Maryland, NJ = New Jersey, NY = New York, RI = Rhode Island, VA = Virginia.

3.5.3.1.1 DEMOGRAPHIC CHARACTERISTICS WITHIN THE ANALYSIS AREA

This subsection describes demographic characteristics and trends in the analysis area. Table 3.5.3-2 describes each potentially affected county and city/town in terms of its area in square miles, population change between 2000 and 2018, population density, and median household income. While a change in population is not itself considered an impact, population change has the potential to drive beneficial or adverse impacts to other socioeconomic variables, such as availability of housing and demand for public infrastructure and services.

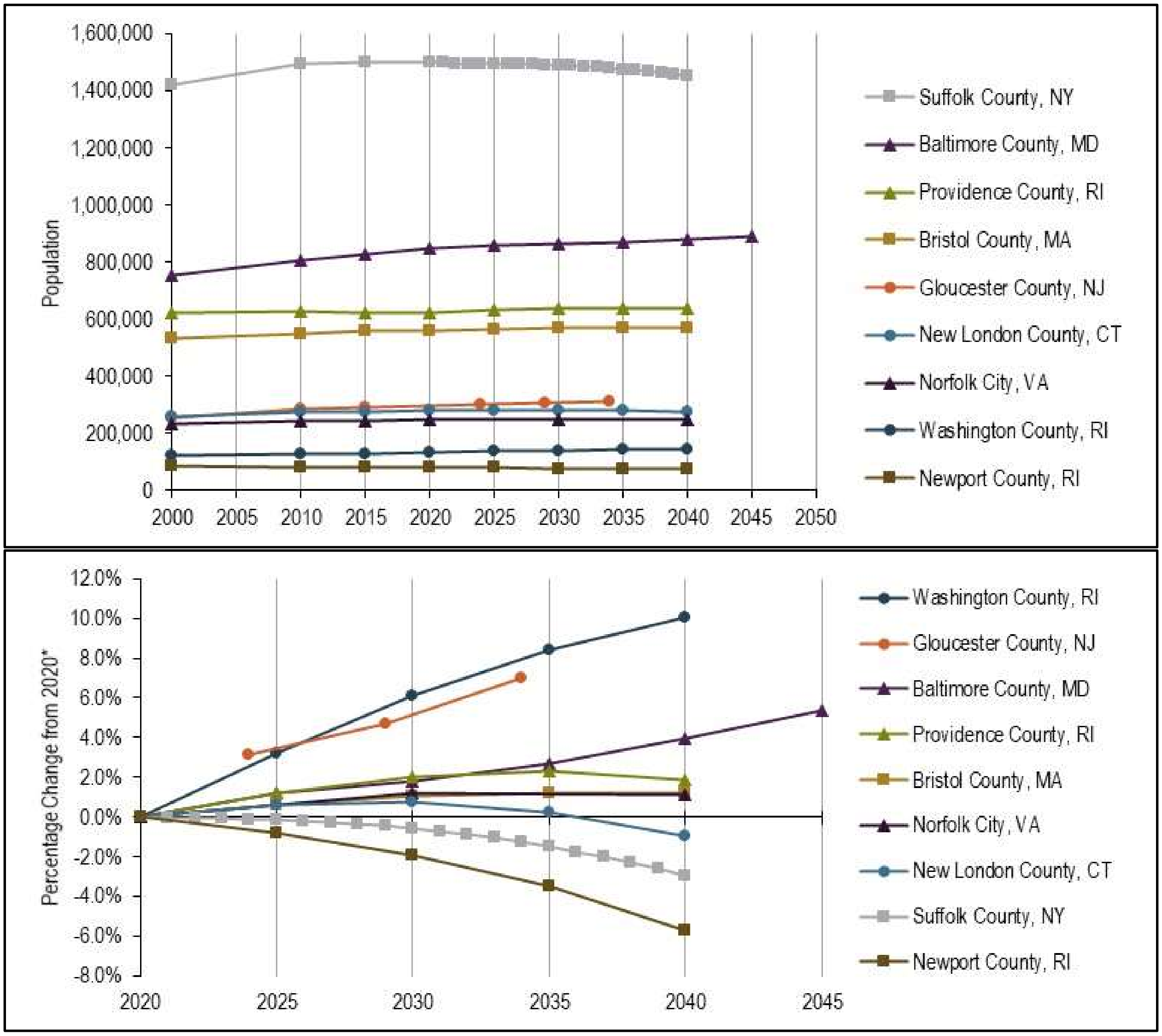
Among the potentially affected counties, Suffolk County, New York, had the largest population with 1.5 million residents, although Providence County in Rhode Island had the highest population density. Gloucester County, New Jersey, experienced the largest rate of population growth from 2000 to 2018 at 14.2%. The counties in Massachusetts, Maryland, New Jersey, and New York all saw growth of at least 4% during this time period. Rhode Island had a smaller rate of growth at approximately 2%. Some of the cities/towns within Washington County, Rhode Island, and Newport County, Rhode Island, decreased in population between 2000 and 2018. New Shoreham Town's population decreased by more than 18%, although it is also the smallest by population of the communities within the analysis area. Cities/towns and counties with smaller populations appear to be more volatile in terms of growth rates.

Table 3.5.3-2. Population and Median Income by City/Town and County

State/County/City or Town		Land Area (square miles)	Population (2010)	Population (2018)	2000–2018 (percent change)	Population Density (population/ square mile)	Median Household Income (2018)
Connecticut	New London County	665	274,055	268,881	3.8%	404	$71,368
	New London	6	27,620	27,032	5.3%	4,814	$39,675
	Stonington	39	18,545	18,436	3.0%	477	$79,250
Massachusetts	Bristol County	553	548,285	558,905	4.5%	1,011	$66,157
	New Bedford	20	95,072	95,117	1.4%	4,757	$43,989
	Westport	50	15,532	15,854	11.8%	318	$80,015
Maryland	Baltimore County	598	805,029	827,625	9.7%	1,383	$74,127
	Edgemere	11	8,669	8,633	-6.7%	797	$75,031
New Jersey	Gloucester County	322	288,288	290,852	14.2%	903	$85,160
	Paulsboro Borough	2	6,097	5,937	-3.6%	3,132	$41,825
New York	Suffolk County	912	1,493,350	1,487,901	4.8%	1,631	$96,675
	East Hampton	74	21,457	21,903	11.1%	295	$97,351
	Montauk (village in East Hampton)	17	3,326	3,655	-5.1%	209	$95,278
	Hampton Bays (hamlet in Southampton)	13	13,603	14,280	16.7%	1,102	$78,344
	Greenport (village in Southhold)	1	2,197	1,945	-5.0%	2,035	$50,208
Rhode Island	Providence County	410	626,667	634,533	2.1%	1,550	$55,233
	Providence	18	178,042	179,435	3.4%	9,752	$42,158
	Washington County	329	126,979	126,242	2.2%	383	$81,301
	Narragansett	14	15,868	15,550	-5.0%	1,119	$80,278
	New Shoreham	9	1,051	827	-18.1%	91	$65,893
	North Kingstown	43	26,486	26,207	-0.5%	607	$89,874
	Newport County	102	82,888	83,075	-2.8%	811	$77,237
	Newport	8	24,672	24,762	-6.5%	3,227	$65,431
	Tiverton	29	15,780	15,816	3.6%	545	$74,553
	Little Compton	21	3,492	3,505	-2.4%	171	$81,523
Virginia	Norfolk City	54	242,803	245,592	4.8%	4,538	$49,146

Source: U.S. Census Bureau (2020).

Figure 3.5.3-1 is a two-panel figure that shows past and forecast trends in population of the counties in the analysis area. The top panel contains population counts and the lower panel shows the forecast percentage change from the 2020 population estimate. While the available population forecasts do not use the same base year or the same set of assumptions with respect to future changes, they generally represent the best publicly available information. For three of the nine counties (Washington County, Rhode Island; Gloucester County, New Jersey; and Baltimore County, Maryland), forecasts show population increasing throughout the forecast period. Population forecasts for three counties increase initially but then flatten while still remaining greater than 2020 (Providence County, Rhode Island; Bristol County, Massachusetts; and Norfolk County, Virginia). Lastly, three counties are forecast to see population decline in the long run (New London County, Connecticut; Suffolk County, New York; and Newport County, Rhode Island).



Sources: Connecticut State Data Center (2018); Demographics Research Group (2019); UMASS Donahue Institute (2018); New Jersey Dept. of Labor and Workforce Development (2014); Cornell Program on Applied Demographics (2018); Rhode Island Statewide Planning Program (2013); Maryland State Data Center (2017).

Figure 3.5.3-1. Population trends and forecasts of counties in the analysis area, 2000–2050.

3.5.3.1.2 ECONOMIC CHARACTERISTICS WITHIN THE ANALYSIS AREA

This section summarizes primary economic characteristics in the analysis area, including the gross domestic product (GDP) of each potentially affected county and state and state and county employment statistics. The GDP represents the market value of goods and services produced by the labor and property located within a geographical area, but it does not include the value of goods imported into the area. GDP serves as a relative indicator of the size of the economies within the analysis area. A focus of this analysis is the GDP for the “ocean economy,” which includes economic activity dependent upon the ocean, such as commercial fishing and seafood processing, marine construction, commercial shipping and cargo handling facilities, ship and boat building, marine minerals, harbor and port authorities, passenger transportation, boat dealers, and ocean-related tourism and recreation (National Ocean Economics Program 2020).

Most analysis area counties display diverse economic activity, and many have well-developed ocean-based economic sectors. In particular, the ocean-related recreation and tourism sector plays a major role in many county economies affected by the Project (see Section 3.5.8 [Recreation and Tourism]). In addition, commercial fishing fleets are important to coastal communities by generating employment and income for vessel owners and crews as well as by creating demand for shoreside products and services to maintain vessels and process seafood products (see Section 3.5.1 [Commercial Fisheries and For-Hire Recreational Fishing]). The marine transportation sector is expanding in some coastal counties, with the major regional ports seeing increased vessel visits and undertaking upgrades to accommodate the increased utilization.

Table 3.5.3-3 summarizes trends in the annualized total GDP and ocean economy GDP of potentially affected states and counties. Among states, New York had both the largest total GDP and ocean economy GDP. Maryland experienced the largest increase in total GDP over the 2001–2018 period, and it also had the highest increase in ocean economy GDP over the 2005–2016 period. Among counties, Washington County, Rhode Island, experienced the largest increase in ocean economy GDP over the 2005–2016 period. The ocean economy GDP of some counties decreased, including Bristol County, Massachusetts; Gloucester County, New Jersey; and Norfolk City, Virginia.

Table 3.5.3-3. Annualized Total and Ocean Economy Gross Domestic Product of Potentially Affected States and Counties

State/County	Total GDP (millions of current dollars)		2001–2018 Percent Change	Percentage of Analysis Area Total GDP (2018)	Ocean Economy GDP (millions of 2012 dollars)		2005–2016 Percent Change	Percentage of Analysis Area Ocean Economy GDP (2019)
	2001	2018			2005	2016		
Connecticut	**$173,127**	**$275,727**	**59.3%**	**6.7%**	**$3,207**	**$3,943**	**22.9%**	**6.5%**
New London County	$11,293	$19,295	70.9%	–	$1,482	$1,796	21.2%	–
Maryland	**$205,450**	**$412,584**	**100.8%**	**10.0%**	**$4,526**	**$7,706**	**70.2%**	**12.6%**
Baltimore County	$30,316	$55,029	81.5%	–	$276	$310	12.1%	–
Massachusetts	**$296,834**	**$569,488**	**91.9%**	**13.7%**	**$4,447**	**$6,685**	**50.3%**	**10.9%**
Bristol County	$15,598	$26,827	72.0%	–	$482	$469	-2.74%	–
New Jersey	**$373,756**	**$622,003**	**66.4%**	**15.0%**	**$7,324**	**$8,949**	**22.2%**	**14.7%**
Gloucester County	$7,683	15,758	105.1%	–	$197	$175	-11.4%	–
New York	**$877,149**	**$1,668,866**	**90.3%**	**40.3%**	**$17,650**	**$23,785**	**34.8%**	**39.0%**
Suffolk County	$49,406	$92,983	88.2%	–	$1,263	$1,894	50.0%	–

State/County	Total GDP (millions of current dollars)		2001–2018 Percent Change	Percentage of Analysis Area Total GDP (2018)	Ocean Economy GDP (millions of 2012 dollars)		2005–2016 Percent Change	Percentage of Analysis Area Ocean Economy GDP (2019)
	2001	2018			2005	2016		
Rhode Island	**$35,992**	**$60,588**	**68.3%**	**1.5%**	**$2,103**	**$2,439**	**15.9%**	**4.0%**
Providence County	$22,067	$36,773	66.6%	–	$630	$630	0.0%	–
Washington County	$3,620	$7,037	94.4%	–	$498	$785	57.6%	–
Newport County	$3,566	$5,953	66.9%	–	$578	$625	8.0%	–
Virginia	**$284,002**	**$532,893**	**87.6%**	**12.9%**	**$6,939**	**$7,555**	**8.9%**	**12.4%**
Norfolk City	Not applicable (N/A)	N/A	N/A	–	$1,050	$942	-10.3%	–
Analysis area	**$2,246**	**$4,142,148**	**84.4%**	**100.0%**	**$46,196**	**$61,062**	**24.3%**	**100.0%**

Sources: U.S. Bureau of Economic Analysis (2020); National Ocean Economics Program (2020).

Note: A detailed list of economic sectors and industries that the National Ocean Economics Program defines as the ocean economy is available at https://www.oceaneconomics.org/Market/sectors.asp.

Table 3.5.3-4 summarizes the employment characteristics of the analysis area, including the size of the labor force/number of persons employed and unemployment rate in 2019. The size of the labor force in each county mirrors the county's population size, with the largest labor force present in urban areas. Among the potentially affected counties, Suffolk County, New York, had the largest labor force in 2019, with 0.78 million workers. Newport County, Rhode Island, had the smallest labor force, with 44,280 workers. The unemployment rate was low throughout the analysis area in 2019, ranging from 2.7% in Virginia to 3.9 in New York. The unemployment rate calculated as the number of unemployed persons in in the labor force over the entire analysis area was 3.4%. However, unemployment rates throughout the United States have risen substantially in recent months due to the restrictions on economic activity that have been imposed as a result of the COVID-19 pandemic.

Table 3.5.3-4. Employment Characteristics of Potentially Affected States and Counties, 2019

State/County	Estimated Size of Labor Force	Estimated number of Person Employed	Percentage of Labor Force That is Unemployed
Connecticut	1,912,889	1,853,997	3.8%
New London County	137,386	132,457	3.1%
Massachusetts	3,816,470	3,727,633	2.8%
Bristol County	304,217	298,047	3.2%
Maryland	3,260,104	3,160,365	3.4%
Baltimore County	457,555	452,655	3.0%
New Jersey	4,489,884	4,367,342	3.7%
Gloucester County	149,747	145,732	3.8%
New York	9,512,296	9,156,258	3.9%
Suffolk County	778,193	747,013	3.8%
Rhode Island	555,418	537,582	3.5%
Providence County	325,490	317,818	3.4%
Washington County	69,050	67,473	2.8%
Newport County	44,280	43,981	2.8%

State/County	Estimated Size of Labor Force	Estimated number of Person Employed	Percentage of Labor Force That is Unemployed
Virginia	4,410,200	4,324,694	2.7%
Norfolk City	112,364	109,594	3.1%
Analysis area	27,957,261	27,127,871	3.4%

Source: U.S. Bureau of Labor Statistics (2020).

3.5.3.2 Environmental Consequences

3.5.3.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.3-5 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts to demographics, employment, and economics for the DEIS. Appendix F provides additional details of the analysis, data sources, and assumptions.

Table 3.5.3-5. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Demographics, Employment, and Economics

Issue	Impact Indicator	Significance Criteria
Development and construction expenditures and employment	Changes in GDP Changes in full-time equivalent (FTE) jobs and income Changes in the demand for housing Changes in the local supply chain for offshore wind farm components	Negligible: No measurable impacts would occur. Minor: Adverse impacts to the affected activity or geographic place could be avoided with EPMs and impacts would not disrupt the normal or routine functions of the affected activity or geographic place. Once the impacting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects. Moderate: Impacts to the affected activity or geographic place are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the impacting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects if proper remedial action is taken. Major: The affected activity or geographic place would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the impacting agent is eliminated, the affected activity or geographic place could retain measurable effects indefinitely, even if remedial action is taken.
Operational expenditures and employment	Changes in FTE jobs and income	
Conceptual decommissioning expenditures and employment	Changes in FTE jobs and income	

3.5.3.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing demographics, employment, and economic trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated demographics, employment, and economic impacts. Future non-Project actions include residential, commercial, and industrial development and onshore utility projects that include solar power, transmission, gas pipeline, communications tower, and land-based wind energy projects. Offshore projects other than offshore wind would support the existing marine industries and workforce. Ocean-based industries, including tourism and recreation, commercial fishing, and marine transportation, would continue to be important to the economies of many of the counties within the geographic analysis area. Attachment 3 in Appendix E also discloses future non-offshore wind activities and associated demographics, employment, and economic impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Energy generation: The assessment of impacts of future activities on demographics, employment, and economics in the analysis area under the No Action alternative primarily focuses on the potential employment from reasonably foreseeable future offshore wind projects. As shown in Appendix E, approximately 20 separate offshore wind development projects are in planning phases through 2030. Together, these wind farms could add over 25,000 MW of renewable energy by 2030 into the energy grid from Massachusetts to North Carolina, using the same geographic ranges of ports specified in the COP for the SFWF Project.

Table 3.5.3-6 shows projected employment from existing and future offshore wind developments within the analysis area for the years 2020–2030 under the No Action alternative. The estimates have been developed using the JEDI Offshore Wind Model[16] using the construction phases described in Tables E-4 and E-5 of Appendix E.[17] It is expected that most of the direct construction-related jobs would be attributed to either the community hosting the regional headquarters of the project developer or the fabrication and storage ports that would be used. In general, the specific locations of the regional fabrication and storage ports for specific projects have not been announced, although it is clear that New Bedford has been selected for the Vineyard Wind project.

Table 3.5.3-6. Projected Construction and Operations Jobs in the Affected Region under the No Action Alternative, 2020–2030

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Wind Farm Construction Jobs (includes pre-construction jobs)*											
Direct jobs	98	770	3,972	6,092	5,355	6,994	8,222	5,136	2,074	630	0
Indirect jobs	166	1,312	6,708	10,293	9,116	11,908	13,935	8,710	3,543	1,078	0
Induced jobs	107	410	2,102	3,225	2,850	3,723	4,363	2,726	1,106	336	0
Total jobs	**370**	**2,493**	**12,782**	**19,611**	**17,320**	**22,624**	**26,519**	**16,573**	**6,723**	**2,044**	**0**
Wind Farm Operations and Maintenance Jobs											
Direct jobs	2	3	3	33	153	258	350	520	662	718	741
Indirect jobs	11	11	17	17	190	880	1,490	2,020	3,001	3,820	4,139
Induced jobs	4	4	6	6	73	338	572	776	1,152	1,467	1,590
Total jobs	**17**	**18**	**26**	**56**	**416**	**1,476**	**2,413**	**3,316**	**4,815**	**6,005**	**6,471**

Source: Estimates were developed using the JEDI-OWM (National Renewable Energy Laboratory 2017).

Note: The O&M jobs shown for 2020 are estimates for the BIWF.

* Construction jobs are defined as full-time equivalents (FTEs), or 2,080-hour units of labor (one construction period job equates to one full-time job for 1 year).

Port utilization and traffic: Offshore wind development could also generate economic activity at ports used to support the construction and operation of offshore wind projects through port upgrades and development as well as marine transportation. These types of upgrades are described in Appendix E. Where existing ports are improved and channels are dredged for use in support of offshore wind, additional shore-based and marine workers would be hired, resulting in a trained workforce for the offshore wind industry and contributing to beneficial local and regional economic activity. Moreover, these port improvements would be beneficial to other port activity. Overall, the port investment and usage generated by offshore wind under the No Action alternative would have long-term beneficial impacts on

[16] The Jobs and Economic Development Impacts Offshore Wind Model—an interactive spreadsheet model developed and maintained by the National Renewable Energy Laboratory (2017)—was used to generate estimates of local employment and income as well as capital and operating expenditures. The model is described more completely in Appendix F.

[17] The timeline shown in the table does not extend into the future far enough to include conceptual decommissioning jobs.

employment and economic activity by providing employment opportunities and supporting marine service industries such as marine construction, ship construction and servicing, and related manufacturing. See Whitney et al. (2016) for a summary of the current status of U.S. ports as well as some of the planned and implemented port expansions to further support offshore wind.

However, congestion and delays could increase fuel costs (i.e., for vessels forced to wait for port traffic to pass) and could decrease productivity for commercial shipping, fishing, and recreational vessel businesses, the income of which depends on the ability to spend time out of port. Collisions could lead to vessel damage and spills, which could have direct costs (i.e., vessel repairs and spill cleanup) as well as indirect costs from damage caused by spills. This would represent a temporary and minor adverse impact.

Land disturbance, presence of structures, new cable emplacement/maintenance, light, noise: Actions associated with onshore and offshore construction and O&M would result in temporary to long-term increases in noise, traffic, lighting, and human activity. These actions would qualify as negligible to minor because it is expected that these impacts would not disrupt normal or routine demographic characteristics, employment, or economic activity in the analysis area—or that, in the case of temporary economic activity specifically associated with construction, any such changes would generally revert to pre-construction conditions following construction completion. Detailed analysis of structure and cable impacts to commercial and for-hire recreation fishing and navigation are provided in Sections 3.5.1.2.2 (No Action Alternative) and 3.5.6.2.2 (No Action Alternative), respectively. Analysis of noise impacts to fish populations, which could indirectly affect fishing-related economic activity, is described in 3.4.2.3.2 (No Action Alternative). Lighting, noise, and structure impacts to recreation and tourism are described in Section 3.5.8.2.2 (No Action Alternative).

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on demographics, employment, and economic activity, primarily through new job formation associated with offshore wind development.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **minor**, and **minor beneficial**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** to **minor beneficial**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor beneficial** impacts, as effects would represent a small improvement.

3.5.3.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

The impact of the Project capital expenditures (CapEx) on GDP would be minor and beneficial for the analysis area.[18] As indicated in Table F-6 in Appendix F, local CapEx for development and construction of the SFWF are expected to inject between $178.9 and 237.5 million into the regional economy,

[18] The Jobs and Economic Development Impacts Offshore Wind Model (JEDI-OWM) —an interactive spreadsheet model developed and maintained by the National Renewable Energy Laboratory (2017)—was used to generate estimates of capital and operating expenditures, together with estimates of local employment and income. JEDI-OWN is described in greater detail in Appendix F.

including taxes, over a 2-year period beginning in 2021, or $89.4–$118.8 million on an annual basis. The range of estimates depends primarily on installed capacity of the wind farm, which could be as low as 90 MW or as high as 180 MW. When compared to the analysis area, this level of spending represents less than 0.005% of the area's total GDP. Even if 100% of the local CapEx amount was spent entirely within Rhode Island (the smallest of the analysis area's state economies), it would account for less than 0.21% of that state's total GDP. If that growth in GDP had been injected into Rhode Island's economy in 2018, the annual GDP growth rate would have increased from 1.70% to 1.89%. Therefore, the impact of the Project on the GDP of states within the analysis area would be beneficial but minor and temporary.

The impact of the Project CapEx on FTE jobs and income would be beneficial throughout the analysis area. Table F-7 in Appendix F indicates that depending on the total Project capacity, direct FTE jobs in the analysis area over the 2-year period would range from 326 to 428, whereas indirect FTE jobs in the supply chain would range from 518 to 686. In addition, between 367 and 473 induced FTE jobs are expected. In total, an estimated 1,211 to 1,587 FTE jobs would be created during Project construction.

Economic benefits are also expected to accrue to ports that undertake improvements to support Project development. Additional shore-based and marine workers would be hired, resulting in a trained workforce for the offshore wind industry and contributing to beneficial local and regional economic activity. Moreover, port improvements would support and enhance other port activities. These beneficial impacts to local employment and economic activity would range from minor to moderate.

The adverse or beneficial economic impacts of Project construction activities on other sectors in the ocean economy aside from marine construction and transportation would be temporary and negligible to minor. With respect to the ocean-related recreation and tourism sector, all construction activities would be conducted such that public recreation would not be precluded from use (see Section 3.5.8 [Recreation and Tourism]). DWSF would establish a construction schedule to minimize economic impacts to local communities during the summer tourist season. Construction and installation of the Project would have temporary minor to moderate adverse economic impacts on commercial fisheries and for-hire recreational fishing because of increased congestion in ports, reduced fishing access, damage to or loss of fishing gear, and decreased catch of target species (see Section 3.5.1 [Commercial Fisheries and For-Hire Recreational Fishing]). As described in Section 3.5.1.2.3, the largest impacts in terms of exposed revenue as a percentage of total commercial fishing revenue in the Mid-Atlantic regions would be in the ports of New Shoreham (3.4%), Little Compton (2.7%), and Tiverton (2.2%). The annual exposed revenue represents about 0.16% of the total commercial fishing revenue across the top ports in the Mid-Atlantic and New England regions that would be most exposed to potential impacts from WEA development. Section 3.5.1.2.3 notes that revenue exposure estimates should not be interpreted as measures of actual economic impact. The actual economic impact would depend on many factors, including the potential for fishing vessel operators to find suitable alternative fishing locations and continue to earn revenue.

Project construction would have a negligible impact on population-related variables such as availability of housing and demand for public infrastructure and services. Workers involved in offshore installation of WTGs, the OSS, the inter-array cable, and the offshore SFEC would all be housed on-board vessels and would be expected to work for several weeks at sea before returning to shore. These conditions imply that offshore crews would have little incentive to relocate to a port city. In ports selected for fabrication and assembly, non-local workers would need temporary housing, but local hiring practices by DWSF contractors for these jobs could mitigate temporary, local increases in demand for housing and public infrastructure and services.

The Project would have a temporary and minor beneficial impact on the local supply chain for offshore wind farm components. Because of the specialized nature of many offshore wind components, a single project is unexpected to spur major investment in manufacturing facilities.

Operations and Maintenance

O&M occupations would consist of wind technicians, plant managers, water transportation workers, and engineers. Section 3.2.1.5 of the COP states the O&M activities would be based in either Quonset Point in North Kingstown, Rhode Island, or in Montauk/East Hampton, New York. As summarized in Table F-7 in Appendix F, results from the Jobs and Economic Development Impacts Offshore Wind Model indicate that local operating expenditures (OpEx) and employment resulting from the Project would create an estimated 49 to 98 FTE jobs annually along with $4 million to $8 million in local annual income. If it is assumed that as many as 50 of the OpEx-related jobs are located in Suffolk County, New York, they would represent less than 0.01% of total employment in the county. Similarly, if 50 of the OpEx-related jobs were located in Quonset Point, they would represent less than 0.08% of the total employment in Washington County, Rhode Island. Thus, the impacts of OpEx employment and income would be beneficial and long term but minor.

In addition to local employment and income, BOEM estimates that the SFWF would provide the U.S. Treasury an annual operating fee of approximately $432,000 (Stillings 2019). The actual value of the fee would depend on various factors, such as annual average wholesale electric power price and the wind farm's capacity factor.

The economic impacts of Project O&M activities on sectors in the ocean economy are expected to be long term but negligible to minor. Economic benefits to ports would be minor, as port use would be limited to vessel traffic associated with routine Project O&M. Operation of onshore Project components would have negligible adverse economic impacts to the ocean-related recreation and tourism sector because onshore maintenance requirements are infrequent (see Section 3.5.8 [Recreation and Tourism]). It is anticipated that ocean beaches could experience a temporary increase in curiosity visits as well as a decrease in visits from users who do not appreciate seeing the WTGs while recreating. All adverse economic impacts to commercial fisheries and for-hire recreational fishing during Project O&M would be minor to moderate (see Section 3.5.1 [Commercial Fisheries and For-Hire Recreational Fishing]). As described in Section 3.5.1.2.3, the largest impacts in terms of exposed revenue as a percentage of total commercial fishing revenue in the Mid-Atlantic regions would be in the ports of Little Compton (1.3%) and Westport (0.8%). The annual exposed revenue represents about 0.02% of the total commercial fishing revenue across the top ports in the Mid-Atlantic and New England regions that would be most exposed to potential impacts from WEA development. Section 3.5.1.2.3 notes that revenue exposure estimates should not be interpreted as measures of actual economic impact. The actual economic impact would depend on many factors, including the potential for continued fishing to occur in the SFWF and for fishing vessel operators to find suitable alternative fishing locations. The "reef effect" of WTG foundations and associated scour protection would have minor to moderate beneficial economic impacts to for-hire recreational fishing, depending on the extent to which the foundations attract targeted species.

Conceptual Decommissioning

As with the Project CapEx, expenditures and employment for conceptual decommissioning of the offshore infrastructure—estimated to take an additional 2 years to complete after the 25-year Project duration—are not expected to substantially change the existing trends of employment and economic activity in the region. As described in Appendix F, conceptual decommissioning costs are expected to range from $111.5 to $134.1 million (see Appendix F for assumptions and data source). Because these costs are primarily labor and contracting costs, a relatively high percentage of these expenditures would accrue to local economies. Thus, conceptual decommissioning would have a temporary, minor beneficial impact on employment and income in the analysis area.

Conceptual decommissioning of the SFWF and offshore SFEC would have similar impacts on commercial fisheries and for-hire recreational fishing as construction. Removal of structures that act as artificial reefs would result in loss of any beneficial fishing impacts that could have occurred during O&M.

Cumulative Impacts

Energy generation: BOEM anticipates that the Proposed Action would result in minor beneficial incremental impacts on demographics, employment, and economics due to new hiring and economic activity. Offshore wind development would provide a regional market and ongoing demand for workers skilled in the professions and trades needed for construction, installation, maintenance, and repair of offshore wind facilities. Construction activities related to future offshore wind projects are expected to create an average of 11,668 FTE jobs from 2020 through 2030, including direct, indirect, and induced jobs. It is estimated that the Project would account for approximately 1% of those jobs. By 2030, O&M activities related to future offshore wind projects are expected to create on average approximately 6,515 annual FTE jobs if direct, indirect, and induced jobs are included, with the Project accounting for about 1.25% of those jobs. Therefore, when considered in combination with past, present, and other reasonably foreseeable projects, the Project would have long-term minor beneficial impacts for demographics, employment, and economics.

Port utilization and traffic: Port upgrades and vessel activity associated with the Proposed Action could result in minor beneficial and minor adverse incremental impacts through an increase in economic and employment opportunities, as well as reduced port access, increased delays and congestion, or increased collision risk. Where existing ports are improved and channels are dredged for use in support of offshore wind, additional shore-based and marine workers would be hired, resulting in a trained workforce for the offshore wind industry and contributing to beneficial local and regional economic activity. Therefore, when considered in combination with past, present, and other reasonably foreseeable projects, the Project would have temporary minor adverse impacts and long-term, minor beneficial impacts for demographics, employment, and economics.

Land disturbance, presence of structures, new cable emplacement/maintenance, light, noise: The Proposed Action would contribute negligible to minor incremental onshore and offshore impacts, including new structures, lighting, and noise sources, to the No Action alternative. The effects of these actions are addressed in other EIS sections. Analysis of structure impacts to commercial and for-hire recreation fishing and navigation are provided in Sections 3.5.1.2.3 (Proposed Action Alternative) and 3.5.6.2.3 (Proposed Action Alternative). Analysis of noise impacts to fish populations, which could indirectly affect fishing-related economic activity, is described in 3.4.2.2.3 (Proposed Action Alternative). Lighting, noise, and structure impacts to recreation and tourism are described in Section 3.5.8.2.3 (Proposed Action Alternative). Overall, effects from these IPFs would be limited in duration and magnitude. Therefore, the Proposed Action when combined with other past, present, and reasonably foreseeable activities would also result in negligible to minor adverse impacts to demographics, employment, and economics.

Conclusions

Project construction and installation and conceptual decommissioning would generate new revenue and jobs to the regional economy. Economic benefits from Project O&M would be much lower than those produced during construction and conceptual decommissioning, but could also result in limited employment and income. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible to minor** adverse and **minor beneficial** to **moderate beneficial**. Therefore, BOEM expects the overall impact on demographics, employment, and economics from the Proposed Action alone to be **minor beneficial** because the effect that would occur would be small.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor** and **minor 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 adverse** and **minor beneficial** impacts to demographics, employment, and economics. BOEM made this call as the effect would be small.

3.5.3.2.4 VESSEL TRANSIT LANE ALTERNATIVE

Under the Transit alternative, the Project would have slightly smaller beneficial economic impacts during the Project construction phase because elimination of turbines would result in lower construction expenditures and employment.

During Project O&M, the Transit alternative would also have less of an adverse economic impact on commercial fisheries relative to the Proposed Action due to the lower navigation complexity of the Transit alternative. All other construction and installation, O&M, and conceptual decommissioning impacts on demographics, employment, and economics would be similar to the Proposed Action: negligible to minor adverse and minor beneficial to moderate beneficial.

Cumulative Impacts

The Transit alternative would contribute less to beneficial economic impacts due to fewer construction-related jobs. This alternative would also contribute fewer adverse impacts for commercial fisheries, due to a reduced number of WTGs. However, as noted above, the Transit alternative would otherwise result in incremental impacts to demographics, employment, and economics at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the cumulative impacts to demographics, employment, and economics would be similar to the Proposed Action: negligible to minor and minor beneficial.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible to minor** adverse and **minor beneficial** to **moderate beneficial**.

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

3.5.3.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Under the Habitat alternative, several of the proposed or alternative WTGs would be eliminated. Consequently, this alternative would have slightly smaller beneficial economic impacts during the Project construction phase as compared to the Proposed Action because elimination of turbines would result in lower construction expenditures and employment. All other impacts on demographics, employment, and economics in the analysis area would be similar to the Proposed Action. Therefore, impacts would not be measurably different than under the Proposed Action: negligible to minor adverse and minor beneficial to moderate beneficial.

Cumulative Impacts

It is presumed that the Habitat alternative would reduce the total number of WTGs, which would result in a marginal reduction in construction-related offshore wind farm employment. These reductions would most often be seen in the duration of employment rather than in the number of employed persons. Therefore, cumulative demographic effects would be only marginally less than the impact under the Proposed Action (i.e., negligible to minor and minor beneficial).

Conclusions

Although the Habitat alternative 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 the alternative alone would be similar to the Proposed Action and range from **negligible to minor** adverse and **minor beneficial** to **moderate beneficial**.

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

3.5.3.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that demographics, employment, and economic impacts would range from **negligible to minor** adverse and **minor beneficial** to **moderate beneficial**. for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor** and **minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor** adverse and **minor beneficial**.

3.5.3.4 Mitigation

No potential additional mitigation measures for demographics, employment, and economics are identified in Appendix G.

3.5.4 Environmental Justice

3.5.4.1 Affected Environment

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, Native American tribes, and indigenous peoples (EPA 2019)."[19] Table 3.5.4-1 describes the minority and low-income characteristics of the 5-km zone around each affected port or landing site and of the corresponding county and state. The minority and low-income characteristics of possible ports supporting Project activities that are also major fishing ports as measured by commercial fishing revenue (see Section 3.5.1) are shown in their own section of the table.

Within the analysis area, 5-km zones around support ports or landing sites were identified as areas of potential environmental justice concern if 1) the minority population exceeds 50% or 2) the minority or low-income population is meaningfully greater than the minority or low-income population percentage in a reference population. For the purposes of this analysis, the reference population is the population of the county or state in which a 5-km zone is located. Appendix F describes the methodology used to calculate whether a minority or low-income population is meaningfully greater than the reference population. Minority and low-income populations were identified using EPA's EJSCREEN tool (EPA 2020b). Within that tool, minority status determination is based on identifying individuals who are non-white or who are white but have Hispanic ethnicity; low-income status determination is based on identifying individuals for whom the ratio of household income to the poverty level in the previous 12 months was less than 2.

Table 3.5.4-2 shows the census block groups in the 5-km zones of the analysis area that are areas of potential environmental justice concern according to the above definition. Of the estimated 533 census block groups in the analysis area, approximately 41% were determined to be areas of potential environmental justice concern because of the concentrations of minority populations, whereas approximately 40% had concentrations of low-income populations. Three of the ports (New Bedford, Providence, and New London) accounted for 90% of the minority census blocks and 85% of the low-income census blocks. Appendix F provides maps (Figures F-1 through F-6) showing the locations of these census block groups.

With respect to tribal and indigenous peoples, the sea and fish have served the important role of sustaining Native American life on Long Island for many millenniums, providing sustenance as well as a base for cultural identity (On This Site 2020). Prior BOEM consultation with Native American tribes in adjacent lease areas to the Project have confirmed significant cultural associations with fishing, shellfish beds, and sea mammal harvesting (BOEM 2020). The connection of Native American tribes to marine fisheries at the current project areas in pre-colonial and post-colonial times is well established (cf. Chaves 2014; Trigger 1978).

[19] The term *indigenous peoples* includes state-recognized tribes; indigenous and tribal community-based organizations; individual members of federally recognized tribes, including those living on a different reservation or living outside Native American country; individual members of state-recognized tribes; Native Hawaiians; Native Pacific Islanders; and individual Native Americans (EPA 2020a).

Table 3.5.4-1. Minority and Low-Income Characteristics of the Ports and Landing Sites in the Analysis Area

Port or Landing Site	City/Town	County, State	Population in 5-Km Zone	County			State		
				Total Population	Minority %	Low-Income %	Total Population (millions)	Minority %	Low-Income %
Potential Ports Supporting Project Activities									
Shinnecock Fishing Dock	Southampton	Suffolk, NY	9,321	1,497,595	32%	18%	19.80	44%	31%
Greenport Harbor	Southold	Suffolk, NY	11,189	1,497,595	32%	18%	19.80	44%	31%
Providence	Providence	Providence, RI	246,748	633,704	38%	35%	1.06	27%	29%
Port of Davisville/ Quonset Point	North Kingstown	Washington, RI	19,666	126,190	9%	21%	1.06	27%	29%
Old Harbor/ New Harbor	New Shoreham	Washington, RI	830	126,190	9%	21%	1.06	27%	29%
Paulsboro Marine Terminal	Paulsboro	Gloucester, NJ	26,457	291,372	21%	18%	8.96	44%	24%
Sparrows Point	Sparrows Point	Baltimore, MD	40,505	828,637	41%	23%	6.00	48%	23%
Norfolk International Terminals	Norfolk City	Norfolk City, VA	41,025	245,752	56%	41%	8.37	37%	26%
Potential Ports Supporting Project Activities That Are Also Major Fishing Ports									
Montauk*	East Hampton	Suffolk, NY	3,662	1,497,595	32%	18%	19.80	44%	31%
New London	New London	New London, CT	74,074	270,772	24%	24%	3.59	32%	23%
Narragansett/ Point Judith	Narragansett	Washington, RI	10,310	126,190	9%	21%	1.06	27%	29%
New Bedford	New Bedford	Bristol, MA	123,333	557,016	17%	27%	6.79	27%	24%
Onshore Areas Potentially Affected as Landing Sites, Onshore Substation, and Cable Routes									
Hither Hills*	East Hampton	Suffolk, NY	18,796	1,497,595	32%	18%	19.80	44%	31%
Beach Lane†	East Hampton	Suffolk, NY	15,910	1,497,595	32%	18%	19.80	44%	31%

Source: EPA (2020b).

Note: CT = Connecticut, MA = Massachusetts, MD = Maryland, NJ = New Jersey, NY = New York, RI = Rhode Island, VA = Virginia.

* Three of the five census block groups included in the zone around Montauk are also included in the zone around Hither Hills, whereas 15 of the 22 census block groups in the zone around Hither Hills are also included in the zone around Beach Lane.

† Fifteen of the 20 census block groups in the zone around Beach Lane are also included in the zone around Hither Hills.

Table 3.5.4-2. Census Block Groups in the Analysis Area that are Areas of Potential Environmental Justice Concern

Port or Landing Site	County, State	Number of Block Groups in 5-Km Zone	Census Block Groups with Minority Populations That Exceed 50% or That Have Meaningfully Greater Percentages of Minority Populations			Census Block Groups That Have Meaningfully Greater Percentages of Low-Income Populations		
			Number of Block Groups	Percentage of Block Groups	Total Population in Block Groups	Number of Block Groups	Percentage of Block Groups	Total Population in Block Groups
Potential Ports Supporting Project Activities								
Shinnecock Fishing Dock	Suffolk, NY	12	0	0%	0	1	8%	1,311
Greenport Harbor	Suffolk, NY	12	1	8%	1,212	3	25%	3,248
Port of Providence	Providence, RI	214	125	58%	150,602	105	49%	131,249
Port of Davisville/Quonset Point	Washington, RI	17	2	12%	2,651	2	12%	2,651
Old Harbor/New Harbor	Washington, RI	2	0	0%	0	0	0%	0
Paulsboro Marine Terminal	Gloucester, NJ	22	3	14%	1,740	5	23%	4,669
Sparrows Point	Baltimore, MD	33	3	9%	2,949	10	30%	14,324
Norfolk International Terminal	Norfolk City, VA	19	8	42%	10,246	8	42%	28,306
Potential Ports Supporting Project Activities That Are Also Major Fishing Ports								
Montauk	Suffolk, NY	6	0	0%	0	0	0%	0
New London	New London, CT	51	20	39%	29,347	18	35%	26,848
Narragansett/Point Judith	Washington, RI	10	1	10%	1,507	3	30%	2,691
New Bedford	Bristol, MA	111	52	47%	54,928	58	52%	59,936
Onshore Areas Potentially Affected as Landing Sites, Onshore Substation, and Cable Routes								
Hither Hills to Substation	East Hampton, NY	22	2	9.1%	2,732	1	4.5%	498
Beach Lane to Substation	East Hampton, NY	20	3	15.0%	3,170	1	5.0%	498

Source: EPA (2020b).

Note: CT = Connecticut, MA = Massachusetts, MD = Maryland, NJ = New Jersey, NY = New York, RI = Rhode Island, VA = Virginia.

3.5.4.2 Environmental Consequences

3.5.4.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.4-3 lists the issues identified for environmental justice and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.5.4-3. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Environmental Justice

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Potential public health and safety impacts</td><td>Qualitative assessment of impacts to minority and low-income populations from Project impacts that could affect public health and safety, including air quality, water quality, noise, and land use impacts</td><td rowspan="3">Negligible: No measurable impacts would occur.
Minor to moderate: Adverse impacts to the affected environmental justice population could be avoided with EPMs or would be unavoidable but not disproportionately high and adverse.
Major: The affected environmental justice population would experience disproportionately high and adverse effects due to 1) impacts on the natural or physical environment; 2) impacts that appreciably exceed or are expected to appreciably exceed those on the general population or other appropriate comparison group; or 3) impacts that occur or would occur in a minority or low-income population, or Native American tribe affected by cumulative or multiple adverse exposures from environmental hazards</td></tr>
<tr><td>Potential job and income losses due to disruption of commercial fisheries or for-hire recreational fishing[*]</td><td>Qualitative assessment of economic impacts to minority and low-income populations due to Project impacts to commercial fisheries and for-hire recreational fishing</td></tr>
<tr><td>Potential underrepresentation of minority or low-income populations in the public participation process</td><td>Not applicable
See discussion of public outreach effort in Appendix A.</td></tr>
</table>

[*] This analysis does not assess economic impacts to minority or low-income populations that could occur as a result of employment and income changes in economic sectors other than the commercial fishing and for-hire recreational fishing industries. As discussed in Section 3.5.3 (Demographics, Employment, and Economics), Project impacts to these other sectors would be largely beneficial, as the Project would support new employment and economic activity. Moreover, Project-related employment and income benefits are expected to be no greater for minority or low-income populations than those experienced by non-minority or non-low-income members of the general population who also reside in the analysis area.

3.5.4.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing environmental justice populations and trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated environmental justice impacts. Future non-Project actions include onshore development or underwater improvements such as dredging in New York, Connecticut, Rhode Island, and Massachusetts, to support the offshore wind industry, as well as offshore wind development and other marine uses. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated environmental justice impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Air emissions and noise: To the extent that ongoing and future onshore and offshore activities result in an increase in air or noise pollution in the analysis area, environmental justice populations could experience adverse environmental and health effects. Future population growth in parts of the analysis area would increase air emissions from motor vehicles, and new onshore development may include emissions-producing industries. See Section 3.3.1 (Air Quality) for additional details. However, a portion of these estimated emissions would not occur near environmental justice populations. In addition, onshore and offshore development would comply with all regulatory requirements for air quality protection.

Therefore, environmental justice populations in the analysis area are expected to experience long-term but minor adverse air quality impacts as a result of ongoing and future non-offshore wind activities. During operations, future offshore wind energy projects would help to reduce air emissions in the analysis area. Minority and low-income populations in the United States may be at increased risk for exposure to, and health effects of, fine particulate matter air pollution from fossil fuel–fired power plants (Thind et al. 2019). Therefore, the air quality improvements from offshore wind energy development would have a long-term beneficial impact on environmental justice populations, although the impact would likely be negligible.

Noise pollution levels in the analysis area could also increase as a result of ongoing and future onshore and offshore activities. See Section 3.5.5 (Land Use and Coastal Infrastructure) for additional onshore details.

Noise impacts could be long term, but they are expected to be minor. State and local agencies would be responsible for managing actions to minimize and avoid noise impacts on nearby neighborhoods. Moreover, the noise impacts to environmental justice populations are not expected to be greater than those experienced by non–environmental justice populations who also reside in the analysis area.

Some of the ports (e.g., New Bedford and Providence) that could be used to support future onshore and offshore development in the analysis area have a relatively high proportion of census block groups determined to be areas of potential environmental justice concern. While the adverse air quality and noise impacts to environmental justice populations from port utilization and expansion could be long term, they are expected to be negligible to minor.

<u>Accidental releases and discharges</u>: Ongoing and future onshore and offshore activities would affect water quality via increased potential turbidity and sedimentation and accidental spills. See Section 3.3.2 (Water Quality) for additional details. However, onshore and offshore development would comply with all regulatory requirements for water quality protection. Therefore, environmental justice populations in the analysis area are expected to experience long-term, but minor adverse water quality impacts as a result of ongoing and future onshore and offshore activities.

<u>Land disturbance, port utilization, presence of structures, new cable emplacement/maintenance, light, traffic</u>: Ongoing and future onshore and offshore activities resulting in temporary to long-term increases in land disturbance, vessel traffic, lighting, and in-water structures and cables could affect low-income or minority individuals. Analysis of habitat, structure, vessel traffic, and cable impacts to commercial fisheries and for-hire recreational fishing and navigation are provided in Sections 3.5.1.2.2 and 3.5.6.2.2, respectively. Air quality and noise impacts associated with port expansion are addressed above. Onshore and offshore lighting, noise, and structure impacts to recreation and tourism as described in Section 3.5.8.2.2 could also result in declines in the economic performance of for-hire recreational fisheries that would adversely affect members of environmental justice populations. Many lower level workers in the commercial fishing industry, such as factory floor seafood processor workers and fishing vessel deckhands, are members of minority and/or low-income groups (National Guestworker Alliance 2016). To the extent that the impacts of ongoing and future onshore and offshore activities result in declines in the economic performance of commercial and for-hire recreational fisheries, members of environmental justice populations could be disproportionately affected, especially if employment in the seafood processing industry declines. However, financial compensation policies implemented by offshore wind developers, together with the ability of fishing vessel operators to adjust transit and fishing locations to avoid conflicts with construction and O&M activities related to offshore wind energy development, would help ensure that fishing businesses could continue to operate with minimal disruption. Therefore, adverse impacts to minority and low-income populations engaged in commercial fisheries and for-hire recreational fishing would be minor to moderate.

In addition, the temporary to long-term adverse impacts of ongoing and future onshore and offshore activities on recreational fisheries could impact low-income residents who disproportionately rely on these fisheries as a food source. Similarly, ongoing and future onshore and offshore activities could have adverse impacts on the subsistence fisheries of tribal and indigenous peoples in the analysis area. Most recreational fishing in the analysis area occurs close to shore (see Section 3.5.8 [Recreation and Tourism]). In addition, historically, much of the fishing by the region's tribal and indigenous peoples was concentrated in the nearshore marine and estuarine environment (Bennett 1955). Recent BOEM consultation with Native American tribes in adjacent lease areas to the Project indicate that tribal subsistence fisheries continue to occur predominately in inshore areas (BOEM 2020). Consequently, future development occurring further offshore, such as offshore wind projects, are expected to have a negligible to minor impact on the recreational and subsistence fishing activities of environmental justice populations.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on environmental justice populations associated with the Project would not occur. However, ongoing and future activities would have temporary to long-term impacts on environmental justice populations, primarily through public health and safety impacts associated with air emissions, noise, and water quality changes, as well as through potential job and income losses due to disruption of commercial fisheries or for-hire recreational fishing.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts to environmental justice populations because the overall effect would be somewhat disruptive.

3.5.4.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Environmental justice impacts in the DEIS are based on adverse impacts that would occur to air quality, water quality, land use and coastal infrastructure, and commercial fisheries and for-hire recreational fishing that are disproportionately borne by environmental justice populations. Adverse impacts to air quality during Project construction were characterized as minor to moderate, regional in extent, and short term (see Section 3.3.1 Air Quality). Similarly, no major adverse impacts to water quality identified during Project construction, with the potential exception of a fuel or oil spill (see Section 3.3.2 [Water Quality]). These potential spills could occur in or near concentrations of minority or low-income populations in East Hampton, New York (Figures F-1 and F-3); however, Table G-1 in Appendix G includes EPMs to avoid or minimize potential spill impacts on water quality, and DWSF would develop an SPCC plan and HDD inadvertent release plan to protect nearby surface waters. With respect to air quality, state and local agencies would be responsible for minimizing and avoiding air quality impacts on nearby neighborhoods during Project construction. Therefore, potential adverse impacts to minority and low-income populations associated with changes in air or water quality as a result of Project construction would be temporary and minor to moderate and are not expected to appreciably exceed those experienced by other adjacent populations.

As described in Section 3.5.5 (Land Use and Coastal Infrastructure), land use and coastal infrastructure affected by construction of offshore Project components would include chosen port facilities. As identified in Table 3.5.4-3, concentrations of minority or low-income populations have been identified near several ports that could support Project construction. These populations could experience short-term, minor to moderate adverse effects as a result of noise, vibration, and vehicular traffic associated with construction-related port activities. Table 3.5.4-3 also shows concentrations of minority or low-income populations near the proposed landing sites and onshore SFEC routes. These populations could also experience short-term, minor to moderate adverse effects through construction noise, vibration, and dust, together with intermittent delays in travel along affected roads. DWSF would employ EPMs (see Table G-1 in Appendix G) to minimize noise and traffic impacts related to Project construction. Moreover, state and local agencies would be responsible for minimizing and avoiding noise and traffic impacts on nearby neighborhoods during Project construction. Therefore, the impacts to minority and low-income populations would be temporary and minor to moderate and not appreciably exceed those experienced by other adjacent populations.

As noted in Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing), some individual operators of commercial fishing or for-hire recreational fishing businesses could experience adverse economic impacts during Project construction as a result of increased port congestion, reduced fishing access, damage to or loss of fishing gear, and decreases in target species' abundance or availability. These impacts would be temporary and minor, but it is conceivable that lower level workers engaged in commercial fisheries and for-hire recreational fishing, such as fishing vessel deckhands and factory floor seafood processor workers, would be more vulnerable to job or income losses should Project construction disrupt fishing activities. As described in Section 3.5.4.2.2 (No Action Alternative), many of these lower level workers are members of minority and/or low-income groups. However, DWSF's communication plans with the fishing industry and its financial compensation program for damage to or loss of fishing gear, together with the ability of many fishing vessel operators to adjust transit and fishing locations to avoid conflicts with construction activities, would help ensure that fishing businesses could continue to operate with minimal disruption. Therefore, adverse impacts to minority and low-income individuals engaged in commercial fisheries and for-hire recreational fishing would be temporary and minor to moderate during Project construction. Although members of environmental justice populations for whom recreational and subsistence fisheries are an important food source generally fish close to shore and are not likely to travel and fish within the SFWF, they could temporarily lose access to fishing areas on the shoreline or close to shore during construction of the offshore SFEC and the Project's onshore components. These temporary, localized impacts on environmental justice populations would be minor. If the O&M facility is located in the Port of Montauk, initial construction dredging would occur, but only within a previously dredged footprint The impact of this dredging on invertebrate and fish populations would be negligible (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). Therefore, potential adverse impacts to environmental justice populations from reduced recreational and subsistence fishing opportunities caused by dredging are considered negligible.

Operations and Maintenance and Conceptual Decommissioning

As described in the respective resource analysis sections, adverse impacts to air quality, water quality, and land use and coastal infrastructure during Project O&M would be negligible to minor. The impacts to minority or low-income populations are not expected to appreciably exceed those experienced by other adjacent populations.

As noted in Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing), some individual operators of commercial fishing or for-hire recreational fishing businesses could experience long-term, minor to moderate adverse economic impacts during Project O&M as a result of reduced fishing access, damage to or loss of fishing gear, and decreases in target species abundance or availability. It is conceivable that lower level workers engaged in commercial fisheries and for-hire recreational fishing, such as fishing vessel deckhands and factory floor seafood processor workers, would be more vulnerable to job or income losses should Project O&M disrupt fishing activities. As described in Section 3.5.4.2.2 (No Action Alternative), many of these lower level workers are members of minority and/or low-income populations. However, DWSF's communication plans with the fishing industry and its financial compensation program for damage to or loss of fishing gear, together with the ability of many fishing vessel operators to adjust transit and fishing locations to avoid conflicts with operation activities, would help ensure that fishing businesses could continue to operate with minimal disruption. Therefore, adverse impacts to minority and low-income populations engaged in commercial fisheries and for-hire recreational fishing would be long term and minor to moderate during Project O&M.

As previously noted, members of environmental justice populations for whom recreational and subsistence fisheries are an important food source generally fish close to shore and are not likely to travel and fish within the SFWF. Therefore, adverse impacts to these individuals during Project O&M would be long term but negligible to minor. If the O&M facility is located in the Port of Montauk, maintenance dredging would occur, but only within a previously dredged footprint. The impact of this dredging on invertebrate and fish populations would be negligible (see Section 3.4.2 [Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish]). Therefore, potential adverse impacts to environmental justice populations from reduced recreational and subsistence fishing opportunities caused by dredging are considered negligible.

Conceptual decommissioning of the SFWF and offshore SFEC would have similar impacts on minority and low-income populations as impacts from construction.

Cumulative Impacts

<u>Air emissions and noise</u>: The Proposed Action would increase exposure to noise and air pollution by environmental justice populations beyond conditions under the No Action alternative. This would be a negligible incremental impact and would cease when construction is complete. As noted in Section 3.5.4.2.2, to the extent that increases in air or noise pollution occur as a result of ongoing and future onshore and offshore activities, environmental justice communities or individuals could experience adverse environmental and health effects. State and local agencies would also be responsible for minimizing and avoiding noise and air quality impacts on nearby neighborhoods. In addition, future offshore wind energy project operations would help to reduce air emissions in the analysis area. Therefore, when combined with past, present, and other reasonably foreseeable projects, the Project would have negligible to minor adverse impacts on environmental justice populations.

<u>Accidental releases and discharges</u>: The Proposed Action could potentially increase water impacts to environmental justice populations. However, it is expected that onshore and offshore development, including the Proposed Action, would comply with all regulatory requirements for water quality protection. Therefore, when combined with past, present, and other reasonably foreseeable projects, the Project would have negligible to minor adverse water quality impacts on environmental justice populations.

<u>Land disturbance, presence of structures, new cable emplacement/maintenance, light, traffic, and port utilization</u>: The Proposed Action would contribute negligible to moderate incremental onshore and offshore impacts, including new structures and cables, lighting, and vessel traffic, to conditions under the No Action alternative. The effects of these actions are addressed in other DEIS sections. Analysis of structure impacts to commercial and for-hire recreation fishing and navigation is provided in Sections 3.5.1.2.3 (Proposed Action Alternative) and 3.5.6.2.3 (Proposed Action Alternative), respectively. Lighting, noise, and structure impacts to recreation and tourism are described in Section 3.5.8.2.3

(Proposed Action Alternative). Air quality and noise impacts associated with port expansion are addressed above. To the extent that these Project impacts, together with the impacts of ongoing and other future onshore and offshore activities, result in declines in the economic performance of commercial and for-hire recreational fisheries, members of environmental justice populations could be disproportionately affected, especially if employment in the seafood processing industry declines. However, financial compensation policies implemented by offshore wind developers, together with the ability of some fishing vessel operators to adjust transit and fishing locations to avoid conflicts with construction and O&M activities related to offshore wind energy development, would help ensure that fishing businesses could continue to operate with minimal disruption. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would also result in minor to moderate incremental adverse impacts to environmental justice populations.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would impact air quality, water quality, land use and coastal infrastructure, and commercial and for-hire recreational fisheries that can be disproportionately borne by minority or low-income populations. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**. However, BOEM expects the overall impact on environmental justice populations from the Proposed Action alone to be **moderate**.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental adverse impacts to environmental justice populations under the Proposed Action resulting from individual IPFs would range from **negligible to moderate**. 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 **moderate adverse** impacts to low income and minority individuals. BOEM made this call because the overall effect to environmental justice populations would be somewhat disruptive.

3.5.4.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative could result in decreased impacts to air and water quality and reduced noise levels in the analysis area during Project construction if less trenching, vessel traffic, or time is needed to install a reduced number of WTGs and their associated inter-array cables. Overall, however, the work areas and construction timing windows for the SFWF and offshore SFEC would be similar to those of the Proposed Action. Moreover, the reduction in the number of WTGs under this alternative is not expected to affect the selection of port facilities that would support construction. Therefore, the construction phase of this alternative would result in short-term, minor to moderate adverse impacts on air and water quality and noise levels. The same environmental justice populations identified under the Proposed Action would be affected, and the level of adverse impacts on air and water quality and noise levels experienced by these populations during the O&M phase of this alternative would also not be measurably different than under the Proposed Action.

As discussed in Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing), the establishment of a vessel transit lane could simplify navigation through the SFWF and potentially reduce conflicts between the Project and businesses involved in commercial fisheries and for-hire recreational fishing. Therefore, the Transit alternative would have a lower adverse impact on members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing, albeit still expected to be minor to moderate.

Cumulative Impacts

The Transit alternative would incrementally add sources of air, water quality, and noise pollution at quantities and durations similar to, or slightly reduced from, the Proposed Action. Offshore, the Transit alternative would have a lower adverse impact on members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing. However, because the cumulative impacts to commercial fisheries and for-hire recreational fishing due to climate change and the presence of structures would not be measurably different under the Transit alternative and the Proposed Action, members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing could still result experience adverse impacts. Therefore, the overall cumulative impacts of this alternative to environmental justice populations when combined with past, present, and reasonably foreseeable activities would be minor to moderate.

Conclusions

Although the Transit alternative 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 adverse impacts to environmental justice populations resulting from the alternative alone would be similar to the Proposed Action and range from **minor** to **moderate**.

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

3.5.4.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative could result in decreased impacts to air and water quality and reduced noise levels in the analysis area during Project construction if less trenching, vessel traffic, or time is needed to install a reduced number of WTGs and their associated inter-array cables. However, the reduction in the number of WTGs under this alternative is not expected to affect the selection of port facilities that would support construction. Therefore, the construction and installation phase of this alternative would be similar to the Proposed Action and result in the short-term, minor adverse impacts on air and water quality and noise levels.

As discussed in Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing), the exclusion of WTG sites to reduce impacts to complex fisheries habitats could simplify navigation through the SFWF and potentially reduce conflicts between the Project and businesses involved in commercial fisheries and for-hire recreational fishing. Therefore, the Habitat alternative would have a lower adverse impact on members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing, albeit still expected to be minor to moderate.

Cumulative Impacts

The Habitat alternative would incrementally add sources of air, water quality, and noise pollution at quantities and durations similar to, or slightly reduced from, the Proposed Action. Offshore, the Habitat alternative would have a lower adverse impact on members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing. However, because the cumulative impacts to commercial fisheries and for-hire recreational fishing due to climate change and the presence of structures would not be measurably different under the Habitat alternative and the Proposed Action, the cumulative impacts to members of minority and/or low-income populations who are employed in commercial fisheries and for-hire recreational fishing could still experience adverse impacts. Therefore, the overall cumulative impacts of this alternative to environmental justice populations when combined with past, present, and reasonably foreseeable activities would be minor to moderate.

Conclusions

Although the Habitat alternative 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 to environmental justice populations resulting from the alternative alone would be similar to the Proposed Action and range from **minor** to **moderate**.

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

3.5.4.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that environmental justice impacts would range from **minor** to **moderate** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact to environmental justice populations of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.5.4.4 Mitigation

No potential additional mitigation measures for environmental justice are identified in Appendix G.

3.5.5 Land Use and Coastal Infrastructure

3.5.5.1 Affected Environment

The Town of East Hampton, one of the 10 towns in Suffolk County, on the south shore of Long Island, is bordered on the south by the Atlantic Ocean, on the north by Gardiner's Bay and Block Island Sound, and on the west by the Town of Southampton. With the exception of Shelter Island, East Hampton is the least populous of the Suffolk County towns (Suffolk County Department of Planning 2011).

East Hampton is characterized by unique hamlets, villages, and countryside; includes world-renowned beaches; and supports one of the highest concentrations of rare and endangered species in New York State (Liquori and Nagle 2005). The incorporated Village of East Hampton and a portion of the incorporated Village of Sag Harbor, as well the hamlets of Amagansett, Montauk, Springs, and Wainscott, lie within the borders of East Hampton (RKG Associates, Inc. 2017). Town land use, as a whole, largely comprises small areas of low-density residential enclaves separated by large blocks of open space; limited areas of commercial, industrial, and institutional land uses occur adjacent to area roadways (Dodson and Flinker et al. 2017). Approximately 45% of East Hampton's land area is in residential land use, with more than half of the residential acreage designated as low density. Protected open space makes up the second highest percentage of land use (31%), and vacant land the third (15%) (Liquori and Nagle 2005). A number of harbors and inlets are along the north shore: Northwest Creek, Three Mile Harbor, Accabonac Harbor, Napeague Harbor, Northwest Harbor, Hog Creek, and Lake Montauk (Dodson and Flinker 2017).

The Project considers two landing sites (see Figure 3.2-3 in the COP). The proposed Beach Lane landing site is located on a Town of East Hampton public road that provides public access to the wide, straight Atlantic beach that fronts the town from the hamlet of Wainscott on the west to the easterly end of the hamlet of Montauk on the east. The public access includes parking along Beach Lane at the terminus of the roadway; the beach access is undeveloped and does not provide restroom or picnic amenities. The landing site is proposed to occur landward of the Beach Lane public parking area and is flanked by residentially developed land to the west and open farmland to the east.

The Hither Hills landing site is located in the hamlet of Montauk in the Town of East Hampton, immediately south of the Montauk Highway in a parking lot that is part of Hither Hills State Park. The parking lot includes three Americans with Disabilities Act parking spaces and parking for 54 additional vehicles. The lot provides trail access to the park's North Trail as well as trail access to the beach, restrooms, the Hither Hills General Store, and nearby beach campgrounds (New York State Office of Parks, Recreation and Historic Preservation 2019).

From the landing sites, installation of the onshore SFEC would occur entirely underground, with access points at strategic locations via manholes for safety and ease of maintenance (Jacobs 2020). Figures 4.6-7 and 4.6-8 in the COP show land uses adjacent to the Beach Lane and Hither Hills SFEC routes.

The interconnection facility for the Project would be located adjacent to the existing East Hampton 69-kV LIPA substation on 2.4 acres of the same parcel that houses the existing substation. The existing substation parcel is zoned for commercial industrial use and the portion of the parcel proposed for the interconnection facility is currently wooded. The interconnection facility site would include all equipment necessary to safely connect the SFEC with the NYISO transmission system (see Figure 3.2-4 of the COP).

In addition to the landing sites and interconnection facility, the Project would use various ports for construction and installation as well as for O&M. DWSF has proposed an O&M facility to be located onshore in an existing port either in Montauk, East Hampton, or in Quonset Point, North Kingstown, Rhode Island.

Montauk Harbor supports the largest commercial fishing port in New York State, both in terms of the landed value of fish and the number of fishing vessels. The harbor is also an estuary supporting populations of fish and wildlife (Liquori and Nagle 2005). The Montauk dock area is a major commercial and industrial center with restaurants and shops alongside a working waterfront with zoning that supports these uses. Land uses are consistent with zoning, including a marina, boatyards, fish processing, a ferry terminal, restaurants, and some retail (Dodson and Flinker 2017). The ferry terminal provides summer service to Block Island, Martha's Vineyard, and New London, Connecticut. The USCG operates a station on Star Island in Montauk Harbor, which serves as a search and rescue and law enforcement unit. Montauk Airport is on the east side of the harbor.

Quonset Point, a port located in the town of North Kingstown, Rhode Island, is a former naval air station that is now a thriving, modern industrial park (Interface Studio 2016). 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 provide opportunities for new industries (Maguire Group, Inc. 2008).

Port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, and/or Virginia would support offshore installation activities for the SFWF and the offshore SFEC (see Table 3.1-5 of the COP). 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, DWSF would finalize mobilization plans and arrangements at port facilities to support Project activities, including logistic support for fabrication, as needed (Jacobs 2020). See Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing), Section 3.5.3 (Demographics, Employment, and Economics), and Section 3.5.8 (Recreation and Tourism) for discussions of recreational vessel and commercial fishing activity in these ports.

3.5.5.2 Environmental Consequences

3.5.5.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.5-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.5.5-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Land Use and Coastal Infrastructure

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Public health and safety</td><td>Construction- or operation-related volume increases, traffic delays, traffic re-routes, and noise
Onshore EMF</td><td rowspan="3">Negligible: No measurable/detectable change to area land use would occur.
Minor: Impacts would be detectable but would be short term and localized.
Moderate: Impacts would be detectable and broad-based, affecting a variety of land uses, but would be short term and would not result in long term change.
Major: Impacts would be detectable, long term, extensive, and result in permanent land use change.</td></tr>
<tr><td>Port improvements and operations</td><td>Changes to vehicle, vessel traffic volumes, and infrastructure demands</td></tr>
<tr><td>Land use code and zoning</td><td>Qualitative assessment of compliance with local land use regulations</td></tr>
</table>

3.5.5.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing land use and coastal infrastructure trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated land use and coastal infrastructure impacts. Future non-Project actions include inlet management; beach, dune, and berm construction; breach response plans; raising and retrofitting homes; road raising; and coastal process features, disaster cleanup and remediation, and port upgrades, including onshore development or underwater improvements such as dredging in New York, Connecticut, Rhode Island, and Massachusetts, to support the offshore wind industry. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated land use and coastal infrastructure impacts. These impacts are also described below.

Future Projects

Onshore, neighboring or adjacent land to reasonably foreseeable projects could temporarily be disturbed by future Project–related noise, vibration, and dust as well as travel delays along impacted roads. The simultaneous construction 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. For the reasons described in the following subsections, under the No Action alternative, land disturbance would have negligible to minor, short-term adverse cumulative impacts to land use and coastal infrastructure.

Accidental releases and discharges: Future offshore activities could result in accidental releases of trash or water quality contaminants (see Section 3.3.2.2.2 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.

Light: Permanent aviation warning lighting on offshore wind WTGs would be visible from south-facing beaches and coastlines. Visibility would depend upon 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 may subsequently be impacted. Lighting from substations could also affect the adjacent property use and residential development. However, new substations would 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.

Port utilization: Various ports would be improved to support future offshore wind projects (see Appendix E). These improvements would occur within the boundaries of existing port facilities or repurposed industrial 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. Therefore, ports would experience long-term, beneficial impacts such as greater economic activity and increased employment due to demand for vessel maintenance services and related supplies, vessel berthing, loading and unloading, warehousing and fabrication facilities for offshore wind components, and other business activity related to offshore wind. State and local agencies would be responsible for minimizing the potential adverse impacts of these future port expansions by managing port resources and traffic control to ensure continued access to ports and adjacent land uses.

Conclusions

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

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **minor**. As described in Appendix E Attachment3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area 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 small, localized, and short term.

3.5.5.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Land uses impacted by the construction of offshore components would include chosen port facilities used for shipping, storing, and fabricating Project components and for crew transfer, cargo logistics, and storage. DWSF would use one or more ports to offload shipments of components, prepare them for installation, and load components onto vessels for delivery and installation. Selected ports could require improvements or upgrades to meet Project needs (see Table 3.1-5 of the COP). Jacobs (2020) notes that required port upgrades could include erection of buildings (up to 350,000 square feet); reinforcement of terrestrial bearing capacity (up to 1,300,000 square feet) and changes to surface materials, reinforcement, and/or rehabilitation of quayside(s) (up to 500 feet); and installation of supporting infrastructure such as lighting, electricity, water, fencing, and/or a security booth. Such upgrades, if necessary, would be conducted by individual ports or lessees operating within the confines of ports and would not be conducted by DWSF.

BOEM (2016) analyzed potential impacts to ports that could require upgrades to accommodate offshore wind projects or that are in the process of completing upgrades in anticipation of increased port use associated with offshore wind projects. BOEM noted that land use and transportation impacts primarily include land-based space conflicts with current or planned uses of adjacent areas and land-side traffic delays or conflicts associated with construction. BOEM (2016) also identified potential water-based space conflicts with other uses of port waterways such as dredging, pile driving, and fill placement. The ports under consideration for construction staging are industrial in character, designated by local zoning and land use plans for heavy industrial activity, and typically adjacent to other industrial or commercial land uses and major transportation corridors.

Activities associated with offshore construction of the Project would generate noise, vibration, and vehicular traffic, and would temporarily alter views at one or more ports listed in Table 3.1-5 of the COP. Port improvements would result in combustion emissions from construction vehicles and equipment and could result in fugitive particulate emissions from soil movement. These impacts would be typical for construction in and operation of industrial ports. Noise, vibration, vehicular traffic increases, and vehicular emission generation would be short term. Space use conflicts would also be short term and would be minimized through siting for minimal displacement and coordination with both waterway users and the USCG (BOEM 2016). Potential land-side transportation impacts would be minimized through construction hour restrictions, improvements such as road widening and signalization, and appropriate route selection (BOEM 2016). Activity and development from the Project would not occur at levels above those typically experienced or expected at these facilities and would not hinder other nearby land use or use of coastal infrastructure. Overall, construction and installation of offshore components would have minor, beneficial impacts to land use and coastal infrastructure by supporting designated uses at ports and supporting port improvements and/or redevelopment. Improvements such as road widening and signalization would provide transportation flow benefits over the long term. Section 3.5.3 Demographics, Employment, and Economics provides additional detail regarding potential economic impacts of the Project's use of the listed ports.

Construction of the chosen landing site and onshore SFEC route would temporarily disturb neighboring land uses through temporary increases in construction noise, vibration and dust, and intermittent delays in travel along impacted roads. Sheet pile installation for sea to shore transition HDD operations would occur over approximately 2 days, would occur during the daytime hours (7:00 a.m. to 8:30 p.m.), and would be largely generated by an excavator, crane, and sheet pile driver. Noise generated by these activities would comply with the Town of East Hampton noise code but would exceed the NYSDEC noise guidelines, requiring implementation of noise BMPs such as notifying nearby residences of the days and times that sheet piling would occur; installing the perimeter sound wall prior to sheet pile driving, if construction logistics allow; and using quieter methods (i.e., push-in piling) to install sheet piling as geological conditions allow.

Construction and installation of the Project's onshore components would require construction staging in parking lots adjacent to or near the landing sites, reducing public parking available at Beach Lane or Hither Hills State Park during construction. These disturbances would be short term, with timing projected to occur between September and May (see COP Table 1.5-1). 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 SFEC and the onshore SFEC in one underground concrete transition vault. The only long-term, visible components of the cable system would be the manhole covers (Jacobs 2020).

Onshore construction and installation would include trench excavation and placement of the onshore SFEC within existing paved roads and the railroad ROW. DWSF would abide by local construction ordinances. Construction would occur primarily during normal daylight hours except for certain activities associated with cable installation at the chosen landing site (Jacobs 2020) that could require nighttime activity to meet rapid construction timelines. DWSF would work with the Town of East Hampton to develop a detailed plan that includes traffic and other control measures prior to beginning major construction. The traffic plan with East Hampton would identify appropriate alternative routes that would accommodate projected traffic loading during construction 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 SFEC cable, the physical size and location of the cable could hamper future installation of public utilities such as water, sewer, and storm water lines, which are typically placed beneath roadway travel lanes. Construction noise would approach or exceed the NYSDEC noise guideline limit for construction activities at receptors immediately adjacent to the road or railroad ROWs. BMPs would be implemented to minimize construction noise such as replacing back-up alarms with strobes, assuring that equipment is functioning properly and is equipped with mufflers, locating especially noisy equipment as far from sensitive locations as possible, using quieter construction equipment, using path noise controls such as portable enclosures, limiting the period of time when construction occurs, and maintaining strong communication with the public. 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 mitigation measures related to fuel-efficient engines and dust control plans, as outlined in Section 3.2.1 Air Quality. As a result, and considering the described traffic, construction and installation of the Project would have a moderate adverse impact to land use and coastal infrastructure.

The interconnection facility would be constructed adjacent to the existing East Hampton substation, in an area zoned for commercial industrial use. Installation of the interconnection facility could increase visibility of the existing substation to nearby residents along Horseshoe Drive (Jacobs 2020). The visual impacts of the interconnection facility would be minimized through the installation of vegetation to provide year-round screening from nearby Horseshoe Drive, appropriate substation siting, low-profile design, and minimal lighting, all of which would be directed downward (EDR 2018). As designed, the interconnection facility would generate sound below existing, ambient sound levels (VHB 2020). According to federal, state, and local noise standards, there would be no impact and no need for mitigation as a result of the operation of the interconnection facility. The interconnection facility, therefore, would have a negligible adverse impact to land use and no impacts to coastal infrastructure.

The Project would include an O&M facility to be located onshore in an existing port either in Montauk, East Hampton or in Quonset Point, North Kingstown, Rhode Island. The O&M facility could use existing buildings or require renovation or new construction and would require improvements to existing piers. If the Port of Montauk is selected, port modification could be required, including reinforcement and/or rehabilitation of the quayside(s) and both initial and maintenance dredging to support the crew transfer vessels (Stantec 2020). To allow for suitable depths for navigation and berthing, a dredge footprint of up to 37,350 square feet (3,500 square meters) could be required. Dredged materials would be loaded onto land-based dump trucks and transported to adjacent beaches for placement as nourishment material. In addition to dredging, other potential in-water work could include replacement of the quayside bulkhead as well as potential bank stabilization. Fixed and floating docks could also be installed to support the vessel berths, which could include pile installation. Additional piles could be necessary to provide safe berthing conditions (i.e., mooring dolphin). These actions could result moderate, short-term adverse land use and coastal infrastructure impacts due to disruption of access, noise, and dust typically associated with construction.

Operations and Maintenance and Conceptual Decommissioning

O&M would require daily activity at the O&M facility and periodic activity at the port chosen for O&M installation. Activity would also occur at other ports, if needed. The O&M facility would include offices, a warehouse, training facilities, repair facilities, and docks, all of which are consistent with the range of land uses associated with the ports listed in Table 3.1-5 of the COP. The increased activity within any of the listed port areas zoned for business and industrial uses would reinforce the designated land use and provide a source of investment in the coastal infrastructure. O&M activities would be limited to temporary, periodic use of vehicles and equipment; associated impacts would be minor and would not affect land uses over those that typically occur at port facilities. Activities at ports, as described under construction and installation, would be consistent with the existing and designated uses at other ports. O&M of offshore components would therefore have minor, beneficial impacts to land use and coastal infrastructure by supporting designated uses at ports and supporting port improvements and/or redevelopment that would benefit port uses beyond those necessary for the Project.

Once installed, the onshore SFEC would be underground and would not change adjacent land uses or affect coastal infrastructure. Modeling results for onshore EMF indicate that maximum emissions would not exceed 4.7 mG at 3.28 feet aboveground and 50 feet from the duct bank line, which is below the New York Public Service Commission EMF limits of 200 mG. The maximum calculated magnetic field level at the sea-to-shore transition is 0.3 mG at an HDD depth of 62 feet, 1.8 mG at an HDD depth of 22 feet, and 11 mG at an HDD depth of 7 feet (Exponent 2018). Because these modeled values are well below the reported human health reference levels of 2,000 mG and 9,040 mG for the general population (Institute of Electrical and Electronics Engineers 2006; International Commission on Non-ionizing Radiation Protection 2010), onshore EMF adverse impacts would be long term but negligible. The SFEC would be installed at least 30 feet (9.1 m) below the current profile of the beach (Jacobs 2020). DWSF has also designed the Project to account for site-specific oceanographic and meteorological conditions within the analysis area; therefore, potential for beach erosion to expose the SFEC at the sea to shore transition zone would be long term but negligible.

O&M activities would include periodic inspections and repairs at the interconnection facility and cable access manholes, which would require minimal use of worker vehicles and construction equipment. Periodic maintenance and repairs would have temporary impacts on access to adjacent land uses. The onshore SFEC would therefore have negligible impacts on land use and coastal infrastructure.

Impacts during conceptual decommissioning would be similar to the impacts during construction and installation. The activity generated at listed ports would continue to be consistent with existing and designated port uses. 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 similar to those experienced during installation. If conceptual decommissioning occurs outside of the June to August peak tourist season, decommissioning of the onshore components of the Project would result in negligible impacts to land use, whereas decommissioning of the offshore components would result in beneficial impacts to port land use through supported port activities and expanded port infrastructure that would be available to other users into the future.

Cumulative Impacts

Onshore construction associated with the Proposed Action would add noise and land disturbance through the removal of 2.4 acres of land for the interconnection facility and a small area (0.1 acre) of land at the selected O&M facility to conditions under the No Action alternative. The Proposed Action would also introduce lighting at the interconnection facility, although lighting would be minimal and directed downward These actions would result in localized, short-term, minor incremental impacts on land use and coastal infrastructure. If DWSF chooses the Hither Hills SFEC route, construction activities could coincide with the projected East Hampton Railroad Station improvements and could increase traffic delays; result in additional traffic rerouting; and increase short-term, construction-related vehicular and equipment emissions that would impact area residents. The FIMP Project to control beach erosion and provide hurricane protection would also extend to Hither Hills State Park, opposite Montauk Harbor. Activities associated with the FIMP Project could overlap with the proposed cable landing and onshore SFEC route initiation at Hither Hills State Park. Longer delays at roadways and extended construction windows could result from the overlapping projects. No other onshore development projects would be adjacent to (and none would use roads impacted by) the Project landing sites and onshore SFEC. BOEM assumes that other projects would occur near existing energy infrastructure or where land development regulations, such as zoning and land use plan designations, allow such uses. State and local agencies would also be responsible for minimizing and avoiding noise, air quality, and other impacts on nearby neighborhoods during construction. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be temporary, localized, and minor.

Offshore impacts would predominately be associated with changes in lighting, port use, and spills.

Accidental releases and discharges: The Proposed Action could result in accidental release of contaminants, trash/debris, or invasive species that could add to releases from other reasonably foreseeable projects. However, the potential volumes of oils, lubricants, and diesel spilled would be minimal and would result in localized, short-term, negligible incremental impacts on land use and coastal infrastructure. The Project and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, storm water, 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 adverse, short-term, and negligible cumulative impacts on land use and coastal infrastructure.

Light: The Proposed Action would add permanent lighting for up to 15 WTGs and one OSS. Although this lighting would be visible, in part, from south-facing beaches and coastlines, this represents a negligible (less than a 1%) incremental 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 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects. 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.

Port utilization: Port upgrades and vessel activity associated with the Proposed Action could result in minor beneficial and minor adverse incremental impacts through an increase in economic and employment opportunities, as well as reduced port access, increased delays and congestion, or increased collision risk. Project port activity and upgrades (via dredging and in-water work) could also coincide with other forecasted projects. Quonset Point is scheduled to undergo remediation at the former NIKE Battery PR-58 and Disaster Village Training Area in 2021. No specific non-Project improvements are proposed for Montauk Harbor, but the New York State Energy Research Development Authority issued an offshore wind master plan that notes Montauk Harbor as having the potential to be used or developed into facilities capable of supporting offshore wind projects (New York State Energy Research Development Authority 2017).

Port activities could be delayed or area transportation routes could experience longer delays as result of the overlap in construction activities. All activities would, however, be in accordance with land use goals and plans. Construction and operation improvements associated with the Project and other offshore wind energy would occur within the boundaries of existing port facilities or repurposed industrial facilities, would be similar to existing activities at the existing ports, and would support state strategic plans and local land use goals for development of waterfront infrastructure as well as economic opportunities (see Section 3.5.3.2.3 [Proposed Action Alternative]). State and local agencies would also be responsible for minimizing the impacts of these future development plans by ensuring continued access to ports and adjacent land uses and minimization or avoidance of noise, air quality, and other impacts on nearby neighborhoods. Therefore, when considered in combination with past, present, and other reasonably foreseeable projects, the Project would have temporary negligible adverse impacts and long-term, minor beneficial impacts.

Conclusions

Project construction and installation and conceptual 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. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**. Project O&M would also generate long-term, **minor beneficial** impacts by supporting designated uses at ports and supporting port improvements and/or redevelopment. Therefore, BOEM expects the overall impact on land use and coastal infrastructure from the Proposed Action alone to be **minor**, as the overall effect would be small, localized, and short term.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor** and **minor 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** impacts and **minor beneficial** impacts to land use and coastal infrastructure. BOEM made this call because the overall effect would be small and the resource would be expected to recover completely.

3.5.5.2.4 VESSEL TRANSIT LANE ALTERNATIVE

This alternative would not impact land use and coastal infrastructure. Therefore, the impacts of this alternative would be the same as those of the Proposed Action. Adverse impacts would be negligible to moderate and both short term and long term; minor beneficial impacts would be long term.

Cumulative Impacts

If the Transit alternative is implemented, economic activity at port facilities and underused industrial sites could increase. These cumulative impacts resulting from the Transit alternative would be consistent with established state and local land use goals and when combined with past, present, and reasonably foreseeable future development could generate beneficial impacts not measurably different from the Proposed Action: negligible to minor and minor beneficial.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, these changes would not measurably affect land use and coastal infrastructure. Therefore, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**. Project O&M would also generate long-term, **minor beneficial** impacts by supporting designated uses at ports and supporting port improvements and/or redevelopment.

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

3.5.5.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would not impact land use and coastal infrastructure. Therefore, the impacts of this alternative would be the same as those of the Proposed Action. Adverse impacts would be negligible to moderate and both short term and long term; minor beneficial impacts would be long term.

Cumulative Impacts

The Habitat alternative would not affect Project onshore activities; therefore, cumulative effects to land use and coastal infrastructure would be the same as those described under the Proposed Action: negligible to minor and minor beneficial.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, these changes would not measurable affect land use and coastal infrastructure. Therefore, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**. Project O&M would also generate long-term, **minor beneficial** impacts by supporting designated uses at ports and supporting port improvements and/or redevelopment.

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

3.5.5.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that land use and coastal infrastructure impacts would range from **negligible** to **moderate and minor beneficial** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible to minor and minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor** adverse and **minor beneficial**.

3.5.5.4 Mitigation

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

3.5.6 Navigation and Vessel Traffic

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to navigation and vessel traffic from implementation of the Proposed Action and other considered alternatives.

3.5.7 Other Uses (marine, military use, aviation, offshore energy)

3.5.7.1 Affected Environment

Marine mineral resources and dredged material disposal: BOEM's Marine Mineral Program manages non-energy minerals (primarily sand and gravel) in federal waters of the OCS and leases access to these resources to target shoreline erosion, beach renourishment, and restoration projects. At this time, there are no active or requested BOEM leases near the Project. The closest active BOEM lease is offshore of New Jersey, approximately 162 miles from the Project (BOEM 2018a). One USACE borrow area (7A) is located offshore the town of Wainscott, in the vicinity of the SFEC.

The EPA designates and manages dredged material disposal sites, and USACE permits the disposal of material in the sites. One active disposal site is located in the analysis area approximately 3 miles east of Block Island, Rhode Island, and 10 miles northwest of the SFWF. No inactive or closed disposal sites are located in the geographic analysis area.

Increased shoreline erosion and coastal damage from storms has led to increased demand for sand resources in recent years. Although this increased demand is expected to continue, BOEM does not anticipate overlap between marine mineral leases and the Proposed Action.

Military and national security uses: 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 2019). 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 U.S. Department of Defense 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).

Military and national security interests are expected to continue to use the onshore and offshore areas in the analysis area at similar levels in the foreseeable future.

Aviation and air traffic: Numerous public and private airports serve portions of New York, Rhode Island, and Massachusetts in the region surrounding the Project. 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 SFWF and 9 miles north of the offshore SFEC.

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.

Air traffic is expected to continue at current levels in and around the Project.

Offshore energy uses: The OCS near the Project is currently experiencing active leasing and exploration in support of offshore wind energy development. Appendix E provides a list of known and anticipated offshore wind project and wind energy leases exist in the area that could lead to additional wind farm development. BOEM anticipates that developers may continue to propose offshore wind energy projects near the Project. The trend in increased wind farm development is anticipated to continue on the OCS. Several tidal energy projects have been implemented in the region and several are in the planning stages. Tidal energy projects are typically located in the nearshore environment where landforms constrict tidal water passage, thereby increasing the velocity of tidal currents. No such landforms exist in the analysis area, so tidal projects are not discussed further in this section.

Undersea cables: At least seven undersea cables are buried in the seabed west of the Lease Area that the offshore SFEC would cross. These cables deliver telecommunications signals between North America and Europe. 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 expected.

Land-based radar systems: Several radar systems supporting commercial air traffic control, national defense, weather forecasting, and ocean condition observation operate in the vicinity of the Project (Epsilon Associates, Inc. 2018). A total of nine radar systems are within operational "line of site" of the SFWF, eight high-frequency radars used to measure ocean currents and one airport surveillance radar (ASR) at Warwick RI (Colburn et al. 2020).

The high-frequency "SeaSonde radars are operated by the Integrated Ocean Observing System. SeaSonde stations are located on the southern shore of Martha's Vineyard (three stations); on the southern shore of Nantucket (two stations); on the southeastern shore of Block Island (one station); on Montauk Point, Long Island (one station); and on the mainland shore at Misquamicut, Rhode Island (one station) (Integrated Ocean Observing System 2018).

The closest air traffic control radar system operates at Boston Logan International Airport and provides flight control for 165,000 square miles of airspace that includes airports in Connecticut, Vermont, Massachusetts, Rhode Island, Maine, New Hampshire, New York State, and Pennsylvania (FAA 2018). The Precision Acquisition Vehicle Entry/Phased Array Warning System installation at Joint Base Cape Cod supports national defense in the regions surrounding the Project. The nearest Next-Generation Radar weather system is located approximately 60 miles north of the Project. Additionally, the FAA operates a Terminal Doppler Weather Radar installation at Boston Logan International Airport.

These radar systems would continue to provide weather, navigational, and national security support to the region. The number of radars and their coverage area is anticipated to remain at current levels for the foreseeable future.

Scientific research and surveys: Regular fisheries management and ecosystem monitoring surveys conducted by or in coordination with the NEFSC could overlap with offshore wind lease areas in the New England region and south into the Mid-Atlantic region. Surveys include 1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; 2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; 3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; and 4) the NEFSC Ecosystem Monitoring Program, a more than

40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units. Scientific research and surveys are anticipated to continue at similar levels to the present. As future wind development continues, alternative platforms, sampling designs, and sampling methodologies could be needed to maintain surveys conducted in or near the Project.

3.5.7.2 Environmental Consequences

3.5.7.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.7-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.5.7-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Other Marine Uses

Issue	Impact Indicator	Significance Criteria
Reduction in the military's ability to access and use the site due to construction vessel traffic and WTG installation	Level of interruption to military exercises	Negligible: No measurable impacts would occur. Minor: Adverse impacts to the affected activity could be avoided with EPMs, and impacts would not disrupt the normal or routine functions of the affected activity. Once the Project is decommissioned, the affected activity would return to a condition with no measurable effects. Moderate: Impacts to the affected activity are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the Project is decommissioned, the affected activity would return to a condition with no measurable effects if proper remedial action is taken. Major: The affected activity would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the Project is decommissioned, the affected activity could retain measurable effects indefinitely, even if remedial action is taken.
Reduced availability of offshore energy (oil/gas) production at the site	Acreage of oil and gas activities excluded due to WTGs or offshore SFEC	
Reduced access to sand and minerals on the OCS	Acreage of mineral extraction area excluded due to WTGs or offshore SFEC	
Risk to aviation traffic	Qualitative assessment of risk to approach flight vectors to regional airports	
Impact to land-based radar (air traffic control, NOAA weather, high-frequency ocean observation radar)	Qualitative assessment of potential for radar shadow	
Impacts to other renewable energy projects, particularly if there is overlap in ports to be used; transit lane orientation	Qualitative assessment of potential for exclusion of other renewable energy projects	
Impact to any proposed/approved pipelines; electricity/telecom transmission lines	Qualitative assessment of potential for exclusion of or damage to other undersea cables	
Impacts to scientific research and surveys	Qualitative assessment of potential for reduced or eliminated survey opportunities	
Impact to dredged material ocean disposal sites	Project overlap with ocean disposal sites	

3.5.7.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing other use trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated impacts to other uses. Future non-Project actions include cable trenching, port expansion, and increased vessel traffic. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated other uses impacts. Impacts associated with future offshore wind activities are described below.

Future Projects

Marine Mineral Resources and Dredged Material Disposal

Presence of structures and new cable emplacement/maintenance: The demand for sand resources is anticipated to grow with increasing trends in coastal erosion, storm events, and sea level rise. The geographic analysis area contains a large area of available sand and mineral resources (over 4 million cubic yards of sand available for authorized use [USACE 2020]). Future offshore wind project infrastructures, including WTGs and transmission cables, could prevent future marine mineral extraction activities where project footprints overlap with extraction areas. However, mineral extraction typically occurs within 8 miles of the shoreline, limiting adverse impacts to cable routes. Additionally, future projects would avoid identified borrow areas by consulting with the BOEM Marine Minerals Program and USACE before approving offshore wind cable routes. Therefore, the combined adverse impacts on sand and mineral extraction are anticipated to be negligible under the No Action alternative.

Military and National Security

Presence of structures: Installation of up to 959 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 E), 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 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 (Brostrom et al. 2019).

Additionally, risk of allision 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 allision 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.

In addition to allision 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 geographic analysis area (BEOM 2020). 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. As discussed in the Vineyard Wind DEIS (BEOM 2020):

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, 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 when structures are removed during conceptual decommissioning. Based on coordinating efforts and the anticipated mitigating measures discussed above, the overall impacts to military and national security uses are anticipated to be minor to moderate under the No Action alternative.

Traffic: Increased vessel traffic due to construction and conceptual 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. Vessel activity could peak in 2025 with as many as 207 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.

Aviation and Air Traffic

Presence of structures: Future offshore wind development could add up to 959 structures to the offshore environment in the RI/MA WEA. WTGs could have maximum blade tip height of 853 feet above mean sea level. As these structures are built, aircraft navigation patters and complexity would incrementally increase. These changes could compress lower altitude aviation activity into more limited airspace above the offshore wind energy lease areas leading to airspace conflicts or congestion, and increasing collision risks for low-flying aircraft.

All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM recommendations to minimize collision risks.

Open airspace around the lease areas would still exist, however, 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, operations, and conceptual decommissioning process to avoid or minimize impacts on aviation activities and air traffic. For this reason, cumulative adverse impacts to aviation and airports are anticipated to be minor.

Offshore Energy Uses

Construction and operation of offshore energy projects are expected between 2021 and 2030. This use is not carried forward for standalone cumulative analysis because the impact of offshore wind is already evaluated as part of all other IPFs.

Undersea Cables

Presence of structures: Up to 959 structures along with 2,623 miles of cables are expected to 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 within any given development footprint, requiring future cables to route around these areas. However, the placement and presence of these cables would not prohibit the placement of additional cables and pipelines. Following standard industry procedures, cables and pipelines can be crossed without adverse impact. 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. Impacts on submarine cables would be eliminated during conceptual decommissioning of offshore wind farms if export cables associated with those projects are removed. Under the No Action alternative, minor cumulative adverse impacts to cables in the area would be anticipated.

Land-Based Radar

Presence of structures: WTGs that are near or in direct line-of-site to land-based radar system can interfere with the radar signal causing shadows or clutter in the received signal. Construction of 959 structures in the RI/MA WEA could lead to long-term, minor cumulative 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. BOEM anticipates individual future offshore wind projects to have negligible impacts on military and civilian radar systems due to anticipated ongoing coordination between individual project operators and military, national security, civilian, and private interests (BOEM 2019).

Scientific Research and Surveys

Presence of structures: If construction of all projected future offshore wind facilities occurs along the Atlantic coast, these developments would add up to 2,050 structures between 2021 and 2030 that could have a maximum blade tip height of up to 853 feet above mean sea level. Collectively, these developments would prevent NMFS from continuing ongoing scientific research surveys or protected species surveys under current vessel capacities and could reduce future opportunities for scientific research in the area. NOAA has determined survey activities within offshore wind facilities are outside of safety and operational limits. Survey vessels would be required to navigate around offshore wind projects to access survey locations, leading to a decrease in operational efficiency. The height of turbines would affect aerial survey design and protocols, requiring flight altitudes and transects to change. Scientific survey and protected species survey operations would therefore be reduced or eliminated as offshore wind facilities are constructed. Development of new survey technologies, changes in survey methodologies, and required calibrations could help to mitigate losses in accuracy and precision of current practices due to the impacts of wind development on survey strata.

BOEM is committed to working with NOAA toward a long-term solution to account for changes in survey methodologies as a result of offshore wind farms.

Overall, the No Action alternative would have major effects on scientific research and protected species surveys, potentially leading to impacts on fishery participants and communities; as well as potential major impacts on monitoring and assessment activities associated with recovery and conservation programs for protected species.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on other uses associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on other uses, due to the presence of structures and vessel traffic.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **major**. As described in Appendix E Attachment 3, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts for most uses, as the overall effect would be small. However, the overall effect would be notable and **moderate** adverse for military uses, and **major** adverse for scientific research and surveys.

3.5.7.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Marine mineral resources and dredged material disposal: There are no BOEM OCS sand and mineral lease areas and no identified sand resource blocks within the SFWF and offshore SFEC; therefore, the Project would have no impacts on these marine mineral resources. Similarly, because Project activities would not overlap any active dredged material disposal sites, the Project would have no impact on dredged material disposal. However, DWSF has requested a buffer area between USACE borrow area 7A and the offshore SFEC. This buffer zone could result in long-term, minor adverse impacts to the USACE's ability to extract sand from the borrow area.

Military and national security uses: Access by military vessels to the SFWF and SFEC would be limited during installation; however, USCG search and rescue activities would still occur. The U.S. Department of Defense concluded that the Proposed Action would have minor but acceptable adverse impacts on their operations (OCM 2019). Therefore, the Project would have minor adverse impacts on military operations and national security.

Aviation and air traffic: WTGs would be marked with appropriate lighting to meet FAA warning guidelines. Some aircraft could reroute to avoid the WTGs, which is anticipated to result in a negligible adverse impact to air traffic. Similarly, 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 leading to short-term adverse impacts. This is anticipated to lead to negligible adverse impacts to air traffic.

Offshore energy uses: Because renewable energy projects occur within individual lease areas, there would be no opportunity for the SFWF to directly overlap or substantially interfere with other renewable energy projects. However, overlapping construction time frames could lead to increased navigation risk or impacts to construction ports. Such impacts are not anticipated to affect construction timelines or alter the layouts of other renewable energy projects. For this reason, adverse impacts to other renewable energy projects are deemed negligible.

Undersea cables: The installation of the SFEC would cross at least seven undersea telecom cables, three active and four inactive (see COP Figure 4.6-10). Because DWSF would use standard techniques during installation to prevent damage to cables, adverse impacts would be minor. Cables installed in the future would be able to cross the SFEC using standard protection techniques; therefore, adverse impacts on future cables would be negligible.

Land-based radar systems: No radar screening analysis has been conducted for the Project; however, because the Project would be installed more than 15 miles from shore, in an area of the OCS very similar to where the Vineyard Wind Energy Project is planned, the radar screening analysis conducted by Vineyard Wind provides an acceptable surrogate. Based on that analysis, BOEM concluded the Project would have only negligible adverse impacts to radar (Epsilon Associates, Inc. 2018).

Scientific research and surveys: Scientific research and protected species surveys could be affected from the construction of the SFWF and SFEC. Some vessels or low-flying aircraft could be required to alter course to avoid WTGs. NOAA policy advises survey vessels to remain at least 1 mile from fixed structures if possible (Hooker 2019). Because Project turbines would be approximately 1 mile apart, the SFWF would exclude survey efforts from its work and operations areas. NOAA has concluded that, within offshore wind facility areas, survey operations would be curtailed, if not eliminated, under current vessel capacities and monitoring protocols. Specifically, coordinators of large vessel survey operations or operations deploying mobile survey gear have currently determined activities within offshore wind facilities are not within their safety and operational limits. The substrate in the SFWF has a substantial rock and cobble component, making it naturally less than optimal for trawling because of the potential for survey equipment to become entangled. This condition is reflected in a commercial fishing effort that is substantially reduced in the SFWF compared to surrounding habitat (Northeast Ocean Data Portal 2018). Vessels or aircraft could be required to make minor course adjustments to avoid collisions and would not be completely blocked from using the areas amongst and between the WTGs. Therefore, because scientific research and protected species surveys could be curtailed within the Lease Area, construction of the SFWF is anticipated to have a moderate, long-term impact to scientific research or protected species surveys.

Operations and Maintenance and Conceptual Decommissioning

Impacts during O&M and conceptual decommissioning of the Project are anticipated to be less than or similar to those described for construction.

Cumulative Impacts

Marine Mineral Resources and Dredged Material Disposal

Presence of structures and new cable emplacement/maintenance: Because the Project would have no impacts on marine mineral resources or on dredged material disposal, other than long-term, minor adverse impacts to the USACE’s ability to extract sand from borrow area 7A, the Project would only add negligible adverse incremental impacts to the conditions under the No Action alternative. Under the No Action alternative, it is expected that the demand for sand resources will grow based on current trends. However, there is a large area of available sand and mineral resources on the OCS (e.g., over 4 million cubic yards of sand available for authorized use [BOEM 2018b]) and future projects would avoid identified borrow areas by consulting with the BOEM Marine Minerals Program and USACE before approving offshore wind cable routes. Therefore, the cumulative impact for the Proposed Action when combined with past, present, and reasonably foreseeable projects would be long term and negligible.

Military and National Security Uses

Presence of structures: The Proposed Action would result in short-term and long-term minor to moderate incremental impacts to military and national security through the installation of 16 structures (15 WTGs and one OSS), along with stationary lift vessels and cranes during construction, to conditions under the No Action alternative, for a total of 975 structures within the RI/MA WEA. Project structures could support artificial reef effects, which may also increase traffic and activity near the WTGs for recreational fishing or sightseeing vessels. These structures would increase the short-term and long-term risks of allision for military and national security vessels, as well as search and rescue vessels. However, deep-draft military vessels are not anticipated to transit outside of 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 conceptual 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.

Proposed Action structures represents no more than a 1% increase over total estimated WTG and OSS foundations across the geographic analysis area under the No Action alternative. BOEM estimates a cumulative total of 975 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind 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 represent a long-term, minor to moderate impact on military and national security uses.

Traffic: As described in Section 3.5.6.2.3 (Proposed Action Alternative), the Proposed Action would require 13 construction vessels 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 a small proportion (2%) of the total vessels potentially present. Therefore, the Proposed Action would result in negligible incremental impacts to military and national security uses.

BOEM estimates a peak of 207 vessels due to offshore wind project construction over a 10-year time frame. Although the number of construction vessels (reaching a maximum of 207 in 2025) would represent a large portion of the traffic in the region, most vessels would remain in the MWA, 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 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, O&M, and conceptual decommissioning activity. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be long term and minor.

Aviation and Air Traffic

Presence of structures: Because WTGs are the tallest features expected to be constructed on the OCS, development of additional offshore wind farms is the only expected activity to cumulatively affect air traffic. The Proposed Action would result in long-term negligible incremental impacts to aviation and air traffic through the installation of 16 structures (15 WTGs and one OSS) to conditions under the No Action alternative. These structures would also increase navigational complexity and navigation patterns for low-flying aircraft. BOEM estimates that these impacts would occur for no more than 10% of air traffic, but affected pilots could be required to alter routes to avoid constructed WTGs. Siting of the Project more than 15 miles offshore would place the Project outside typical approach routes to nearby airports. All existing stationary structures would have navigation marking and lighting in accordance with FAA, USCG, and BOEM guidelines to minimize collision risks. WTGs would also be visible on aircraft radar.

Proposed Action structures represents no more than a 1% increase over total estimated WTG and OSS foundations across the geographic analysis area under the No Action alternative. BOEM estimates a cumulative total of 975 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind 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 represent a long-term, minor impact on aviation and air traffic uses.

Undersea Cables

Presence of structures: The Proposed Action would result in long-term negligible incremental impacts to existing undersea cables through the installation of 16 structures (15 WTGs and one OSS) and 82.5–86.9 miles of cable to conditions under the No Action alternative. BOEM estimates a cumulative total of 975 offshore WTGs and OSS foundations and up to 2,710 miles of cable for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. Placement of these project components would not preclude the placement of additional cables and pipelines. Following standard industry procedures, cables and pipelines can be crossed without adverse impact. Cable maintenance vessels transiting through or working within the geographic analysis area would be at risk of allisions with Project structures, but required navigational hazard marking and implementation of a 1 × 1–nm spacing would minimize this risk, as would the relatively infrequent need for maintenance activities. For the same reasons, the cumulative effects associated with the Proposed Action and past, present, and reasonably foreseeable activities would result in long-term but negligible impacts on undersea cables.

Land-Based Radar

Presence of structures: The Proposed Action would result in long-term negligible incremental impacts to land-based radar through the installation of 16 structures (15 WTGs and one OSS) to conditions under the No Action alternative. These structures would increase the long-term risk of radar interference or clutter, but existing radars are sited at such a distance to minimize interference. Any impacts on long-range radar systems are anticipated to be mitigated by overlapping coverage and radar optimization.

Therefore, for the same reasons, the Proposed Action and past, present, and reasonably foreseeable activities would result in long-term and negligible cumulative impacts on radar systems.

Scientific Research and Surveys

Presence of structures: The Proposed Action would result in long-term negligible incremental impacts to scientific research and surveys through the installation of 16 structures (15 WTGs and one OSS) to conditions under the No Action alternative. These structures would result in adverse impacts to scientific research and protected species surveys due to 1) WTG blade tip height that would exceed the survey altitude for current surveying methodologies, and 2) Lease Area geographic overlap with ongoing Northeast Fisheries Science Center fishery resource monitoring surveys.

Proposed Action structures represents no more than a 1% increase over total estimated 2,050 WTG and OSS foundations under the No Action alternative that could be present along the Atlantic coast if all projected future offshore wind facilities are constructed. BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects. 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 represent a long-term, major impact on NMFS's scientific research and protected species surveys and the resulting stock assessments.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would affect ongoing military, aviation, and scientific research studies occurring in the analysis area. Similar impacts from Project O&M would occur, although at lesser extent and duration for some uses. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**. Therefore, BOEM expects the overall impact on other uses from the Proposed Action alone to be **minor**, as the overall effect would be small and the resource would be expected to return to a condition with no measurable effects.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate**. 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 range from **minor** adverse impacts for most uses, to **moderate** adverse for military uses, and **major** adverse for scientific research and surveys.

3.5.7.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would lead to the same types of impacts on other uses from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, construction of this alternative would install fewer WTGs and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Therefore, this alternative would result in negligible to moderate impacts to ongoing military, aviation, and scientific research studies occurring in the analysis area.

Cumulative Impacts

The Transit alternative would add resource impacts at quantities and durations similar to, or slightly reduced from, the Proposed Action, driven by the continued presence of offshore structures—primarily WTGs—in the Lease Area.

The transit lanes could reduce cumulative impacts related to allision and collision risk throughout the lease areas (USCG 2020). Conversely, allisions and collisions could increase if commercial and recreational fishing and boating occurs within, or congregates alongside, the transit lanes. Implementing transit lanes could allow easier access for scientific research and survey activity within the transit lanes; however, these activities would still be impacted by the presence of offshore structures. Therefore, the overall cumulative impacts of this alternative when combined with past, present, and reasonably foreseeable activities would range from minor adverse impacts for most uses, moderate adverse for military uses, and major adverse for scientific research and protected species surveys.

Conclusions

Although the Transit alternative 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 the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Transit alternative's incremental impacts would be similar to the Proposed Action (with individual IPFs leading to impacts ranging from **negligible** to **moderate**. The overall impacts of the Transit alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse impacts for most uses, **moderate** adverse for military uses, and **major** adverse for scientific research and protected species surveys.

3.5.7.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Impacts to marine mineral resources and dredged material disposal, military and national security uses, aviation and air traffic, offshore energy uses, undersea cables, land-based radar, and scientific research and surveys from construction and installation, O&M, and conceptual decommissioning of the SFWF, SFEC, and Montauk O&M facility would be similar to the Proposed Action. Therefore, the Habitat alternative is anticipated to result in negligible to moderate adverse impacts.

Cumulative Impacts

The Habitat alternative is similar to the Proposed Action except that it has a slightly smaller construction and operational footprint. Therefore, the Transit alternative would add resource impacts at quantities and durations similar to, or slightly reduced from, the Proposed Action, driven by the continued presence of offshore structures—primarily WTGs—in the Lease Area. As such, the overall cumulative impacts of this alternative when combined with past, present, and reasonably foreseeable activities would range from minor adverse impacts for most uses, moderate adverse for military uses, and major adverse for scientific research and protected species surveys.

Fisheries Habitat Impact Minimization Alternative Conclusions

Although the Habitat alternative 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 the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Habitat alternative's incremental impacts would be similar to the Proposed Action (with individual IPFs leading to impacts ranging from **negligible** to **moderate**). The overall impacts of the Habitat alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse impacts for most uses, **moderate** adverse for military uses, and **major** adverse for scientific research and protected species surveys.

3.5.7.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that impacts to other uses would range from **negligible** to **moderate** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor** for most uses, **moderate** adverse for military uses, and **major** adverse for scientific research and protected species surveys.

3.5.7.4 Mitigation

Implementation of a DWSF-funded mitigation program to address adverse impacts from the Project on recurring scientific research and protected species surveys may not significantly reduce the expected major impacts on NOAA scientific surveys from the Project in the short term but should lessen long-term impacts. The mitigation program could be applied to future wind energy facility projects to minimize or avoid similar impacts.

3.5.8 Recreation and Tourism

The reader is referred to Table 2.3.1-1 and Appendix H for a discussion of current conditions and potential impacts to recreation and tourism from implementation of the Proposed Action and other considered alternatives.

3.5.9 Visual Resources

3.5.9.1 Affected Environment

This Visual Resources section addresses non-historic visual resources. Historic visual resources are addressed in the Cultural Resources section (Section 3.5.2).

Coastal Massachusetts, Rhode Island, and Connecticut have a wide range of visual characteristics, with communities and landscapes ranging from large cities to small towns, suburbs, rural areas, and wildlife preserves (EDR 2020). Daytime and nighttime skies are characterized by clear conditions, clouds, fog, and haze. The scenic quality of the coastal environment is important to the identity, attraction, and economic health of many of the coastal communities (EDR 2020). The visual qualities of historic coastal towns, which include marine activities within small-scale harbors, and the ability to view birds and marine life, are important community characteristics (EDR 2018, 2020). The characteristic onshore landscape includes high to moderate quality scenery elements, as follows: landforms, comprising a ridge (elevation 182 feet), dunes, and scenic sea coast; waterbodies, including ponds and the Atlantic Ocean; vegetation, including dune grasses, forest, coastal scrub, and residential plantings; structures, including residential buildings, fences, roads, parking; and cultural resource elements, including the East Hampton Scenic Areas of Statewide Significance (New York State Department of State, Division of Coastal Resources 2010). The onshore landscape includes Wainscott, Georgica, Hook, Lily and Town Ponds, surrounding upland landscapes, and 7 miles of Atlantic beaches.

The characteristic seascape of the SFWF and offshore SFEC (Figure C-31) comprises views of open ocean from recreational and commercial boating (offshore) and views from the mainland and islands (onshore). Because of the proximity of the Atlantic Ocean and the views associated with the shoreline, coastal New England has been extensively developed for water-based recreation and tourism (EDR 2020) and commercial and industrial uses. Recreational and commercial vessels and activities contribute to the visual character of the seascape.

3.5.9.2 Environmental Consequences

3.5.9.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.9-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for the DEIS.

Table 3.5.9-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Visual Resources

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Change in scenic quality of the landscape and seascape</td><td>Visual contrast and dominance of Project component structures and activities onshore and offshore visible in the viewshed</td><td rowspan="2">Negligible:
The landscape or seascape character appears to be intact.
Very low levels of change that do not attract viewer attention and/or atmospheric conditions obscure visibility of Project components.
Project activities are not readily evident with no or minimal overall contrast and are often indistinct or not obvious.
The scale of Project components is very small to small in comparison with the existing visual environment.
Minor:
The landscape or seascape character appears to be noticeably altered.
Low levels of change that may be seen but do not attract the viewer's attention and/or atmospheric conditions begin to obscure visibility of Project components but are discernible.
Project activities may be evident but do not attract attention with weak contrast, which may be visible or evident.
The scale of Project components are small in comparison with the existing visual environment.
Moderate:
The existing landscape or seascape character appears substantially altered.
Moderate levels of change that may attract attention but do not dominate the view.
Project activities are evident and begin to attract attention with moderate contrast and are clearly visible or noticeable.
The scale of Project components are moderate in comparison with the existing visual environment.
Motion of wind turbines begins to be the focus of attention in offshore views.
Major:
The existing landscape or seascape character appears severely altered.
Major levels of change with strong contrast that dominates the view and are the major focus of viewer attention and cannot be overlooked.
The scale of Project components are large in comparison with the existing visual environment.</td></tr>
<tr><td>Change seen and perceived as Project facilities by people/ sensitive viewers</td><td>Luminance and illuminance from Project component lighting sources onshore and offshore visible in the viewshed</td></tr>
</table>

3.5.9.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing visual resource trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated visual impacts. Future non-Project actions include offshore wind facility development and onshore communications tower updates and replacements, development projects, and port upgrades. Attachment 3 in Appendix E also discloses future non-offshore wind activities and associated visual impacts. Impacts associated with future offshore wind activities are described below.

Future Projects

Offshore

Presence of structures: Proposed or anticipated future wind facility projects would consist of an estimated up to 857 WTGs and associated OSS in the visual geographic analysis area (see Attachment 4 in Appendix E). The combined visual effects of the WTGs and associated infrastructure when visible from viewing areas would create long-term, minor to major visual impacts if future projects are fully implemented. The degree of the perceivable contrast, dominance, and scale of WTGs and an OSS along the horizontal plane of the ocean depends on the viewer's proximity and orientation to the wind energy projects and will either increase or decrease as natural lighting angles and atmospheric conditions change throughout the day. Under clear conditions and depending on lighting angles, projects built within BOEM leases that are within 12 miles of viewing areas would have major visual impacts, viewing areas within 12 to 24 miles would have moderate to major impacts, and viewing areas within 24 to 30 miles would have minor impacts. Viewing areas that exceed 30 miles from projects would have negligible visual impacts due to distance, curvature of the Earth, and the influence of atmospheric conditions, which would decrease the ability of the viewer to discern or perceive projects at that distance.

Light: Development of offshore wind lease areas would increase the amount of offshore light sources associated with construction and installation, O&M, and conceptual decommissioning during the life of future projects. Lighting associated with night construction and decommissioning for future projects would be localized and temporary. Construction and conceptual decommissioning for each future project within BOEM lease areas are also assumed to be staggered; therefore, the lease areas would not have light sources across the entirety of the geographic analysis area at one time. However, light sources, depending on quantity, intensity, and location, could be visible from unobstructed sensitive onshore and offshore viewing locations based on viewer distance.

FAA hazard lighting systems would be in use for the duration of Project O&M for each reasonably foreseeable offshore wind project (857 structures). The amassing of these WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle within the lease areas would have long-term minor to major impacts on sensitive onshore and offshore viewing locations based on viewer distance and angle of view, and assuming no obstructions. Similar to structures discussed above, atmospheric and environmental factors such as haze and fog would also influence visibility and perceivability of hazard lighting from sensitive viewing locations.

Field observations associated with visibility of FAA hazard lighting for the BIWF off the coast of Rhode Island were conducted in May 2019 (HDR 2019). The BIWF project consists of five WTGs with a blade tip height of approximately 600 feet. Observations of FAA nighttime lighting visibility under clear sky conditions in open water identified that FAA hazard lighting may be visible to the naked eye at a distance of 26.8 miles from the viewer (HDR 2019). The BIWF report also concludes that daytime visibility of WTGs from land and water viewing locations is strongly dependent on weather conditions and distance (HDR 2019).

The implementation of an ADLS (or a similar system) would activate the hazard lighting system in response to detection of nearby aircraft. Implementation of an ADLS may be required by BOEM as a mitigation measure and condition of COP approval. The synchronized flashing of the ADLS if implemented would result in shorter duration night sky impacts on the surrounding landscape. The shorter duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation. Based on recent studies associated with the SFWF, activation of the ADLS if implemented, would occur for 3 hours and 49 minutes per year, or on average, from 2 minutes to 46 minutes per month as compared to standard continuous FAA hazard lighting (EDR 2020). It is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce duration of the potential impacts of nighttime aviation lighting to less than 1% of the normal operating time that would occur without using the ADLS.

Because of the variable distances from visually sensitive viewing locations (EDR 2020), other reasonably foreseeable offshore wind projects would have minor to major long-term cumulative effects on non-historic visually sensitive viewing areas. As also discussed in Section 3.5.8 Recreation and Tourism, the recreational and commercial boating community would experience major adverse effects in foreground views. Onshore viewers would experience minor to major effects from nighttime lighting associated with construction and O&M. After conceptual decommissioning, the minor to major impacts associated with O&M would cease.

Onshore

Future port upgrade planning projects could require port modifications and expansions, although specific locations and design have not been determined (see Appendix E, Table E-8). However, any improvements to existing port facilities and the development of new port facilities are anticipated to occur within areas of current port development. Therefore, the addition of additional structures, infrastructure, and night lighting sources associated with port expansion would have long-term, negligible to moderate impacts to sensitive onshore and offshore daytime and nighttime visually sensitive viewing areas, depending on the final location of port upgrade locations.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on non-historic visual resources associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on non-historic visual resources, primarily through construction and O&M of WTGs and related lighting schemes.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **major**. BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** to **major**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts because the overall effect would be notable, but the resource would be expected to recover completely after conceptual decommissioning.

3.5.9.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Analysis area residents and visitors would experience observable changes to the characteristic background landscape and/or seascape during Project construction, including the presence of lighting, structural features, vessels, heavy equipment, vehicles, and personnel for the time period of construction. The onshore components of the Project include the interconnection facility, onshore SFEC routes, sea-to-shore transition vault (i.e., manhole), and O&M facility (located in Quonset Point, Rhode Island, or Montauk Harbor, New York); see Section 2.1.1.3, Construction and Installation, for further information.

Offshore, the increase and concentration in vessel activity during WTG construction, installation, and transport activities along with the addition of navigational marking and lighting would create short-term to long-term moderate to major impacts to visually sensitive viewing areas. Similarly, during the installation of offshore cable systems, vessels and equipment would be concentrated and visible within the Lease Area. As cable system construction activities transition onshore, temporary vegetation clearing and surface disturbance would occur. Construction of the interconnection facility would involve temporary staging areas and vehicle traffic. The Project-related offshore and onshore construction activity would create short-term minor to moderate impacts to visually sensitive viewing areas.

Operations and Maintenance and Conceptual Decommissioning

Visual impacts from the onshore and offshore Project components would persist for the life of the Project. Because of the similarity of the existing adjacent East Hampton substation's visual features and screening by mature vegetation throughout the area, the operation of the onshore interconnection facility would cause negligible to minor long-term adverse visual impacts. Nighttime impacts caused by the onshore interconnection facility lighting would be minor because of their low-profile design, which would be directed downward.

The Quonset Point O&M facility would include two approximately 30-foot-tall structures to house office space (approximately 1,000 square feet) and storage space (approximately 11,000 square feet) with one 60-foot-tall crane that would be in use at the quayside and would be set among existing modern Air National Guard Base structures and activities. These new structures for Quonset Point would be similar to existing industrial infrastructure that have large repetitive vertical and horizontal geometric, rectangular elements and are anticipated to result in negligible to minor adverse visual impacts. The Montauk O&M facility would include similar structures for office space (1,000 square feet) and storage space (6,600 square feet) with one 60-foot-tall crane set among other similar active harbor structures and operations (EDR 2019). The structures for Montauk Point would include either reuse of the existing structures or replacement in kind of the existing structures, which have large repetitive vertical and horizontal geometric, rectangular elements and are anticipated to result in negligible long-term adverse visual impacts.

Visual impacts of offshore vessel and onshore vehicle traffic during the O&M phase would be temporary and negligible because of the low volumes of traffic. Visual impacts from vessel traffic during conceptual decommissioning would be similar to construction impacts.

The offshore components of the Project include the WTGs and the OSS, which would be visible from the visually sensitive areas in New York, Connecticut, Rhode Island, and Massachusetts. Based on visual simulations, the WTGs would be visible on the horizon from shore (unobstructed view) within the analysis area. The WTGs (and OSS) would be painted RAL 9010 Pure White or RAL 7035 Light Grey to blend into the horizon. The effects of sun lighting, shade, and shadows would cause backlit contrasts and higher impacts for onshore and offshore views from the northeast, north, and northwest. The color contrast varies due to sun angles and atmospheric clarity shifting from white WTGs against a blue or gray backdrop to a dark gray WTG against a light gray backdrop. Distance between the viewer and the WTGs, as noted in Table 3.5.9-1, along with the curvature of the Earth affects how much of the WTG is visible from sensitive viewing locations and influences its visible scale and dominance.

The 15 WTGs and one OSS would appear generally low on the horizon because of distance and the curvature of the Earth and would be located behind and partially screened or buffered by other lease area WTGs, as viewed from the northern and eastern onshore communities and sensitive viewing locations. The SFWF WTGs would be more visually apparent as viewed from the western communities and sensitive viewing locations (Montauk, New York, and Block Island, Rhode Island) due to less screening from other lease areas under the foreseeable development scenario. The scale of the 15 WTGs would become less perceivable as the distance from sensitive viewing locations is increased. Atmospheric and environmental factors such as haze, sun angle, time of day, cloud cover, fog, sea spray, and wave action would also influence visibility and perceivability from sensitive viewing locations. The combined visual effect of the reasonably foreseeable WTGs in the geographic analysis area when visible from sensitive viewing areas would create long-term minor to major visual impacts once future projects are fully implemented (see Table 3.5.9-2).

As a result, O&M would cause long-term negligible to major visual impacts to visually sensitive viewing areas (see Table 3.5.9-2) for the life of the Project. Visual impacts from conceptual decommissioning of the WTGs and OSS would be similar to construction impacts. Long-term moderate to major visual impacts would occur at night when aviation and navigation lighting are visible from shore that focus viewers' attention to linear, repetitive, and concentrated areas of dark skies.

Table 3.5.9-2. Summary of Impacts by Viewing Area

Viewpoint Location	Viewpoint Name	Viewer Type	Aesthetic Resource	Distance (miles)	Landscape Similarity Zone	Overall Impact
Viewpoints within 12 miles						
30	Atlantic Ocean	Tourists, fishing community	Atlantic Ocean	8.6	Open Water	Major
Viewpoints between 12 and 18 miles						
29	Nomans Land	No access	Nomans Land Island National Wildlife Refuge	15.9	Shoreline Bluffs	Minor
29	Nomans Land Sunset	No access	Nomans Land Island National Wildlife Refuge	15.9	Shoreline Bluffs	Moderate
Viewpoints between18 and 24 miles						
4	Fred Benson Beach	Resident, tourist	Crescent Beach, State Scenic Area, Rhode Island Historic District, Town Beach	20.7	Shoreline Beach	Minor
4B	New Shoreham Beach	Resident, tourist	Lakeside Drive Shore Fishing Access	20.6	Shoreline Beach	Minor
4C	Block Island Ferry	Resident, tourist, through traveler, fishing community	Block Island Sound	19.8	Open Water	Minor
5B	Southeast Lighthouse	Resident, tourist	National Register Historic Site, Mohegan Bluffs Scenic Area	19.4	Maintained Recreational Area	Minor
5B	Southeast Lighthouse Construction View	Resident, tourist	National Register Historic Site, Mohegan Bluffs Scenic Area	19.4	Maintained Recreational Area	Minor
5N	Southeast Lighthouse Night	Resident, tourist	National Register Historic Site, Mohegan Bluffs Scenic Area	19.4	Maintained Recreational Area	Major
6	Point Judith Lighthouse	Resident, tourist, fishing community	National Register Historic Site, Point Judith State Scenic Area	23.6	Maintained Recreational Area	Negligible
6N	Point Judith Lighthouse Night	Resident, tourist, fishing community	National Register Historic Site, Point Judith State Scenic Area	23.6	Maintained Recreational Area	Moderate
18	Cuttyhunk Island	Resident, tourist	The Elizabeth Islands, Buzzards Bay	22.7	Coastal Scrub/Scrub Forest	Moderate
19	Aquinnah Overlook	Resident, tourist	Gay Head Aquinnah Shops Area State Historic Area, Gay Head West Tisbury Unit State Scenic Area	20.4	Shoreline Bluffs	Minor
19	Aquinnah Overlook Sunset	Resident, tourist	Gay Head Aquinnah Shops Area State Historic Area, Gay Head West Tisbury Unit State Scenic Area	20.4	Shoreline Bluffs	Moderate
19N	Aquinnah Overlook Nighttime	Resident, tourist	Gay Head Aquinnah Shops Area State Historic Area, Gay Head West Tisbury Unit State Scenic Area	20.4	Shoreline Bluffs	Major

Viewpoint Location	Viewpoint Name	Viewer Type	Aesthetic Resource	Distance (miles)	Landscape Similarity Zone	Overall Impact
20A	Moshup Beach	Resident, tourist	Gay Head West Tisbury State Scenic Area, Moshup Beach	20.1	Coastal Dunes	Moderate
20A	Moshup Beach Sunset	Resident, tourist	Gay Head West Tisbury State Scenic Area, Moshup Beach	20.1	Coastal Dunes	Moderate
21	Gay Head Lighthouse	Resident, tourist	Gay Head Lighthouse, Gay Head West Tisbury Unit State Scenic Area	20.4	Maintained Recreation Area	Negligible
22	Philbin Beach	Resident, tourist	Gay Head West Tisbury Unit State Scenic Area, Philbin Beach	20.2	Shoreline Beach	Minor
22	Philbin Beach Sunset	Resident, tourist	Gay Head West Tisbury Unit State Scenic Area, Philbin Beach	20.2	Shoreline Beach	Minor
25	Lucy Vincent Beach	Resident, tourist	Gay Head West Tisbury Unit State Scenic Area, Lucy Vincent Beach	23.8	Coastal Dunes	Negligible
25	Lucy Vincent Beach Sunset	Resident, tourist	Gay Head West Tisbury Unit State Scenic Area, Lucy Vincent Beach	23.8	Coastal Dunes	Moderate
Viewpoints between 24 and 30 miles						
2A	Trustom Pond National Wildlife Refuge	Resident, tourist	Trustom Pond/Matunuk State Scenic Area, Trustom Pond National Wildlife Refuge	27.9	Salt Pond/ Tidal Marsh	Negligible
7	Scarborough Beach	Resident, tourist	Scarborough State Beach	24.8	Shoreline Beach	Negligible
9	Narragansett Beach	Resident, tourist	Narragansett Town Beach	26.9	Shoreline Beach	Negligible
10	Beavertail Lighthouse	Resident, tourist	National Register Historic Site, Beavertail Point Scenic Area, Rhode Island Historic District, Beavertail State Park	26.3	Maintained Recreation Areas, Coastal Bluff	Negligible
11	Brenton Point State Park	Resident, tourist	Newport/Ocean Drive State Scenic Area, Brenton Point State Park, Rhode Island Historic District	25.5	Maintained Recreation Areas	Negligible
11N	Brenton Point State Park Nighttime	Resident, tourist	Newport/Ocean Drive State Scenic Area, Brenton Point State Park, Rhode Island Historic District	25.5	Maintained Recreation Areas	Moderate
12	Newport Cliff Walk	Resident, tourist	Newport/Ocean Drive State Scenic Area, Brenton Point State Park, Rhode Island Historic District	24.8	Maintained Recreation Areas, Shoreline Residential	Minor
14	Sachuest Beach (Second Beach)	Resident, tourist	Second Beach, Narragansett Bay	26.7	Shoreline Beach	Negligible
14A	Hanging Rock (Norman Bird Sanctuary)	Resident, tourist	Norman Bird Sanctuary, Paradise Avenue and Associated Roads State Scenic Byway, Second Beach	26.7	Coastal Scrub/Scrub Forest	Moderate

Viewpoint Location	Viewpoint Name	Viewer Type	Aesthetic Resource	Distance (miles)	Landscape Similarity Zone	Overall Impact
14B	Sachuest Point National Wildlife Refuge	Resident, tourist	Sachuest Point National Wildlife Refuge, Sachuest Point State Scenic Area	25.6	Coastal Scrub//Scrub Forest	Negligible
15	South Shore Beach	Resident, tourist	Narragansett Bay, Little Compton Agricultural Lands State Scenic Area, South Shore Beach	27	Shoreline Beach	Negligible
17	Gooseberry Island	Resident, tourist	Horseneck Beach State Reservation, Westport South Dartmouth Unit State Scenic Area, Buzzards Bay	26.2	Coastal Scrub/Scrub Forest	Moderate
17	Gooseberry Island Sunset	Resident, tourist	Horseneck Beach State Reservation, Westport South Dartmouth Unit State Scenic Area, Buzzards Bay	26.2	Coastal Scrub/Scrub Forest	Moderate
24	Peaked Hill Reservation	Resident, tourist	Identified by the Wampanoag of Gay Head	24.2	Forest	Minor
24	Peaked Hill Reservation Sunset	Resident, tourist	Identified by the Wampanoag of Gay Head	24.2	Forest	Moderate
Viewpoints beyond 30 miles						
1D	Montauk Point State Park	Resident, tourist, fishing community	Montauk Point State Park, National Register Historic Site, Scenic Area of Statewide Significance	35.3	Maintained Recreation Areas	Negligible
1N	Montauk Point State Park Nighttime	Resident, tourist	Montauk Point State Park, National Register Historic Site, Scenic Area of Statewide Significance	35.3	Maintained Recreation Areas	Negligible
2	Watch Hill Lighthouse	Resident, tourist	Rhode Island Historic District, State Scenic Area		Maintained Recreation Areas, Shoreline Residential	Negligible
26A	Nobska Lighthouse	Resident, tourist	National Register of Historic Places, Church Street/Nobska Point State Historic District, Nobska Beach Association Beach		Maintained Recreation Areas	Negligible
26A	Nobska Lighthouse Sunset	Resident, tourist	National Register of Historic Places, Church Street/Nobska Point State Historic District, Nobska Beach Association Beach		Maintained Recreation Areas	Negligible
27	South Beach State Park	Resident, tourist	South Beach State Park		Shoreline Beach	Negligible
27	South Beach State Park Sunset	Resident, tourist	South Beach State Park		Shoreline Beach	Minor

Cumulative Impacts

Offshore

Offshore impacts would be predominately associated with changes in above-water structures and lighting.

Presence of structures: Construction activities would incrementally add up to 15 additional WTGs and one OSS to the No Action alternative; an increase in the number of WTGs in the geographic analysis area by less than 2%. As a result, proportionately over 90% of the WTGs in the geographic analysis area would be associated with other future offshore wind development (EDR 2020). Additionally, the Proposed Action would locate WTGs no closer than approximately 12 miles from shore. When combined with other past, present, and reasonably foreseeable projects, the Proposed Action would therefore result in long-term and minor to major adverse cumulative visual impacts from sensitive viewing locations.

Light: Construction related activities would incrementally add navigational safety lighting used by offshore vessels to the No Action alternative. Additionally, construction of up to 15 WTGs and one OSS would also incrementally add navigation and aviation lighting to the No Action alternative. New lighting from the Proposed Action would increase in-water structures with lighting impacts from past, present, and reasonably foreseeable future projects by no more than 2%. Nighttime vessel and construction area lighting during construction of the Proposed Action would be limited in duration and cease when construction is complete. Atmospheric and environmental conditions would influence visibility and perceivability from sensitive viewing locations. Cumulatively, when combined with other past, present, and reasonably foreseeable projects, the Proposed Action could result in long-term minor to major adverse visual impacts on non-historic sensitive viewing locations.

Onshore

Onshore construction and installation would incrementally add an O&M facility and an interconnection facility to the No Action alternative. These new onshore structures and night lighting sources would be constructed in existing industrial areas, would use or replace existing structures, and would be expected to result in negligible to moderate visual impacts to sensitive receptors. Similarly, future port upgrades required to service the offshore wind industry would also be expected to result in similar negligible to moderate visual impacts to sensitive receptors. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in long-term negligible to moderate adverse cumulative impacts to daytime and nighttime visually sensitive viewing areas from structures and night lighting sources.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would introduce visible structures and navigation and aviation lighting to the geographic analysis area. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **major** and short term to long term. However, BOEM expects the overall impact on non-historic visual resources from the Proposed Action alone to be **moderate**, as the overall effect would be notable but the resource would be expected to return to pre-project conditions after conceptual decommissioning.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate**. BOEM anticipates that the overall impacts associated with the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in **moderate** impacts to non-historic visual resources. BOEM made this call because the overall effect would be notable but the resource would be expected to return to pre-project conditions after conceptual decommissioning.

3.5.9.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would not affect Project onshore activities; therefore, effects would be the same as the Proposed Action: negligible to major. Offshore, this alternative could result in decreased visual impacts related to nighttime aviation and navigation lighting because there would be fewer WTGs. All other visual impacts related to construction and installation, O&M, and conceptual decommissioning of onshore and nearshore components would be similar to the Proposed Action and result in similar short- and long-term negligible to major adverse visual impacts to daytime and nighttime viewers.

Cumulative Impacts

The Transit alternative would not affect Project onshore activities. Offshore, the Transit alternative would incrementally add sources of visual impacts (structures, lighting) to the geographic analysis area at quantities and durations similar to the Proposed Action. Therefore, the overall cumulative impacts of the Transit alternative on visual resources when combined with past, present, and reasonably foreseeable activities would have long-term negligible to major impacts.

If the Transit alternative is implemented, the WTGs associated with other reasonably foreseeable offshore wind projects may need to be relocated or eliminated within lease areas to avoid the informal or undesignated transit lanes. If these shifts result in WTG reductions that further reduce views of structures and/or nighttime lighting, these effects could decrease visual impacts relative to the Proposed Action.

Conclusions

Although the Transit alternative would reduce the number of WTGs visible in the seascape, which would have an associated reduction in visible structures with navigation and aviation lighting, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **major**.

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

3.5.9.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

This alternative would not affect Project onshore activities; therefore, effects would be the same as the Proposed Action: negligible to major.

Offshore, this alternative could result in decreased visual impacts related to nighttime navigation lighting because there would be fewer WTGs and associated nighttime lighting. All other visual impacts related to construction and installation, O&M, and conceptual decommissioning of onshore and nearshore components would be similar to the Proposed Action and would result in similar short- and long-term negligible to major adverse visual impacts to daytime and nighttime viewers.

Cumulative Impacts

This alternative would not affect Project onshore activities. Offshore, this alternative would incrementally add sources of visual impacts (structures, lighting) at quantities and durations similar to the Proposed Action. Therefore, the overall cumulative impacts of the alternative on visual resources when combined with past, present, and reasonably foreseeable activities would have long-term negligible to major impacts.

Conclusions

Although the Habitat alternative would reduce the number of WTGs visible in the seascape, which would have an associated reduction in visible structures with navigation and aviation lighting, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **major**.

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

3.5.9.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives, although some variation in impacts is acknowledged due to fewer WTGs being constructed. Although the number of WTGs varies slightly, BOEM expects that non-historic visual impacts would range from **negligible** to **major** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ, as they do here. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.5.9.4 Mitigation

BOEM could require installation of an ADLS as a mitigation measure. The use of ADLS technology would reduce long-term, negligible to major adverse visual impacts to non-historic properties from night-time lighting because short-duration synchronized flashing of the ADLS would have substantially fewer visual impacts at night than the standard continuous, medium-intensity red strobe light aircraft warning systems due to the short duration of activation.

CHAPTER 4. REQUIRED DISCLOSURES

4.1 UNAVOIDABLE ADVERSE IMPACTS

Table 4.1.1-1 summarizes unavoidable adverse impacts for each analyzed resource, subject to applicable EPMs (see Table G-1 in Appendix G). Table 4.1.1-1 does not include potential additional mitigation measures that could avoid or further minimize or mitigate Project impacts. Please see the individual resource discussions in Chapter 3 for detailed analyses.

4.1.1 Potential Unavoidable Adverse Impacts of the Action Alternatives

Table 4.1.1-1. Potential Unavoidable Adverse Impacts of the Action Alternatives

Resource Area	Potential, Unavoidable Adverse Impact of the Action Alternatives
Air quality	Impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation
Water quality	Increase in erosion, turbidity and sediment resuspension, and inadvertent spills during construction and installation, O&M, and conceptual decommissioning
Bats	Displacement and avoidance behavior due to habitat loss and alteration, equipment noise, and vessel traffic Individual mortality due to collisions with operating WTGs
Benthic habitat, EFH, invertebrates, and finfish	Increase in suspended sediments and resulting effects due to seafloor disturbance Habitat quality impacts including reduction in habitat as a result of seafloor surface alterations Displacement, disturbance, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, sediment deposition, and electromagnetic fields Individual mortality due to construction and installation, O&M, and conceptual decommissioning Conversion of soft-bottom habitat to new hard-bottom habitat
Birds	Displacement and avoidance behavior due to habitat loss and alteration, equipment noise, and vessel traffic Individual mortality due to collisions with operating WTGs
Marine mammals	Displacement, disturbance, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, and sediment deposition during construction and installation and O&M Temporary loss of acoustic habitat and increased potential for vessel strikes
Terrestrial and coastal habitats and fauna	Displacement and avoidance behavior from habitat loss and alteration and from equipment noise Individual mortality from collisions with vehicles or construction equipment Short-term habitat alteration and increased invasive species risk
Sea turtles	Disturbance, displacement, and avoidance behavior due to habitat loss and alteration, equipment noise, vessel traffic, increased turbidity, sediment deposition, and electromagnetic fields
Wetlands and other WOTUS	Increase in soil erosion, sedimentation, and discharges and releases from land disturbance during construction and installation, O&M, and conceptual decommissioning
Commercial fisheries and for-hire recreation fishing	Disruption to access or temporary restriction in port access or harvesting activities due to construction of offshore Project elements Disruption to harvesting activities during operations of offshore wind facility Changes in vessel transit and fishing operation patterns Changes in risk of gear entanglement or target species
Cultural resources	Impacts to unidentified or undefined submerged marine cultural resources from Project construction and installation and O&M Impacts to terrestrial cultural resources and to the viewshed from Project construction and installation and O&M
Demographics, employment, and economics	No unavoidable adverse impacts
Environmental justice	Changes to air quality, water quality, land use and coastal infrastructure, and commercial fisheries and for-hire recreational fishing that are disproportionately borne by minority or low-income populations from Project construction and installation, O&M, and conceptual decommissioning

Resource Area	Potential, Unavoidable Adverse Impact of the Action Alternatives
Land use and coastal infrastructure	Land use disturbance due to construction as well as effects due to noise, vibration, and travel delays
Navigation and vessel traffic	Changes in vessel transit patterns
Other marine uses	Changes in access to marine mineral resource, and cable placement Disruption of scientific surveys, radar systems, military, and aviation traffic
Recreation and tourism	Disruption of coastal recreation activities during onshore construction, such as beach access Viewshed effects from the WTGs altering enjoyment of marine and coastal recreation and tourism activities Disruption to access or temporary restriction of in-water recreational activities from construction of offshore Project elements Hindrances to some types of recreational fishing from the WTGs during operation
Visual resources	Change in scenic quality of landscape and seascape

4.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the short-term loss of timber productivity in forested areas that are kept clear for a power line or a road. Table 4.2.1-1 summarizes irreversible or irretrievable effects for each analyzed resource, subject to applicable EPMs. Table 4.2.1-1 does not include potential additional mitigation measures that could avoid or further minimize or mitigate Project impacts. Chapter 3 provides a detailed discussion of effects associated with the Project.

4.2.1 Irreversible and Irretrievable Commitment of Resources by Resource Area

Table 4.2.1-1. Irreversible and Irretrievable Commitment of Resources by Resource Area

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Air quality	No	No	BOEM expects air emissions to be in compliance with permits regulating air quality standards, and emissions would be temporary during construction activities. If the Proposed Action displaces fossil-fuel energy generation, overall improvement of air quality would be expected.
Water quality	No	No	BOEM does not expect activities to cause loss of or major impacts on existing inland waterbodies or wetlands. Turbidity and other water quality impacts in the marine and coastal environment would be short term, with the rare exception of a major spill.
Bats	No	No	Based on the healthy populations of bat species more susceptible to collision with operating WTGs, and assuming implementation of time-of-year restrictions for tree clearing, displacement, avoidance behavior, and individual mortality due to collisions with operating WTGs are not expected to be irreversible or irretrievable.
Benthic habitat, EFH, invertebrates, and finfish	No	No	Although local mortality could occur, BOEM does not anticipate population-level impacts. The Project could alter habitat during construction and operations but could restore the habitat after conceptual decommissioning.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Birds	No	No	Based on the healthy populations of bird species more susceptible to collision with operating WTGs, displacement, avoidance behavior, and individual mortality due to collisions with operating WTGs are not expected to be irreversible or irretrievable. Irreversible and irretrievable impacts on bird species could occur if one or more individuals of species listed under the ESA were injured or killed. However, ongoing consultation with the USFWS would identify mitigation measures that would reduce or eliminate the potential for such impacts on listed species.
Marine mammals	No	Yes	Irreversible impacts on marine mammals could occur if one or more individuals of species listed under ESA were injured or killed; however, mitigation measures would reduce or eliminate the potential for such impacts on listed species. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of displacement from the Lease Area.
Terrestrial and coastal habitats and fauna	No	No	Although local mortality could occur, BOEM does not anticipate population-level impacts on other terrestrial and coastal fauna. The Project could alter habitat during construction and operations but could restore the habitat after conceptual decommissioning.
Sea turtles	No	Yes	Irreversible impacts on sea turtles could occur if one or more individuals of species listed under the ESA were injured or killed; however, mitigation measures would reduce or eliminate the potential for impacts on listed species. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of displacement from the Lease Area.
Wetlands and other WOTUS	No	No	BOEM does not expect activities to cause loss of or major impacts on existing wetlands or other WOTUS.
Commercial fisheries and for-hire recreation fishing	No	Yes	Based on the anticipated duration of construction and installation and O&M, BOEM does not anticipate impacts on commercial fisheries to result in irreversible impacts. The Project could alter habitat during construction and operations, limit access to fishing areas during construction, or reduce vessel maneuverability during operations. However, the conceptual decommissioning of the Project would reverse those impacts. Irretrievable impacts could occur due to the loss of use of fishing areas at an individual level.
Cultural resources	Yes	Yes	Although unlikely, unanticipated removal or disturbance of previously unidentified cultural resources onshore and offshore could result in irreversible or irretrievable impacts.
Demographics, employment, and economics	No	No	Based on the anticipated duration of construction and installation and O&M, BOEM does not anticipate that contractor needs, housing needs, and supply requirements would lead to an irretrievable loss of workers for other projects or increase housing and supply costs.
Environmental justice	No	No	Potential environmental justice impacts, if any, would be short term and localized.
Land use and coastal infrastructure	Yes	Yes	Land use required for construction and operation activities, such as the land proposed for the interconnection facility, could result in a minor irreversible impact. Construction activities could result in a minor irretrievable impact due to the temporary loss of use of the land for otherwise typical activities. Onshore facilities may or may not be decommissioned.
Navigation and vessel traffic	No	Yes	Based on the anticipated duration of construction and installation and O&M, BOEM does not anticipate impacts on vessel traffic to result in irreversible impacts. Irretrievable impacts could occur due to changes in transit routes, which could be less efficient during the life of the Project.
Other marine uses	No	No	BOEM does not anticipate the potential impacts to be irreversible or irretrievable.
Recreation and tourism	No	No	Construction activities near the shore could result in a minor, temporary loss of use of the land for recreation and tourism purposes, but these impacts would not be irreversible or irretrievable.
Visual resources	No	Yes	Viewshed changes would persist for the life of the Project, until conceptual decommissioning is complete.

4.3 RELATIONSHIP BETWEEN THE SHORT-TERM USE OF THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The CEQ's NEPA implementing regulations (40 CFR 1502.16) require that an EIS address the relationship between short-term use of the environment and the potential impacts of such use on the maintenance and enhancement of long-term productivity. Such impacts could occur as a result of a reduction in the flexibility to pursue other options in the future, or assignment of a specific area (land or marine) or resource to a certain use that would not allow other uses, particularly beneficial uses, to occur at a later date. An important consideration when analyzing such effects is whether the short-term environmental effects of the action would result in detrimental effects to long-term productivity of the affected areas or resources.

As assessed in Chapter 3, BOEM anticipates that most of the potential adverse effects associated with the Proposed Action would occur during construction activities, and would be temporary and minor or moderate as defined in Sections 3.3–3.5. Table 4.1.1-1 and Table 4.2.1-1 identify unavoidable, irretrievable, or irreversible impacts that would be associated with the Project. However, BOEM expects most of the marine and onshore environments to return to normal long-term productivity levels after Project conceptual decommissioning. Based on these findings, BOEM also anticipates that the Proposed Action would not result in impacts that would significantly narrow the range of future uses of the environment.

Additionally, the Project would provide several long-term benefits:

- Promotion of clean and safe development of domestic energy sources and clean energy job creation
- Promotion of renewable energy to help ensure geopolitical security; combat climate change; and provide electricity that is affordable, reliable, safe, secure, and clean
- Delivery of power to the South Fork of Suffolk County, Long Island, to contribute to New York's renewable energy requirements
- Increased habitat for certain fish species

APPENDIX A

Required Environmental Permits and Consultations

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REQUIRED ENVIRONMENTAL PERMITS AND CONSULTATIONS

Introduction

This appendix discusses required permitting and public, agency, and tribal involvement in the preparation of the *South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement* (EIS). This involvement included formal consultations, cooperating agency exchanges, and a public scoping comment period.

One Federal Decision (Executive Order 13807)

Presidential Executive Order (EO) 13807 (Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure) addresses the need for a coordinated, predictable, and transparent federal environmental review and authorization process for infrastructure projects while protecting public health, safety, and the environment. EO 13807 establishes an approach called "One Federal Decision" for use with major infrastructure projects. The *Memorandum of Understanding Implementing One Federal Decision Under Executive Order 13807* outlines the roles and responsibilities of the lead, cooperating, and participating agencies (U.S. Department of the Interior et al. 2018).

- The lead agency (Bureau of Ocean Energy Management [BOEM]) is responsible for organizing the federal environmental review and authorization processes for a proposed project, including the preparation of a single EIS and record of decision (ROD) for the project in coordination with the other federal cooperating agencies.
- Cooperating agencies are those federal agencies with authorizations and who are coordinating and synchronizing their authorization reviews with the lead agency's development of the EIS and issuance of the ROD.
- Participating agencies are other federal agencies participating in the EIS and/or other authorizations for the proposed project.

Authorizations and permits are listed in Table A-1 and cooperating or participating federal agencies are described below. BOEM has completed the following One Federal Decision milestones to-date for the South Fork Wind Farm and South Fork Export Cable Project (the Project):

- Permitting timetable: August 21, 2020
- Purpose and need: August 28, 2020
- Alternatives carried forward for evaluation: September 18, 2020

Other Federal and State Review

Table A-1 provides a discussion of other federal and state reviews required, including legal authority, jurisdiction of the agency, and the regulatory process involved.

Table A-1. Cooperating Agencies, Required Environmental Permits, and Consultations for the Project

Agency/Regulatory Authority	Cooperating Agency Status	Permit/Approval	Status
Federal			
BOEM	Lead federal agency	Construction and operations plan approval	Originally filed on June 29, 2018; revisions submitted on May 24, 2019, and again in February 2020
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service	Cooperating agency	Incidental Harassment Authorization or Letter of Authorization	To be filed (TBF)
U.S. Department of Defense, U.S. Army Corps of Engineers	Cooperating agency	Clean Water Act (CWA) Section 404/Rivers and Harbors Act of 1899 Section 10 Individual Permit	TBF
U.S. Department of Homeland Security, U.S. Coast Guard	Cooperating agency	Private Aids to Navigation authorization	TBF
U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement	Cooperating agency	None	Not applicable
U.S. Environmental Protection Agency	Cooperating agency	Outer Continental Shelf Air Permit	Filed on February 1, 2019
State (portions of the Project within state jurisdiction)*			
Commonwealth of Massachusetts Office of Coastal Zone Management	Cooperating agency	Concurrence with the Coastal Zone Management Program Federal Consistency Determination pursuant to the following: Coastal Zone Management Act (16 United States Code [USC] 1451 et seq., 15 Code of Federal Regulations [CFR] 930; 30 CFR 585.611(b), 627(b)) Massachusetts General Law (21A, Subpart 4A) Massachusetts Coastal Zone Management Program Policies (310 Code of Massachusetts Regulations 20.00 and 21.00)	Filed on October 22, 2018
State of Rhode Island Coastal Resources Management Council	Cooperating agency	Coastal Zone Management Act Consistency Certification	Filed on October 22, 2018
State of Rhode Island Department of Environmental Management	Cooperating agency	None	Not applicable
New York Department of State, Division of Coastal Resources	None	Coastal Zone Management Act (16 USC 1451 et seq.) State Executive Law Article 42, 19 New York Codes, Rules and Regulations (NYCRR) Part 600	Filed on October 22, 2018

Agency/Regulatory Authority	Cooperating Agency Status	Permit/Approval	Status
New York State Department of Environmental Conservation	None	State Pollutant Discharge Elimination System General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity, pursuant to 6 NYCRR 750–757	TBF
		Water quality certification pursuant to Environmental Conservation Law (ECL) Article 15 (Water Resources) Title 5 (Protection of Water) (CWA Section 401, 16 USC 1451)	TBF
		Individual permit may be required for construction greater than 1 acre at the substation pursuant to ECL Article 17 (Water Pollution Control) Title 8 (State Pollutant Discharge Elimination System) (CWA Section 402).	TBF
		ECL Article 24 (Freshwater Wetlands): A freshwater wetlands permit may apply to onshore transmission line components near freshwater wetland resources.	TBF
		ECL Article 25 (Tidal Wetlands): Permits for activities that will alter tidal wetlands or the adjacent areas. The adjacent areas extend up to 300 feet inland from the wetland boundary.	TBF
		ECL Article 70 (Uniform Procedures): The construction or placement of a structure, or any action or use of land that materially alters the condition of land, including grading, excavating, dumping, mining, dredging, filling, or any disturbance of soil is a regulated activity requiring a coastal erosion management permit.	TBF
New York State Department of Public Service	None	Certificate of Environmental Compatibility and Public Need, pursuant to Article VII of the New York Public Service Law (16 NYCRR 85 through 88), Article 15 (6 NYCRR 608 and 621), and Article 25 (6 NYCRR 661)	Q1 2020
		Environmental Management and Construction Plan, pursuant to Article VII (16 NYCRR 85 through 88)	TBF
		Section 68 Petition (permission to exercise the grants of municipal rights), pursuant to Article VII (Section 68(1))	TBF
		Water Quality Certification, pursuant to Section 401 of the CWA and Implementing Regulations (6 NYCRR 701, 702, 704, 754 and 800–941)	TBF
New York State Department of Transportation - Region 10	None	Utility Work Permit - Form Perm 32, pursuant to New York State Highway Law (Article 3, design2)	3–6 months prior to construction start
New York State Office of General Services, Bureau of Land Management	None	Grant to use New York State Lands Under Water, pursuant to New York State Public Lands Law (Article 2, Section 3, Subsection 2)	Q1 2020
New York Office of General Services	None	New York Public Lands Law, Article 2, Section 3 responsible for the granting of easements, rights-of-way or other permissive instruments to grant permission for the use of the underwater lands.	TBF

Agency/Regulatory Authority	Cooperating Agency Status	Permit/Approval	Status
Local*			
Town of East Hampton	Cooperating agency	Township of East Hampton Section 246-2 – Placement of boats, floats, moorings and anchors	TBF
Trustees of the Freeholders and Commonalty of the Town of East Hampton	Cooperating agency	None	Not applicable
Village of East Hampton	None	Coastal Erosion Permit	TBF
		Excavation/Utility Work Permit	TBF
		Design and Site Plan Application	TBF

* State and local agencies are considered cooperating agencies under the National Environmental Policy Act, but not One Federal Decision.

Cooperating Agencies

As part of the National Environmental Policy Act (NEPA) process, BOEM invited other federal agencies and state, tribal, and local governments to consider becoming cooperating agencies in the preparation of the EIS. According to Council on Environmental Quality guidelines, qualified agencies and governments are those with "jurisdiction by law" or "special expertise" (40 Code of Federal Regulations [CFR] 1501.6). BOEM asked potential cooperating agencies to consider their authority and capacity to assume the responsibilities of a cooperating agency and to be aware that an agency's role in the environmental analysis neither enlarges nor diminishes the final decision-making authority of any other agency involved in the NEPA process. BOEM also provided potential cooperating agencies participating in the FAST-41 process with a written summary of expectations for cooperating agencies, including time schedules and critical action dates, milestones, responsibilities, scope, detail of cooperating agencies' contributions, and availability of pre-decisional information.

Cooperating agency status is provided in Table A-1. More specific details regarding federal agency roles and expertise are described below.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) is serving as a cooperating agency pursuant to 40 CFR 1501.6 because the scope of the Proposed Action and alternatives involves activities that could affect marine resources under their jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to the Marine Mammal Protection Act, as amended (MMPA; 16 United States Code [USC] 1361 et seq.); the regulations governing the taking and importing of marine mammals (50 CFR 216); the Endangered Species Act (ESA; 16 USC 1531 et seq.); and the regulations governing the taking, importing, and exporting of threatened and endangered species (50 CFR 222–226). In accordance with 50 CFR 402, NMFS also serves as the consulting agency under Section 7 of the ESA for federal agencies proposing actions that may affect marine resources listed as threatened or endangered. NMFS has additional responsibilities to conserve and manage fishery resources of the United States, which include the authority to engage in consultations with other federal agencies pursuant to the Magnuson-Stevens Fishery Conservation and Management Act and 50 CFR 600 when proposed actions may adversely affect essential fish habitat (EFH). MMPA is the only authorization for NMFS that requires NEPA compliance, which will be met via adoption of BOEM's EIS and issuance of the ROD.

Bureau of Safety and Environmental Enforcement

The Bureau of Safety and Environmental Enforcement (BSEE) is serving as a cooperating agency pursuant to 40 CFR 1501.6 because the scope of the Proposed Action and alternatives involves activities that could affect marine resources under their jurisdiction by law and special expertise.

U.S. Coast Guard

The U.S. Coast Guard is serving as a cooperating agency pursuant to 40 CFR 1501.6 because the scope of the Proposed Action and alternatives involves activities that could affect navigation and safety issues that fall under their jurisdiction by law and special expertise.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) is serving as a cooperating agency pursuant to 40 CFR 1501.6 because the scope of the Proposed Action and alternatives involves activities that could affect resources under their jurisdiction by law and special expertise. The EPA is responsible for issuing an Outer Continental Shelf (OCS) permit for the Project under the Clean Air Act.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) is serving as a cooperating agency pursuant to 40 CFR 1501.6 because the scope of the Proposed Action and alternatives involves activities that could affect resources under their jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. As an offshore wind energy project, the Project needs to be situated offshore in the water. Consequently, the fill activities associated with the Project, which consist of the inter-array cable armoring at the base of the wind turbine generator (WTG) foundations, protective cable armoring for the South Fork Export Cable, and construction of a temporary cofferdam, are water dependent. Issuance of Section 10 or Section 404 permits requires NEPA compliance, which will be met via adoption of BOEM's EIS and issuance of the ROD.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is serving as a participating agency for the Project. The USFWS also serves as the consulting agency under Section 7 of the ESA for federal agencies proposing actions that may affect terrestrial resources listed as threatened or endangered.

Consultations

The following section provides a summary and status of BOEM consultations as part of the Project (ongoing, complete, and the opinion or finding of each consultation). Section 1.3.1 of the construction and operations plan (COP) provides a discussion of other federal and state consultation processes being led by Deepwater Wind South Fork, LLC (DWSF) (Jacobs Engineering Group Inc. [Jacobs] 2020).

Coastal Zone Management Act

The Coastal Zone Management Act requires that federal actions within and outside the coastal zone that have reasonably foreseeable effects on any coastal use or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally approved coastal management program. On October 22, 2018, DWSF submitted a federal consistency certification with the New York State Department of State – Division of Coastal Resources, Commonwealth of Massachusetts Office of Coastal Zone Management, and the State of Rhode Island Coastal Resources Management Council per 15 CFR 930.76 Subpart E. DWSF and these state agencies have mutually agreed to stay the consistency decision date; the latest stay is as follows for each state:

- Massachusetts – consistency determination on or before April 25, 2021
- New York – stay will expire on December 22, 2020
- Rhode Island – consistency determination on or before January 31, 2021

The COP provides the necessary data and information under 15 CFR 930.58 (Jacobs 2020). The states' concurrence is required before BOEM could approve, or approve with conditions, the COP per 30 CFR 585.628(f) and 15 CFR 930.130(1).

Endangered Species Act

Section 7(a)(2) of the ESA of 1973, as amended (16 USC 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency could affect a protected species or its critical habitat, that agency is required to consult with either the NMFS or the

USFWS, depending upon the jurisdiction of the services. Pursuant to 50 CFR 402.07, BOEM has accepted designation as the lead federal agency for the purposes of fulfilling interagency consultation under Section 7 of the ESA for listed species under the jurisdiction of NMFS and USFWS. BOEM will consult on the proposed activities considered in this EIS with both NMFS and USFWS for listed species under their respective jurisdictions. Draft biological assessments were submitted to NMFS and USFWS on January 8, 2020. BOEM anticipates completing the USFWS consultation by May 23, 2021, and the NMFS consultation by July 8, 2021.

Government-to-Government Consultation and Other Tribal Coordination

EO 13175 commits federal agencies to engage in government-to-government consultation with tribes, and Secretarial Order No. 3317 requires U.S. Department of the Interior agencies to develop and participate in meaningful consultation with federally recognized tribes where a tribal implication may arise. A June 29, 2018, memorandum outlines BOEM's current tribal consultation policy (BOEM 2018). This memorandum states that "consultation is a deliberative process that aims to create effective collaboration and informed Federal decision-making" and is in keeping with the spirit and intent of the National Historic Preservation Act (NHPA) and NEPA, executive and secretarial orders, and U.S. Department of the Interior policy (BOEM 2018). BOEM implements tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and engagement.

BOEM conducted government-to-government consultations with the Narragansett Indian Tribe, the Mashantucket Pequot Tribal Nation, and the Mohegan Tribe of Indians of Connecticut in an overview of planned offshore wind development projects off southern New England, including the South Fork project, in August 2018.

In October 2018, individual email invitations to participate in the scoping process for this EIS were sent to the federally recognized Narragansett Indian Tribe, Mashpee Wampanoag Tribe, Mashantucket Pequot Tribal Nation, Mohegan Tribe of Indians of Connecticut, and Shinnecock Indian Nation and the state-recognized Chappaquiddick Tribe of the Wampanoag Nation in Massachusetts and Unkechaug Nation in New York. Although no tribal comments were received during the scoping period, draft copies of the EIS will be provided to the tribes for their review and comment. Federally recognized tribes may choose to become cooperating agencies after review of the draft EIS. BOEM also conducted government-to-government consultations with the Mashpee Wampanoag Tribe in February 2019.

Between January 15 and 17, 2020, BOEM met again with the Mohegan Tribe of Indians of Connecticut, the Mashantucket Pequot Tribal Nation, and the Narragansett Indian Tribe to discuss multiple BOEM actions, including the Proposed Action. Tribal concerns include possible effects on marine mammals, other marine life, and the Nantucket Sound Traditional Cultural Property (TCP). One tribe emphasized the importance of open sea views to the east during sunrise, as well as the night sky, while others emphasized their long historical association with the sea and islands off southern New England and the critical role of fishing and shellfish gathering. All of the tribes emphasized the importance of understanding the interconnected nature of the human world, the sea, and the living things in both worlds.

On July 21, 2020, BOEM and the BSEE conducted three separate meetings with the Mashantucket Pequot Tribal Nation, the Wampanoag Tribe of Gay Head (Aquinnah), and the Mashpee Wampanoag Tribe. These meetings generally focused on developing mitigation measures for offshore wind project impacts, funding, and best practices. Tribal concerns included project effects and layout, a desire to redefine the Nantucket Sound TCP boundaries, recommendations for mitigation measures, aboriginal rights and titles, communication with developers, and cumulative effects of the present and future offshore wind projects in the area.

On July 27, 2020, BOEM held a government-to-government meeting with the Mashantucket Pequot Tribal Nation, Mashpee Wampanoag Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah). Concerns voiced by the tribes included site avoidance, tribal staffing, best practices, and additional tribal involvement. This meeting concluded with some action items for BOEM, including providing additional information on marine life and electrocution risk and terrestrial and marine analysis methods, a review of previous documents, scheduling a future meeting concerning environmental studies with the National Oceanic and Atmospheric Administration (NOAA), and following up with the Advisory Council on Historic Preservation (ACHP) regarding sharing the location of marine archaeological data with consulting parties during NHPA Section 106 reviews.

On August 20, 2020, BOEM consulted with the Delaware Tribe, Mashantucket Pequot Tribal Nation, Mashpee Wampanoag Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah) to discuss the impacts of offshore wind developments on marine mammals. This included an overview of the consultation process and environmental review, the BOEM Environmental Studies program and process, existing and upcoming studies related to the North Atlantic right whales, and the marine mammal analysis and findings noted in the supplemental EIS. The meeting concluded with some action items for BOEM, including to provide the above-referenced consulting parties with additional reports and to research funding options to provide tuition assistance for tribal members interested in participating in the Protected Species Observer training certificate program.

BOEM continues to consult with these and other tribes on developments in offshore wind. Additional government-to-government consultations are planned for the future.

As part of COP development, DWSF also conducted prior coordination with engaged tribes, State Historic Preservation Officers, and other stakeholders identified as having potential to inform the design process (see COP Table 1.4-1).

Marine Mammal Protection Act

The MMPA was enacted to protect and conserve marine mammals and established a general moratorium on the taking and importation of marine mammals, with certain enumerated exceptions. Unless an exception applies, the act prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 USC 1372(a)(1), (a)(2)). Section 101(a) of the act provides the prohibitions for the incidental taking of marine mammals. The incidental take of a marine mammal falls under three categories: mortality, serious injury, or harassment (i.e., injury and/or disruption of behavioral patterns). Sections 101(a)(5)(A) and (D) of the act provide the exceptions to the prohibition on take, which give NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals, provided certain determinations are made and statutory and regulatory procedures are met. Entities seeking to obtain authorization for the incidental take of marine mammals under NMFS jurisdiction must submit such a request (in the form of an application). Incidental take authorizations (ITA) may be issued as either 1) regulations and associated letters of authorization or 2) incidental harassment authorizations when a proposed action will not result in a potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. NMFS also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals (50 CFR 216) and produced Office of Management and Budget (OMB)–approved application instructions (OMB Number 0648-0151) that prescribe the procedures necessary to apply for permits. All applicants must comply with these regulations and application instructions in addition to the provisions of the MMPA. Once NMFS determines an application is adequate and complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on the affected marine mammal species or stocks and an unmitigable impact on their availability for taking for subsistence uses. NMFS must also prescribe the "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, and on the availability of those species or stocks for subsistence uses, as well as monitoring and reporting requirements.

NMFS received an application for an ITA from DWSF on September 15, 2020. As outlined above, NMFS reviews applications to determine whether to issue an authorization for the activities described in the application. NMFS will publish a proposed ITA in the *Federal Register* for public review once the appropriate determinations are made.

National Historic Preservation Act

Section 106 of the NHPA (54 USC 306108 et seq.) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties and afford the ACHP an opportunity to comment. BOEM has determined that approving a COP constitutes an undertaking subject to Section 106 of the NHPA. The construction of WTGs, installation of electrical support cables, and development of staging areas are ground- or seabed-disturbing activities that could directly affect archaeological resources. The presence of WTGs could also introduce visual elements out of character with the historic setting of historic structures or landscapes; in cases where historic setting is a contributing element of historic properties' eligibility for the NRHP, the Project could affect those historic properties.

BOEM is using the public scoping process to fulfill the public involvement requirements under NEPA as well as to seek public involvement in its Section 106 review, pursuant to 36 CFR 800.2(d)(3).

BOEM initiated review under Section 106 of the NHPA on April 7, 2019, with letters sent to identify consulting parties for this undertaking. Letters were then sent on June 29, 2020, to initiate consultation with those parties previously identified for the undertaking. Consultation is ongoing to define the area of potential effect (APE) for the Project, to identify historic properties within the APE, and to assess effects of the undertaking on identified historic properties. BOEM held an initial consultation meeting with consulting parties on September 29, 2020. If determined appropriate, BOEM will develop a memorandum of agreement with consulting parties to resolve adverse effects to NRHP-listed or NRHP-eligible properties resulting from the Project.

The NEPA and NHPA process will be coordinated by BOEM as the evaluation of the COP proceeds, with a summary included in the ROD for the final EIS.

Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation Management Act, federal agencies are required to consult with NMFS on any action that may result in adverse effects on EFH. NMFS regulations implementing the EFH provisions of the act can be found at 50 CFR 600. As provided for in 50 CFR 600.920(b), BOEM has accepted designation as the lead agency for the purposes of fulfilling EFH consultation obligations under Section 305(b) of the act. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with NMFS. BOEM has developed an EFH assessment (BOEM 2020) concurrent with this EIS and will transmit the findings of that EFH assessment to NMFS on January 8, 2021. BOEM's EFH assessment determined that the Proposed Action would not adversely affect quality and quantity of EFH for several species of managed fish. BOEM and NMFS anticipate completing the EFH consultation by June 7, 2021.

Development of Draft Environmental Impact Statement

This section provides an overview of the development of the EIS, including public scoping, cooperating agency involvement, and distribution of the EIS for public review and comment.

Scoping

On October 19, 2018, BOEM issued a notice of intent (NOI) to prepare an EIS consistent with the regulations implementing NEPA (42 USC 4321 et seq.) to assess the potential impacts of the Proposed Action and alternatives (83 *Federal Register* 53104). The notice of intent began the public scoping process for identifying issues and potential alternatives for consideration in the EIS. BOEM held three public scoping meetings near the Project to solicit feedback and identify issues and potential alternatives for consideration in the EIS. Throughout the scoping process, federal agencies; state, local, and tribal governments; and the general public had the opportunity to help BOEM identify potential significant resources and issues, impact-producing factors, reasonable alternatives (e.g., size, geographic, seasonal, or other restrictions on construction and siting of facilities and activities), and potential mitigation measures to be analyzed in the EIS, as well as provide additional information. The formal scoping period lasted from October 19 through November 10, 2018.

BOEM accepted comment submissions on the NOI via the following mechanisms:

- Electronic submissions received via www.regulations.gov on docket number BOEM-2018-0010
- Electronic submissions received via email to a BOEM representative
- Hard copy comment letters submitted to BOEM via traditional mail
- Hard copy comment cards and/or letters received during each of the public scoping meetings
- Comments submitted verbally at each of the public scoping meetings

BOEM held three public scoping meetings at the following locations and dates:

- November 5, 2018, American Legion Post 419, Amagansett, New York
- November 7, 2018, UMASS Dartmouth SMAST East, New Bedford, Massachusetts
- November 8, 2018, Narragansett Community Center, Narragansett, Rhode Island

Summary of Scoping Comments

BOEM reviewed and considered, as appropriate, all scoping comments in the development of the draft EIS and used the comments to identify alternatives for analysis. A scoping summary report (SWCA 2019) summarizing the submissions received and the methods for analyzing them is available on BOEM's website at https://www.boem.gov/South-Fork/. In addition, all public scoping submissions received can be viewed online at http://www.regulations.gov by typing "BOEM-2018-0010" in the search field. As detailed in the scoping summary report, the resource areas or NEPA topics most referenced in the scoping comments include alternatives; commercial fisheries and for-hire recreation fishing; finfish, invertebrates, and EFH; NEPA process and engagement; and socioeconomics.

Distribution of the Draft Environmental Impact Statement for Review and Comment

This EIS is available in electronic form for public viewing at https://www.boem.gov/South-Fork/. Hard copies and/or digital versatile disks (DVDs) of the EIS can be requested by contacting the Program Manager, Office of Renewable Energy in Sterling, Virginia. Publication of this draft EIS initiates a 45-day comment period where government agencies, members of the public, and interested stakeholders can provide comments and input. BOEM will accept comments in any of the following ways:

- In hard copy form, delivered by hand or by mail, enclosed in an envelope labeled “South Fork COP EIS” and addressed to Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166. Comments must be received or postmarked no later than February 22, 2021.
- Through the regulations.gov web portal by navigating to http://www.regulations.gov and searching for docket number “BOEM-2020-0066.” Click the “Comment Now!” button to the right of the document link. Enter your information and comment, then click “Submit.”
- By attending one of the EIS public meetings at the locations and dates listed in the notice of availability and providing written or verbal comments.

BOEM will use comments received during the public comment period to inform its preparation of the final EIS, as appropriate. EIS notification lists for the Project are provided in Tables A-2 through A-4.

NOTIFICATION LIST

Table A-2. Federal Agencies

Agency	Contact	Location
Cooperating Federal Agencies		
EPA	Tim Timmermann	Boston, Massachusetts
NOAA, NMFS	Sue Tuxbury	Gloucester, Massachusetts
U.S. Coast Guard	George Detweiler	Washington, D.C.
U.S. Coast Guard	Michele DesAutels	Boston, Massachusetts
U.S. Coast Guard	Sarah Geoffrion	East Providence, Rhode Island
U.S. Department of the Interior, BSEE	Jordan Creed	Sterling, Virginia
USACE	Joshua Helms	Concord, Massachusetts
USACE	Naomi Handell	New York
Participating Federal Agencies		
USFWS	Tom Chapman	Concord, New Hampshire

Table A-3. State and Local Agencies or Other Interested Parties

Agency	Contact	Location
Cooperating State and Local Agencies		
Commonwealth of Massachusetts Office of Coastal Zone Management	Robert Beori	Boston, Massachusetts
State of Rhode Island Coastal Resources Management Council	Jeff Willis	Wakefield, Rhode Island
State of Rhode Island Department of Environmental Management	Janet Coit	Providence, Rhode Island
Trustees of the Freeholders and Commonalty of the Town of East Hampton	Francis Bock	Amagansett, New York
Libraries		
Amagansett Free Library	–	Amagansett, New York
East Hampton Library	–	East Hampton, New York
Hampton Library	–	Southampton, New York
Maury Loontjens Memorial Library	–	Narragansett, Rhode Island
New Bedford Public Library	–	New Bedford, Massachusetts

Table A-4. Tribes and Native Organizations

Tribes and Native Organizations	State
Mashantucket Pequot Tribal Nation	Connecticut
Mashpee Wampanoag Tribe	Massachusetts
Mohegan Tribe of Indians of Connecticut	Connecticut
Narraganset Indian Tribe	Rhode Island
Shinnecock Indian Nation	New York
Wampanoag Tribe of Gay Head (Aquinnah)	Massachusetts

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APPENDIX B

List of Preparers and Reviewers, References Cited, and Glossary

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Cody, Mary	Marine mammals; sea turtles
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Howson, Ursula	Benthic, finfish, invertebrates, and essential fish habitat; commercial fisheries and for-hire recreational fishing; terrestrial and coastal fauna; wetlands
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Jenkins, Jill	Demographics, employment, and economics; recreation and tourism; land use and coastal infrastructure; commercial fisheries and for-hire recreational fishing; navigation and vessel traffic; other uses
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Wilmot, Susan; SWCA	Project manager; all sections
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Bockey, Chris; SWCA	Visual
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Name	Role/Resource Area
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GLOSSARY

Term	Definition
affected environment	Environment as it exists today that could be impacted by the proposed Project
ancient submerged landform feature	A landform as it was in ancient times
automatic identification system	Automatic tracking system used on vessels to monitor ship movements and avoid collision
algal blooms	Rapid growth of the population of algae, also known as algae bloom
allision	A moving ship running into a stationary ship
anthropogenic	Generated by human activity
archaeological resource	Historical place, site, building, shipwreck, or other archaeological site on the American landscape
baleen whale	A cetacean with baleens (whalebones) instead of teeth
below grade	Below ground level
benthic	Related to the bottom of a body of water
benthic resources	The seafloor surface, the substrate itself, and the communities of bottom-dwelling organisms that live within these habitats
Cetacea	Order of aquatic mammals made up of whales, dolphins, porpoises, and related lifeforms
coastal habitat	Coastal areas where flora and fauna live, including salt marshes and aquatic habitats
coastal waters	Waters in nearshore areas where bottom depth is less than 98.4 feet
coastal zone	The lands and waters starting at 3 nautical miles from the land and ending at the first major land transportation route
commercial fisheries	Areas or entities raising and/or catching fish for commercial profit
commercial-scale wind energy facility	Wind energy facility usually greater than 1 megawatt that sells the produced electricity
cultural resource	Historical districts, objects, places, sites, buildings, shipwrecks, and archeological sites on the American landscape, as well as sites of traditional, religious, or cultural significance to cultural groups, including Native American tribes
cumulative impacts	Impacts that could result from the incremental impact of a specific action, such as the proposed Project, when combined with other past, present, or reasonably foreseeable future actions or other projects; can occur from individually minor, but collectively significant actions that take place over time
criteria pollutant	One of six common air pollutants for which the U.S. Environmental Protection Agency sets National Ambient Air Quality Standards: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, or sulfur dioxide
critical habitat	Geographic area containing features essential to the conservation of threated or endangered species
demersal	Living close to the ocean floor
design envelope	The range of proposed Project characteristics defined by the applicant and used by the Bureau of Ocean Energy Management (BOEM) for purposes of environmental review and permitting
dredging	Removal of sediments and debris from the bottom of lakes, rivers, harbors, and other water bodies
duct bank	Underground structure that houses the onshore export cables, which consists of polyvinyl chloride (PVC) pipes encased in concrete
ecosystem	Community of interacting living organisms and nonliving components (such as air, water, soil)
environmental protection measure (EPM)	Measure proposed in COP to avoid or minimize potential impacts

Term	Definition
offshore substation	The interconnection point between the wind turbine generators and the export cable; the necessary electrical equipment needed to connect the inter-array cables to the offshore export cables
electromagnetic field	A field of force produced by electrically charged objects and containing both electric and magnetic components
endangered species	A species that is in danger of extinction in all or a significant portion of its range
ensonified	The process of filling with sound
environmental consequences	The potential impacts that the construction, operations, maintenance, and decommissioning of the proposed Project would have on the environment
environmental justice communities	Minority and low-income populations affected by the proposed Project
Endangered Species Act–listed species	Species listed under the Endangered Species Act
essential fish habitat	“Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (50 Code of Federal Regulations 600)
export cables	Cables connecting the wind facility to the onshore electrical grid power
Private aids to navigation	Visual references operated and maintained by the U.S. Coast Guard, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation
finfish	Vertebrate and cartilanginous fishery species, not including crustaceans, cephalopods, or other mollusks
for-hire commercial fishing	Commercial fishing on a for-hire vessel, i.e. a vessel on which the passengers make a contribution to a person having an interest in the vessel in exchange for carriage
foundation	The bases to which the wind turbine generators and offshore substation are installed on the seabed. Three types of foundations have been considered and reviewed for the Project: jacket, monopile, or gravity-based structure. Monopile is the selected foundation type for the Project.
hard-bottom habitat	Benthic habitats comprised of hard-bottom (e.g., cobble, rock, and ledge) substrates
historic property	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the National Register of Historic Places. Also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
horizontal directional drilling	Trenchless technique for installing underground cables, pipes, and conduits using a surface-launched drilling rig
hull	Watertight frame or body of a ship
inter-array cables	Cables connecting the wind turbine generators to the electrical service platforms
invertebrate	Animal with no backbone
jack-up vessel	Mobile and self-elevating platform with buoyant hull
jet plow	Method of submarine cable installation equipment that primarily uses water jets to fluidize soil, temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor.
knot	Unit of speed equaling 1 nautical mile per hour
landing site	The shoreline landing site at which the offshore cable transitions to onshore
marine mammal	Aquatic vertebrate distinguished by the presence of mammary glands, hair, three middle ear bones, and a neocortex (a region of the brain)
marine waters	Waters in offshore areas where bottom depth is more than 98.4 feet
mechanical cutter	Method of submarine cable installation equipment that involves a cutting wheel or excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor.

Term	Definition
mechanical plow	Method of submarine cable installation equipment that involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share.
monopile or monopile foundation	A long steel tube driven into the seabed that supports a tower
nautical mile	A unit used to measure sea distances and equivalent to approximately 1.15 miles
interconnection facility	Substation connecting the proposed Project to the existing bulk power grid system
operations and maintenance facilities	Would include offices, control rooms, warehouses, shop space, and pier space
outer continental shelf	All submerged land, subsoil, and seabed belonging to the United States but outside of states' jurisdiction
onshore South Fork Export Cable	Export cables located on land
offshore South Fork Export Cable	Export cables located in state or marine waters
pile	A type of foundation akin to a pole
pile driving	Installing foundation piles by driving them into the seafloor
pinnipeds	Carnivorous, semiaquatic, fin-footed marine mammals, also known as seals
plume	Column of fluid moving through another fluid
Project	The siting and development of the South Fork Wind Farm and the South Fork Export Cable
protected species	Endangered or threatened species that receive federal protection under the Endangered Species Act of 1973 (as amended)
scour protection	Protection consisting of rock and stone that would be placed around all foundations to stabilize the seabed near the foundations as well as the foundations themselves
sessile	Attached directly by the base
South Fork Wind Farm (SFWF)	The work area containing all proposed wind turbine generators, offshore substations, and inter-array cables
soft-bottom habitat	Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble, rock, and ledge) substrates, as well as biogenic habitat (e.g., eelgrass, mussel beds, and worm tubes) created by structure-forming species
transition vault	Underground concrete transition vault that to be constructed at the landing site and inside of which offshore and shore South Fork Export Cable would be spliced together.
substrate	Earthy material at the bottom of a marine habitat; the natural environment that an organism lives in
suspended sediments	Very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom. Such material remains in suspension due to the upward components of turbulence and currents, and/or by suspension.
threatened species	A species that is likely to become endangered within the foreseeable future
tidal energy project	Project related to the conversion of the energy of tides into usable energy, usually electricity
trawl	A large fishing net dragged by a vessel at the bottom or in the middle of sea or lake water
turbidity	A measure of water clarity
right-of-way	Registered easement on private land that allows access by another entity
vibracore	Technology/technique for collecting core samples of underwater sediments and wetland soils
viewshed	Area visible from a specific location

Term	Definition
visual resource	The visible physical features on a landscape, including natural elements such as topography, landforms, water, vegetation, and manmade structures
Wetland	Land saturated with water; marshes; swamps
wind energy	Electricity from naturally occurring wind
wind energy area	Areas with significant wind energy potential and defined by BOEM
Lease Area	The entire area that Deepwater Wind New England, LLC purchased from BOEM
wind turbine generator	Component that puts out electricity in a structure that converts kinetic energy from wind into electricity

APPENDIX C

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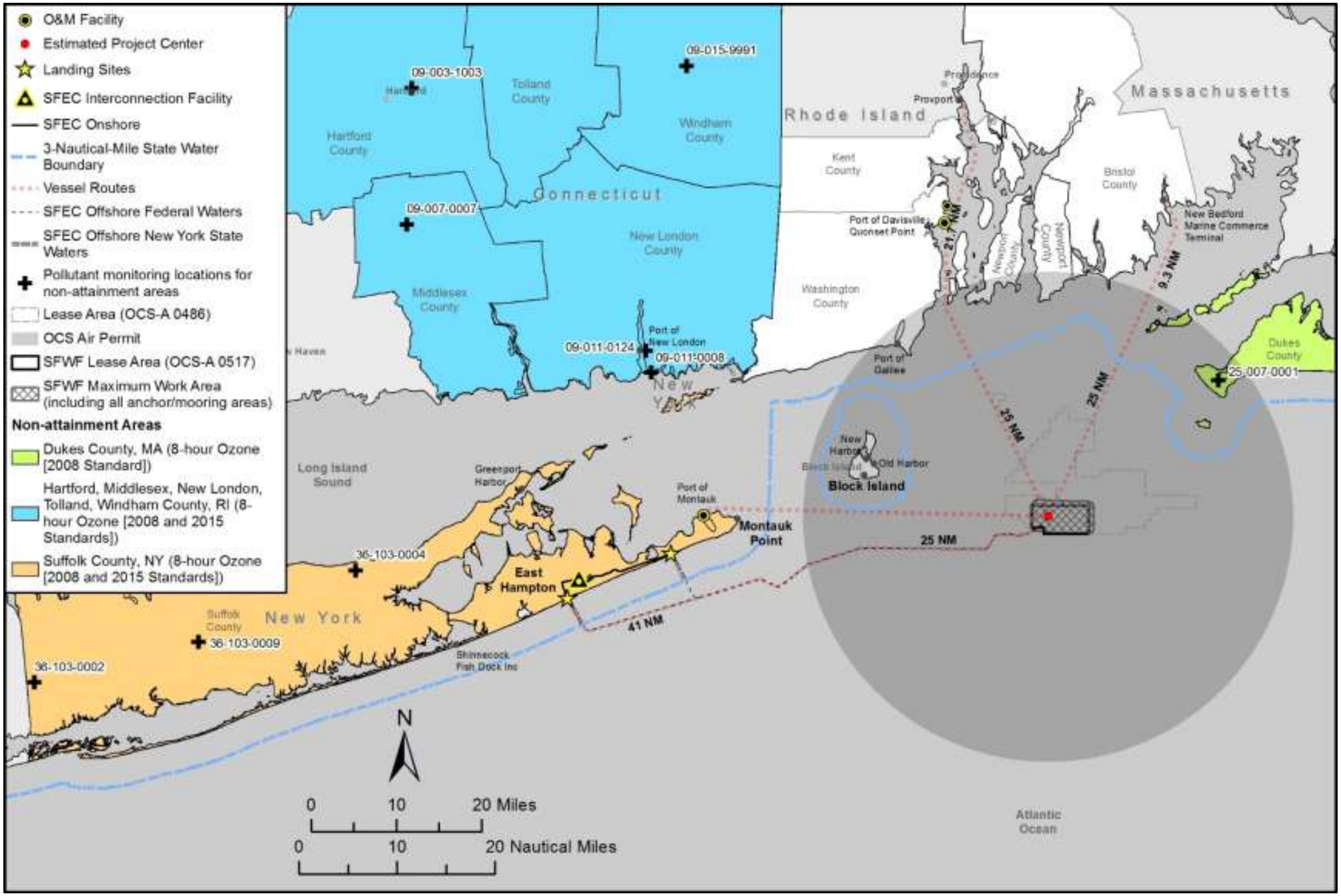
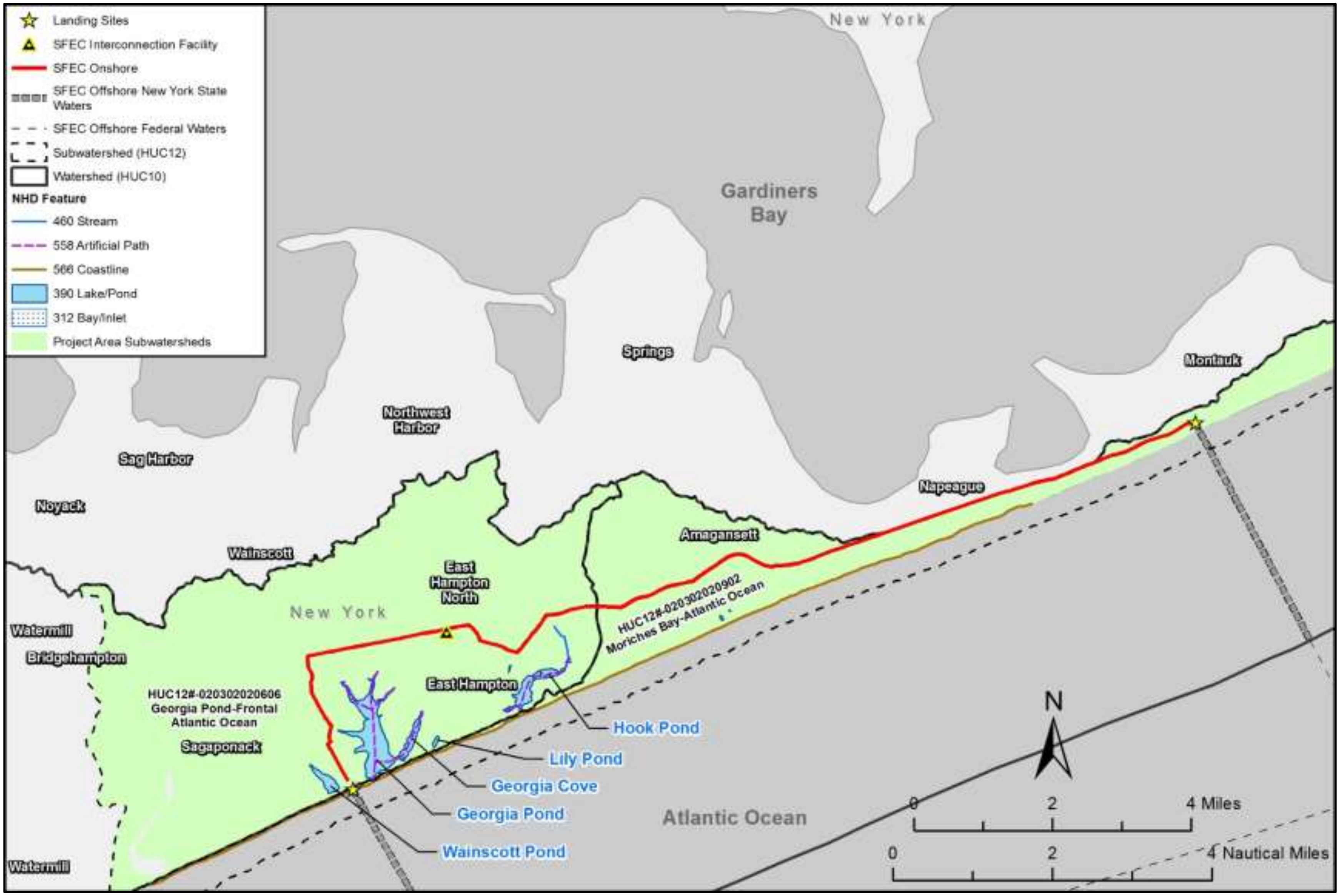


Figure C-1. Air quality information.



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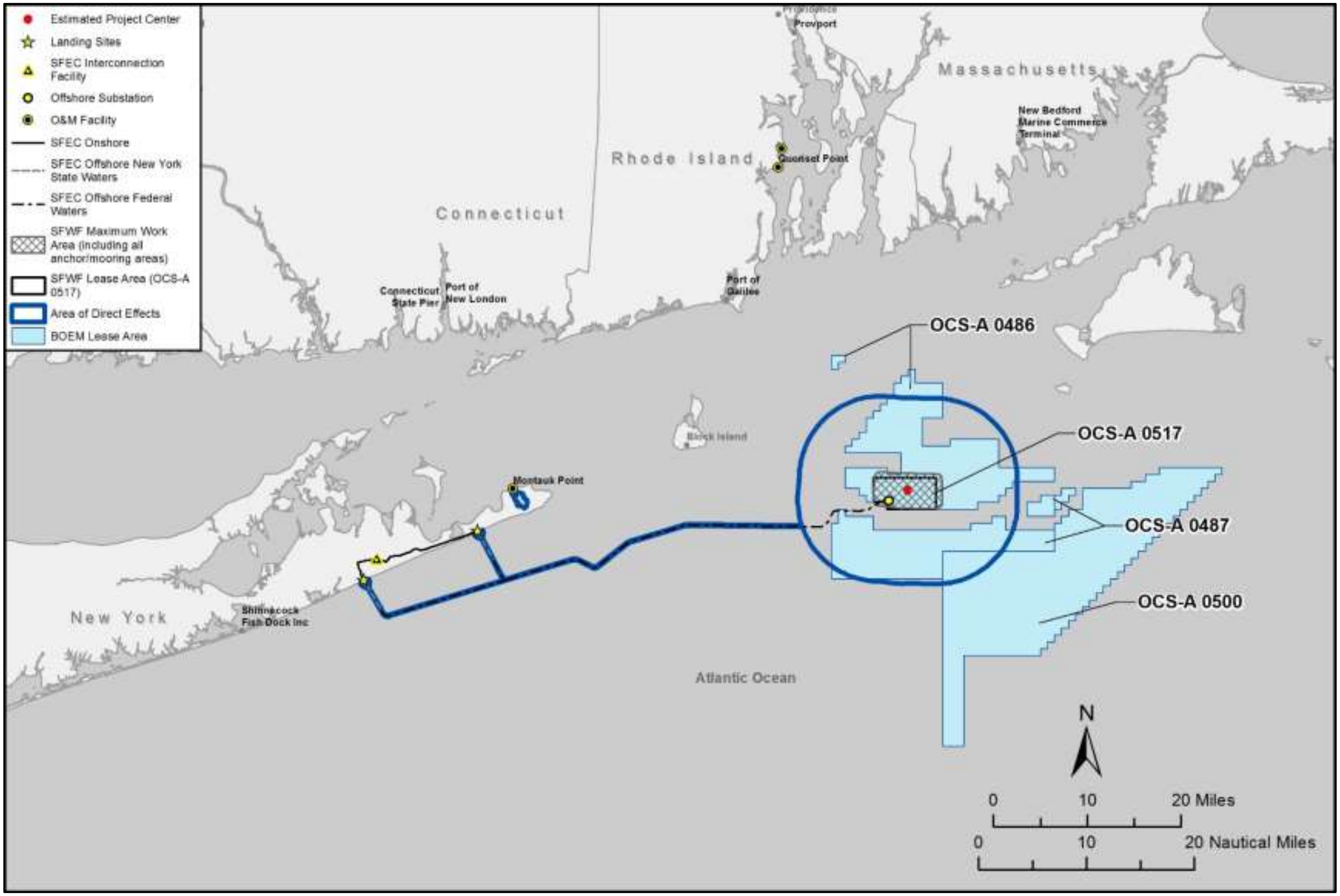

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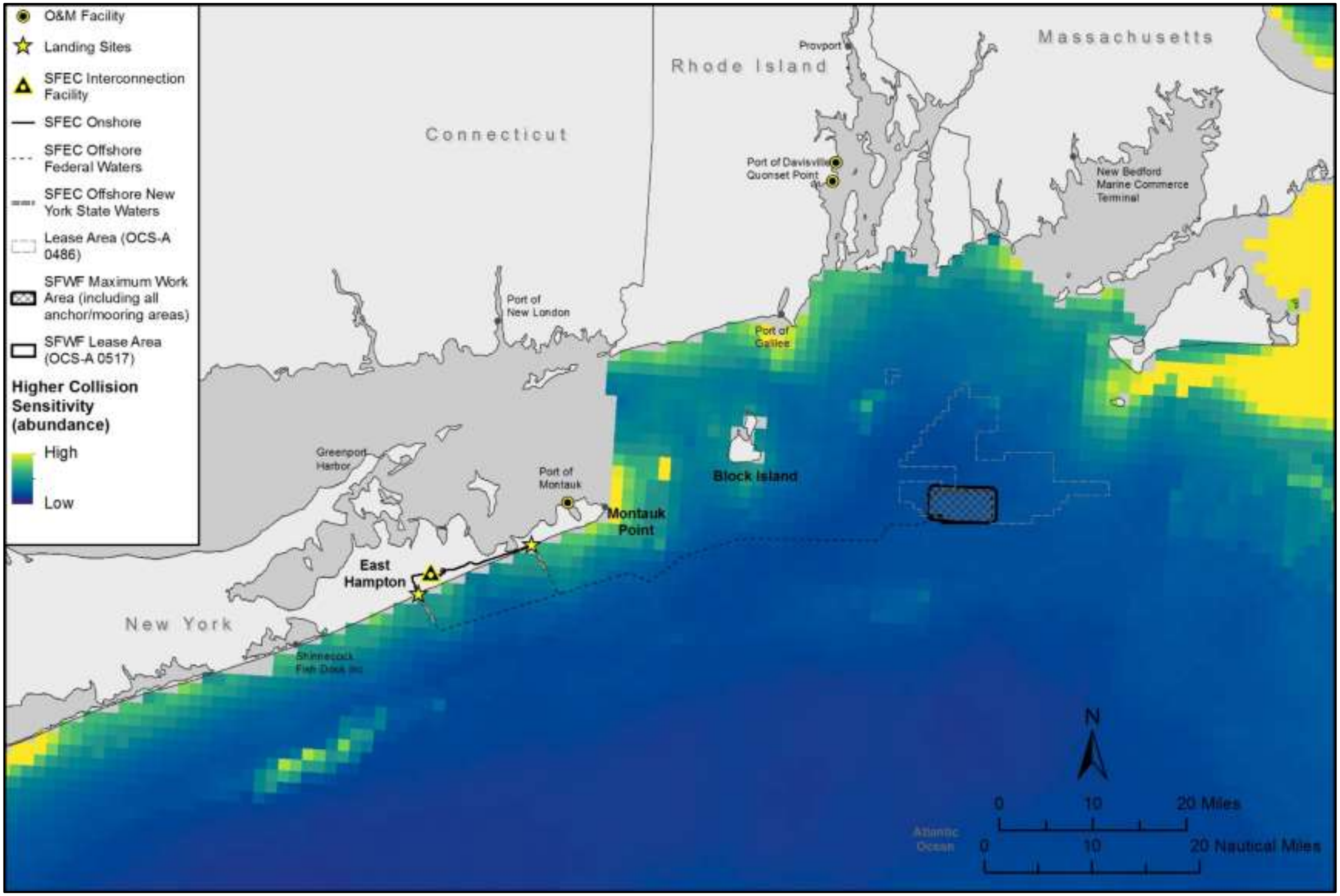

Figure C-4. Total avian relative abundance distribution for the higher collision sensitivity species group (NROC 2019).

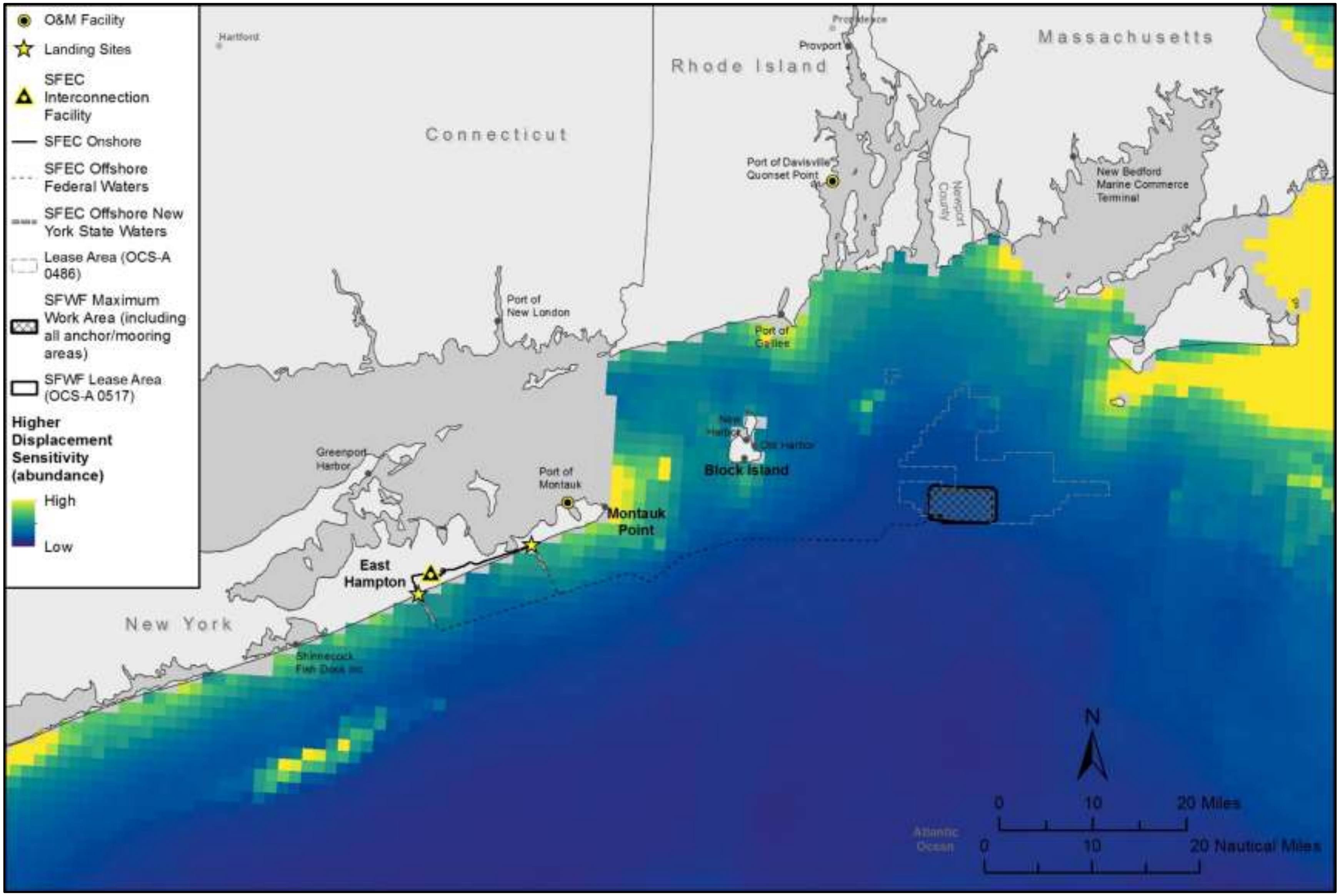

Figure C-5. Total avian relative abundance distribution for the higher displacement sensitivity species group (NROC 2019).

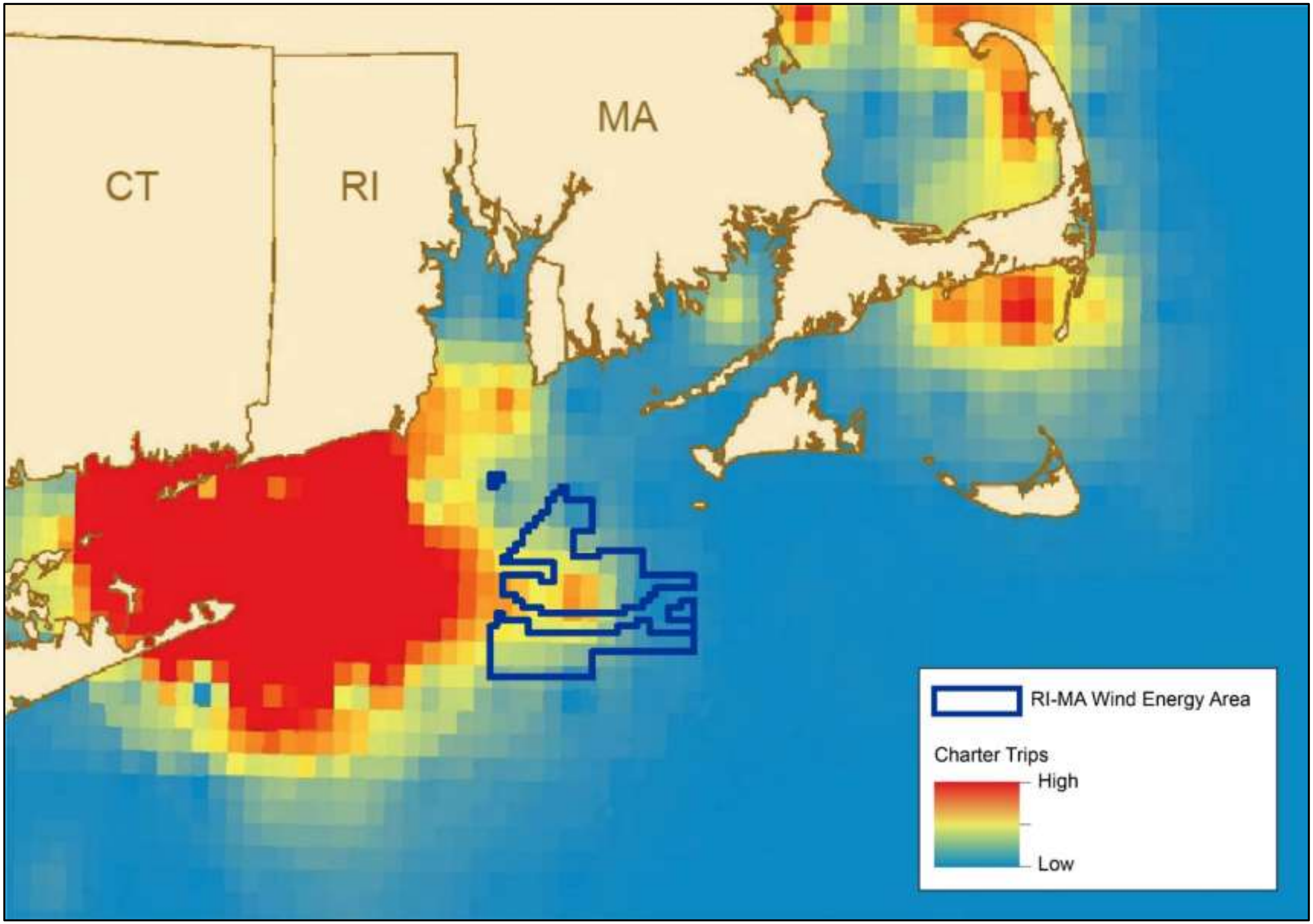

Figure C-6. Vessel trip report data for charter vessels (2001–2010). Figure developed using data from BOEM (2012).

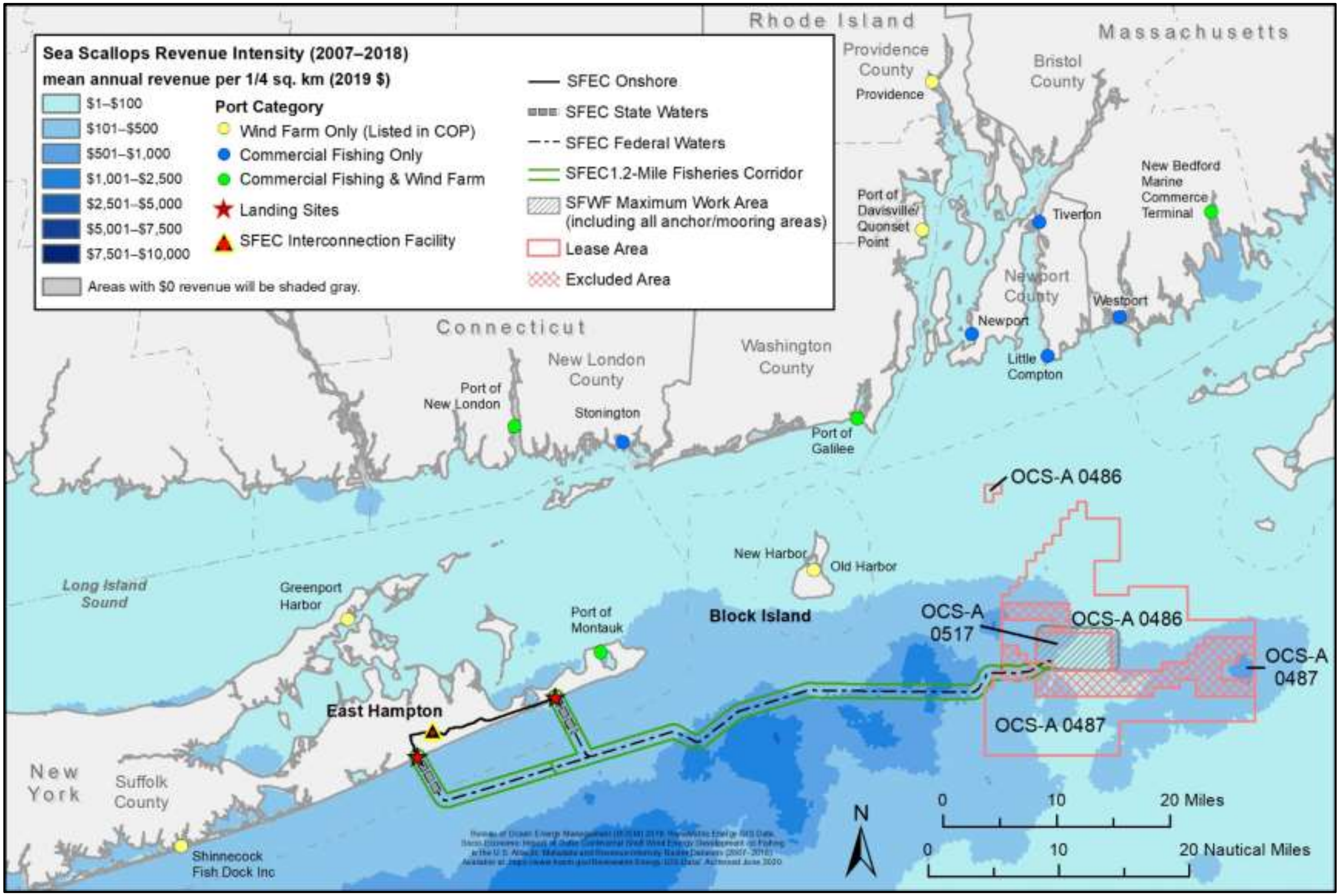

Figure C-7. Intensity of average annual revenue of federally permitted vessels: Sea Scallop Fishery Management Plan (2007–2018).

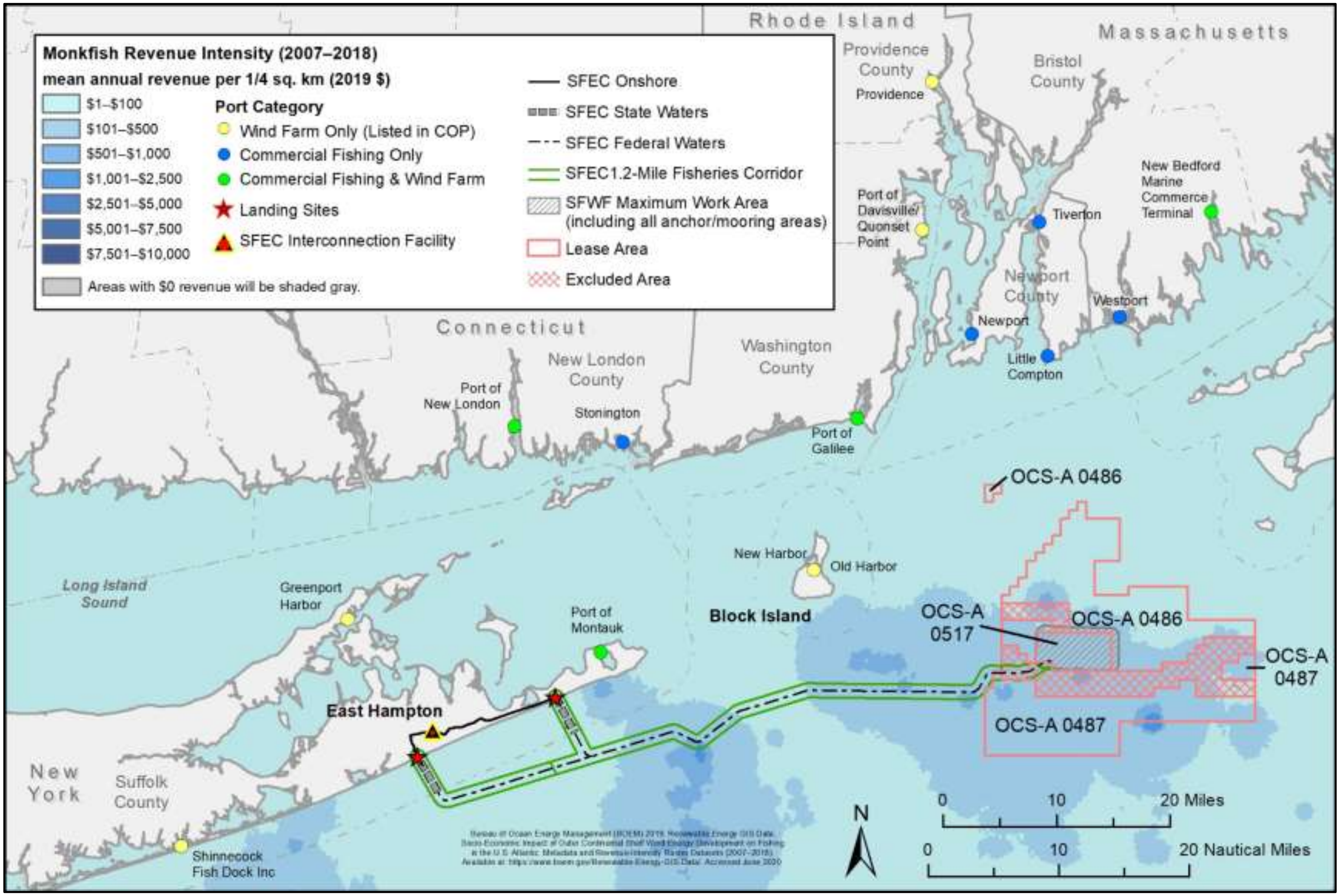

Figure C-8. Intensity of average annual revenue of federally permitted vessels: Monkfish Fishery Management Plan (2007–2018).

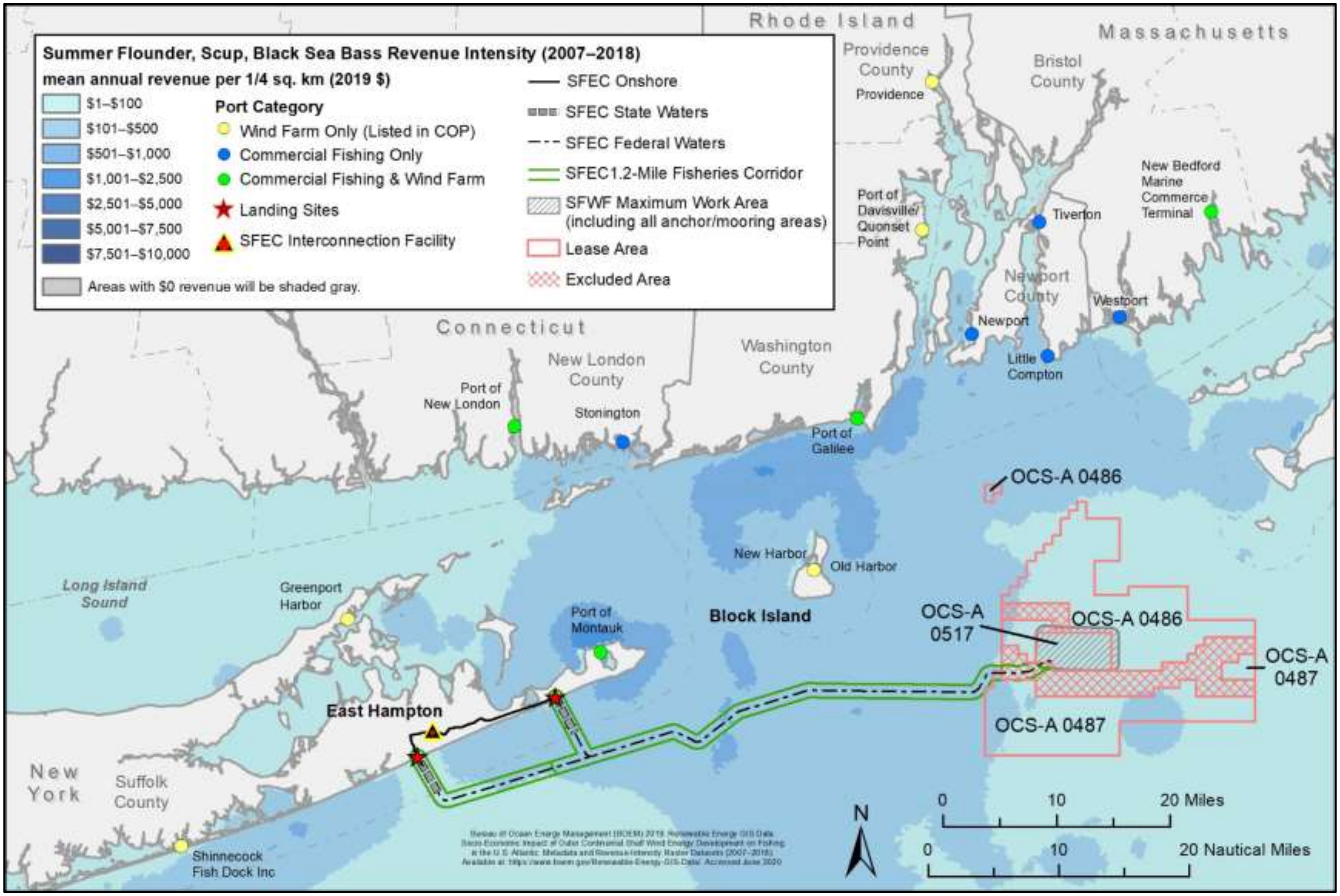

Figure C-9. Intensity of average annual revenue of federally permitted vessels: Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (2007–2018).

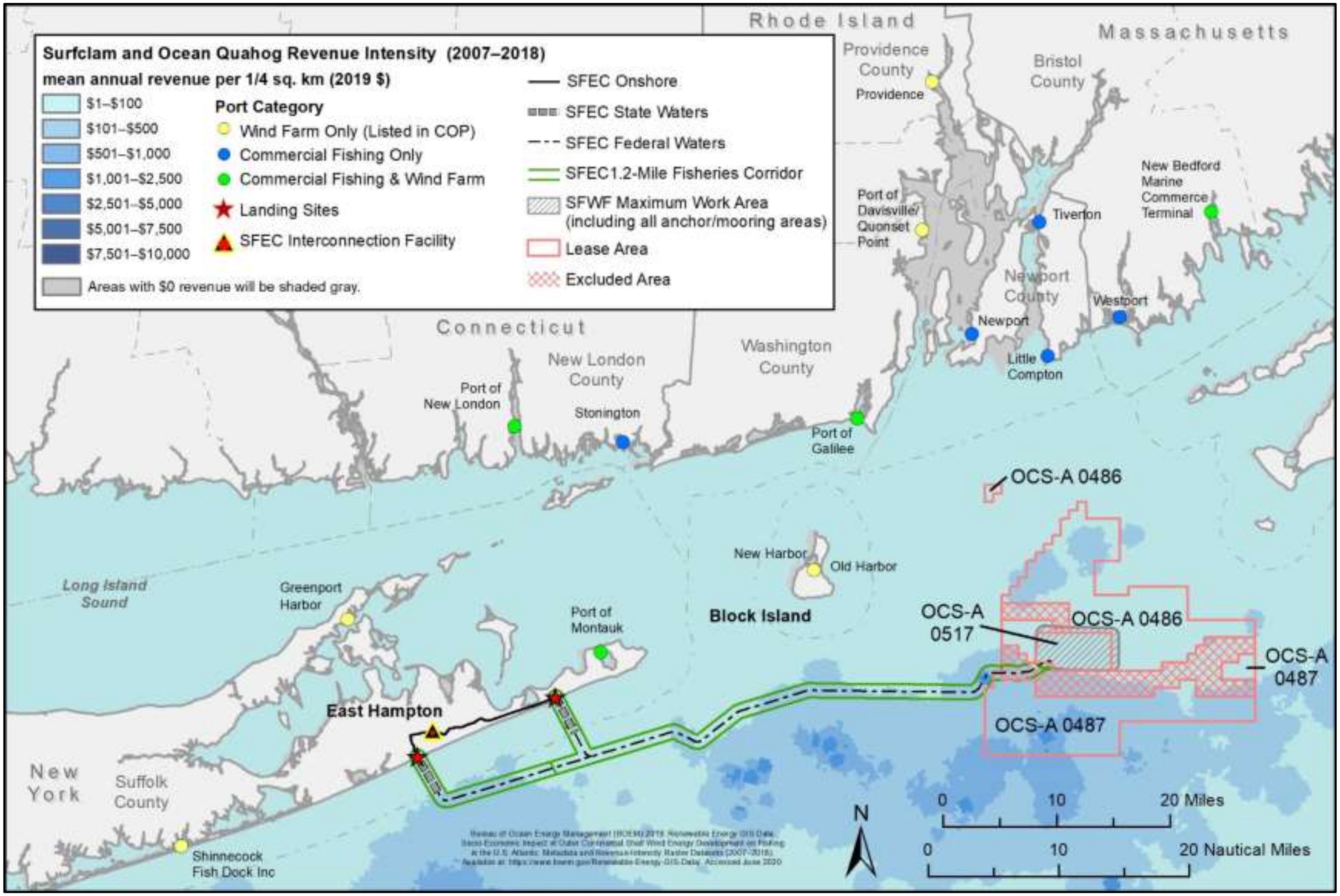

Figure C-10. Intensity of average annual revenue of federally permitted vessels: Surfclam and Ocean Quahog Fishery Management Plan (2007–2018).

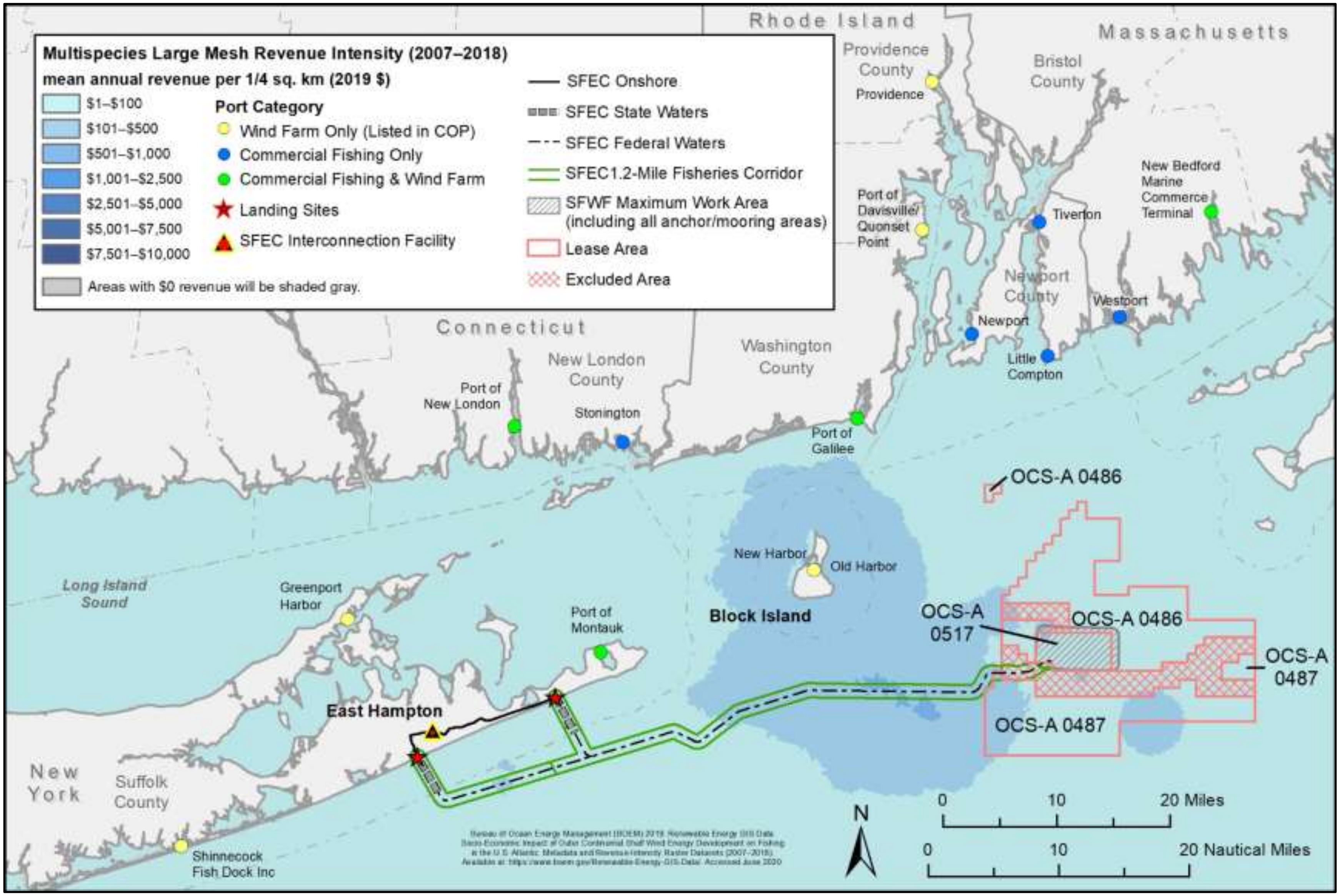

Figure C-11. Intensity of average annual revenue of federally permitted vessels: Multispecies Large Mesh Fishery Management Plan (2007–2018).

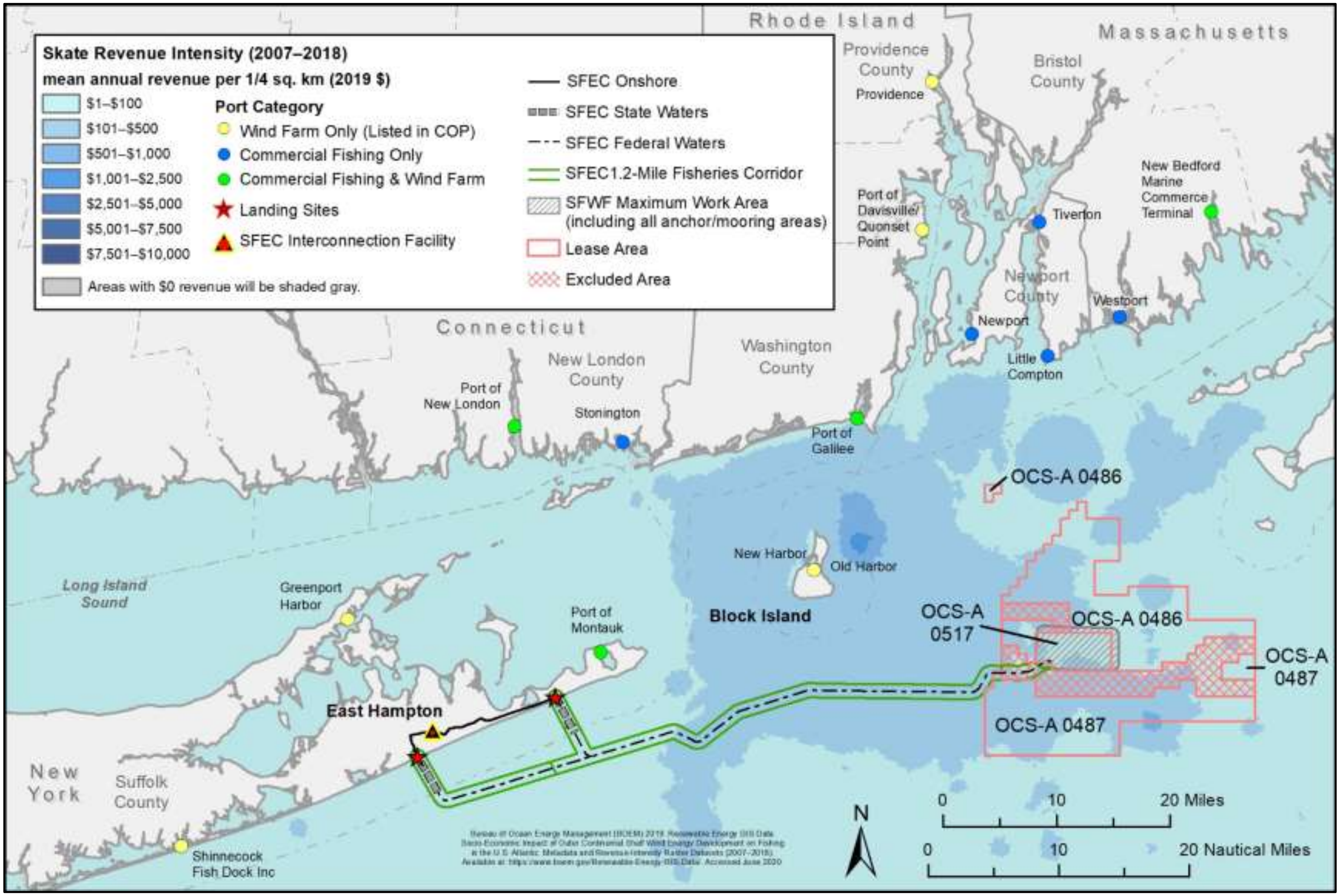

Figure C-12. Intensity of average annual revenue of federally permitted vessels: Skate Fishery Management Plan (2007–2018).

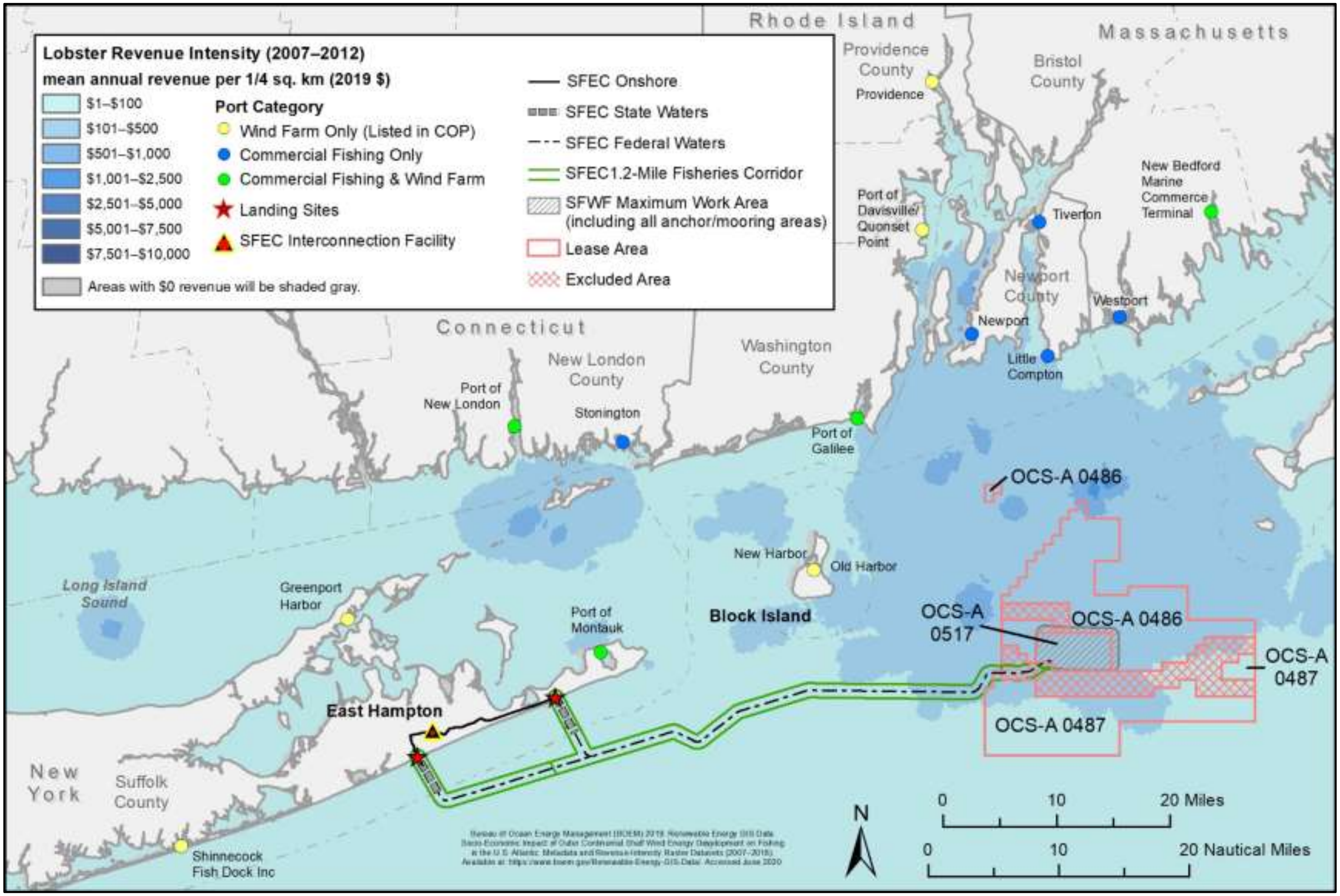

Figure C-13. Intensity of average annual revenue of federally permitted vessels: Lobster Fishery Management Plan (2007–2012).

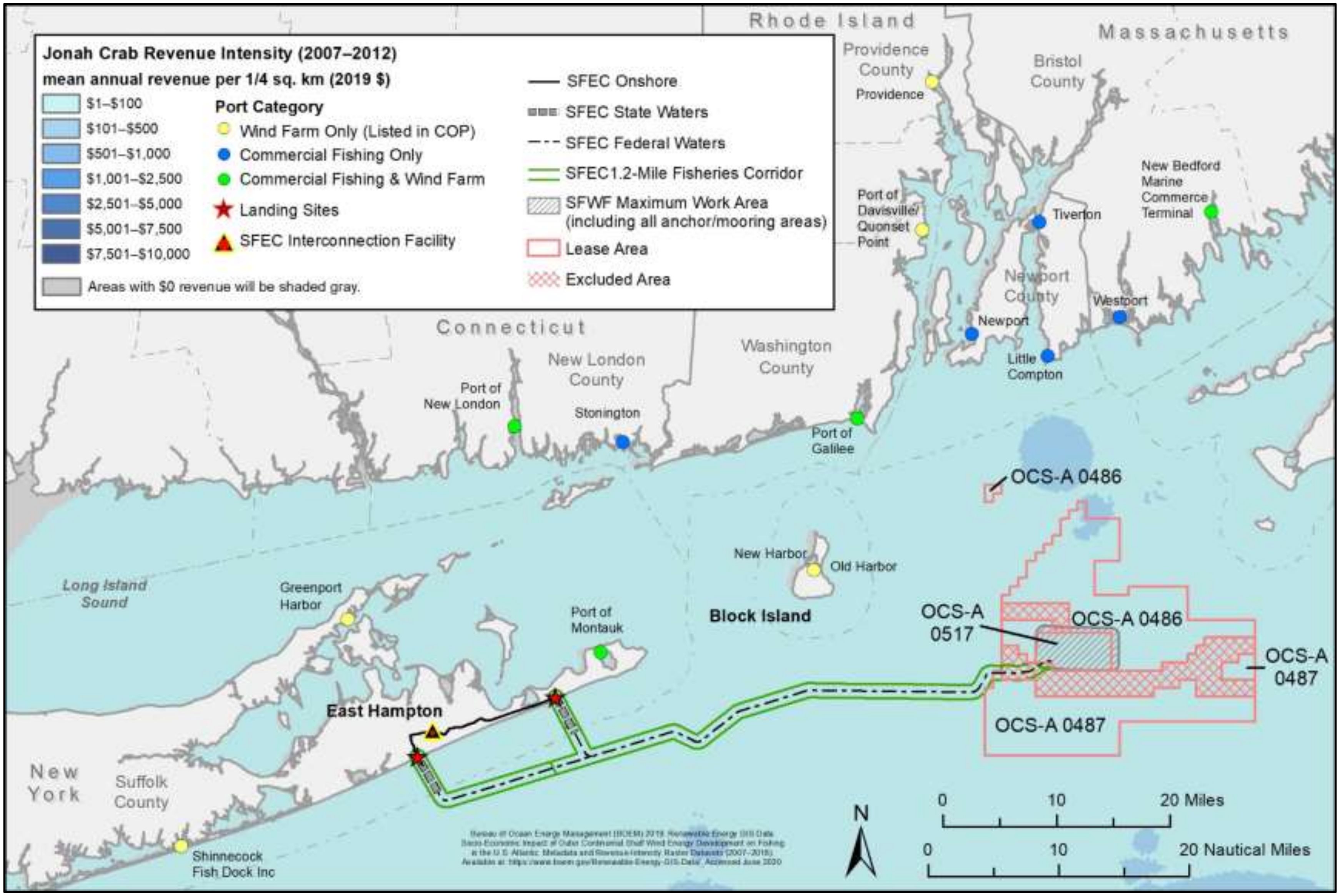

Figure C-14. Intensity of average annual revenue of federally permitted vessels: Jonah Crab Fishery Management Plan (2007–2012).

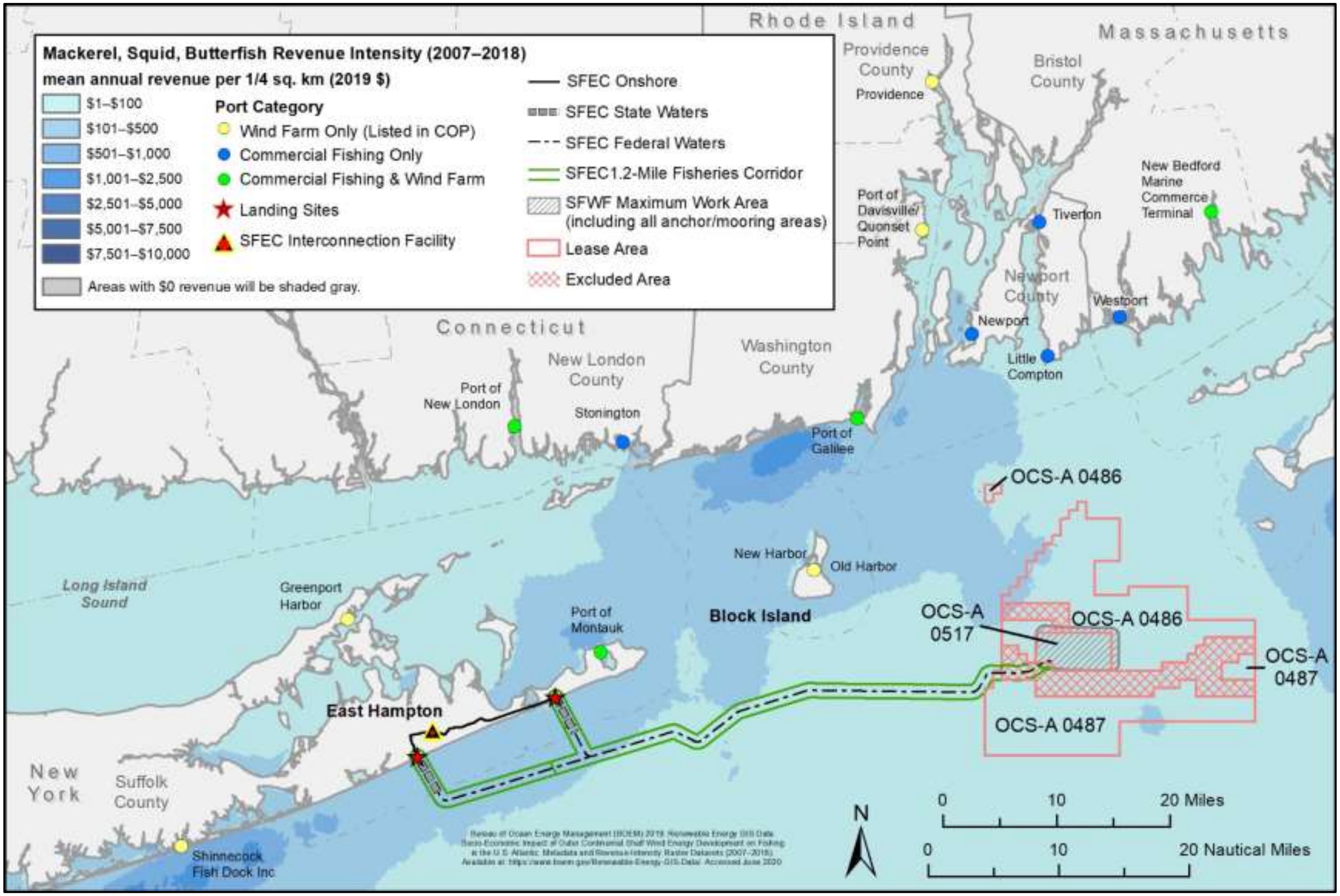

Figure C-15. Intensity of average annual revenue of federally permitted vessels: Mackerel, Squid, and Butterfish Fishery Management Plan (2007–2018).

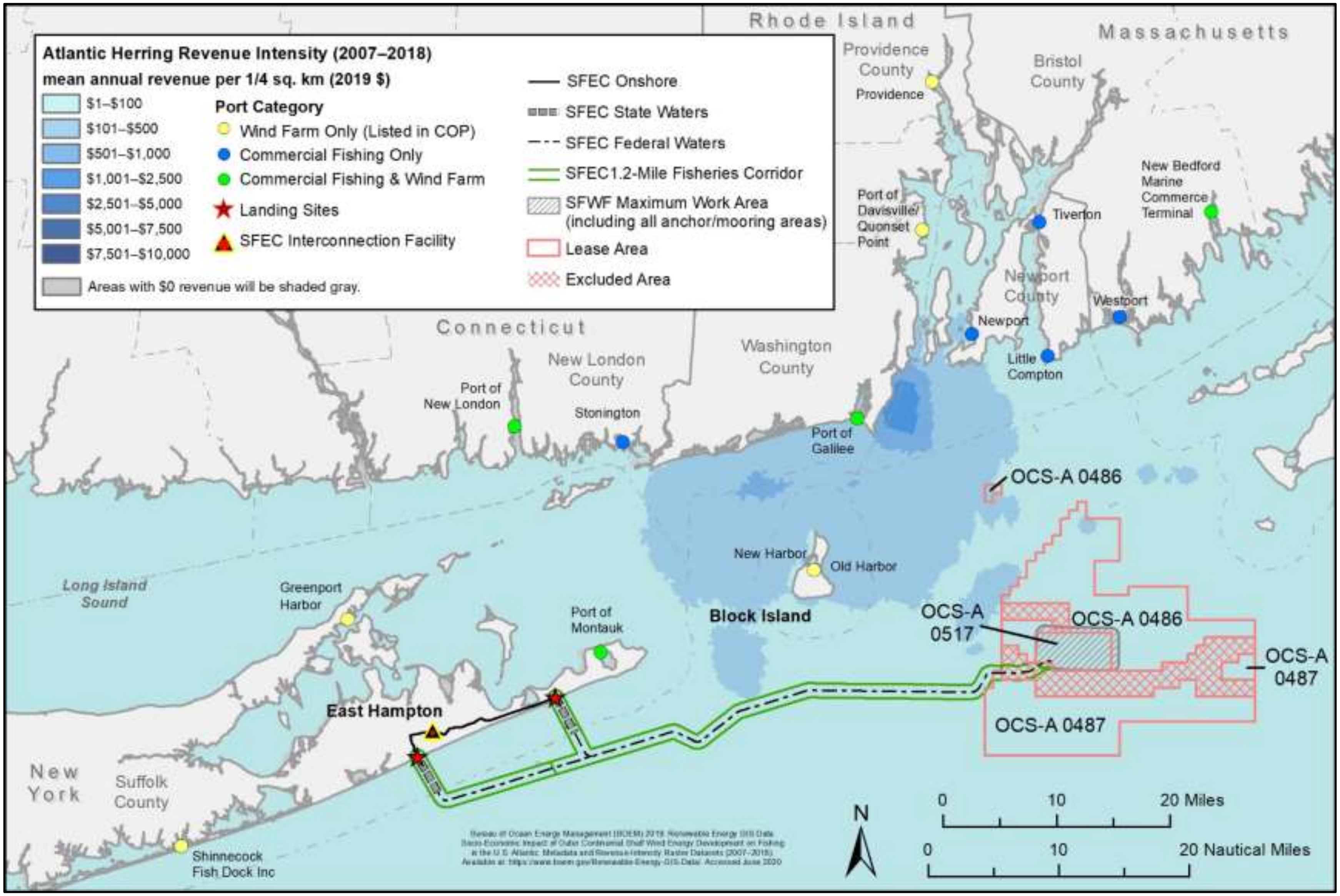

Figure C-16. Intensity of average annual revenue of federally permitted vessels: Atlantic Herring Fishery Management Plan (2007–2018).

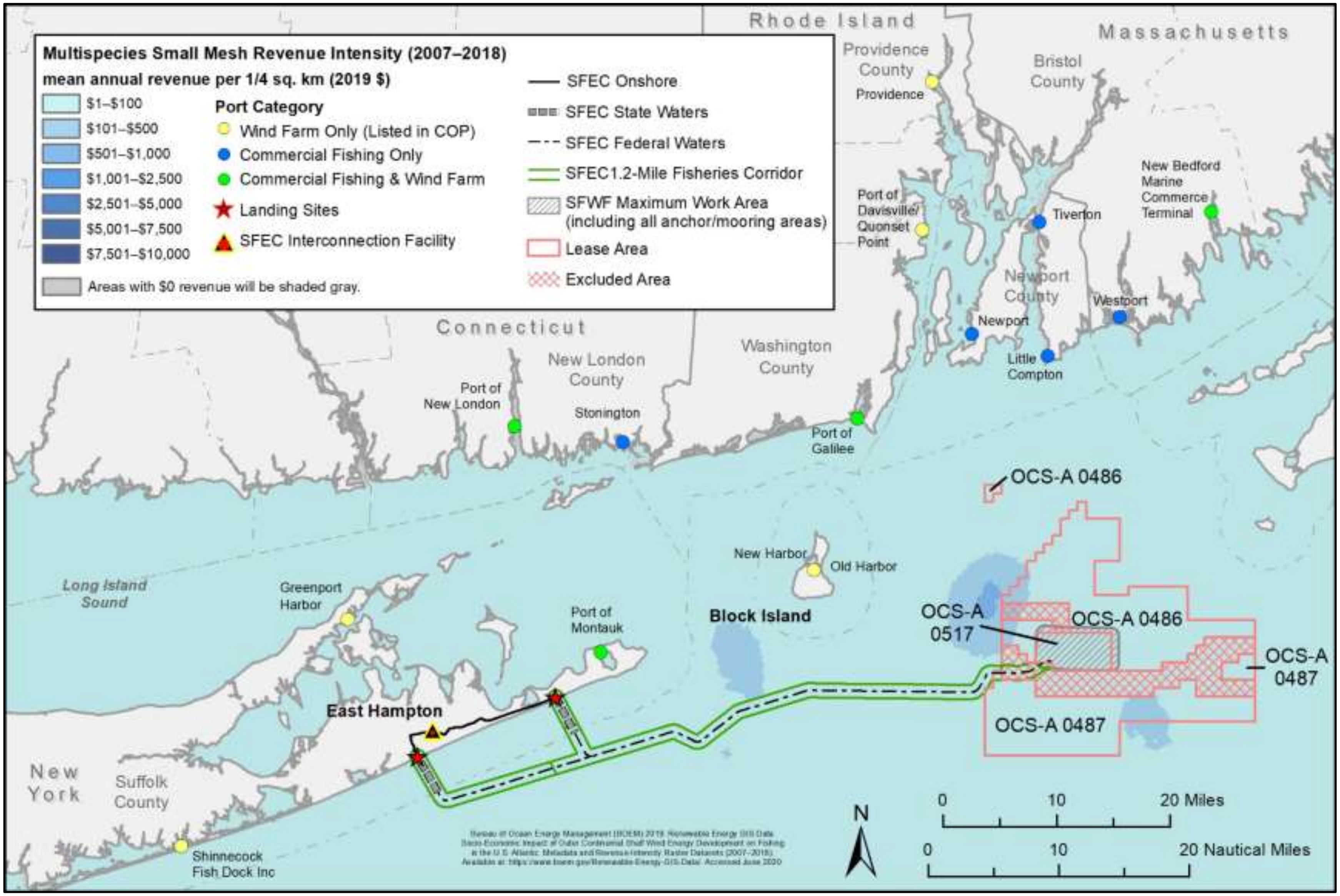

Figure C-17. Intensity of average annual revenue of federally permitted vessels: Multispecies Small Mesh Fishery Management Plan (2007–2018).

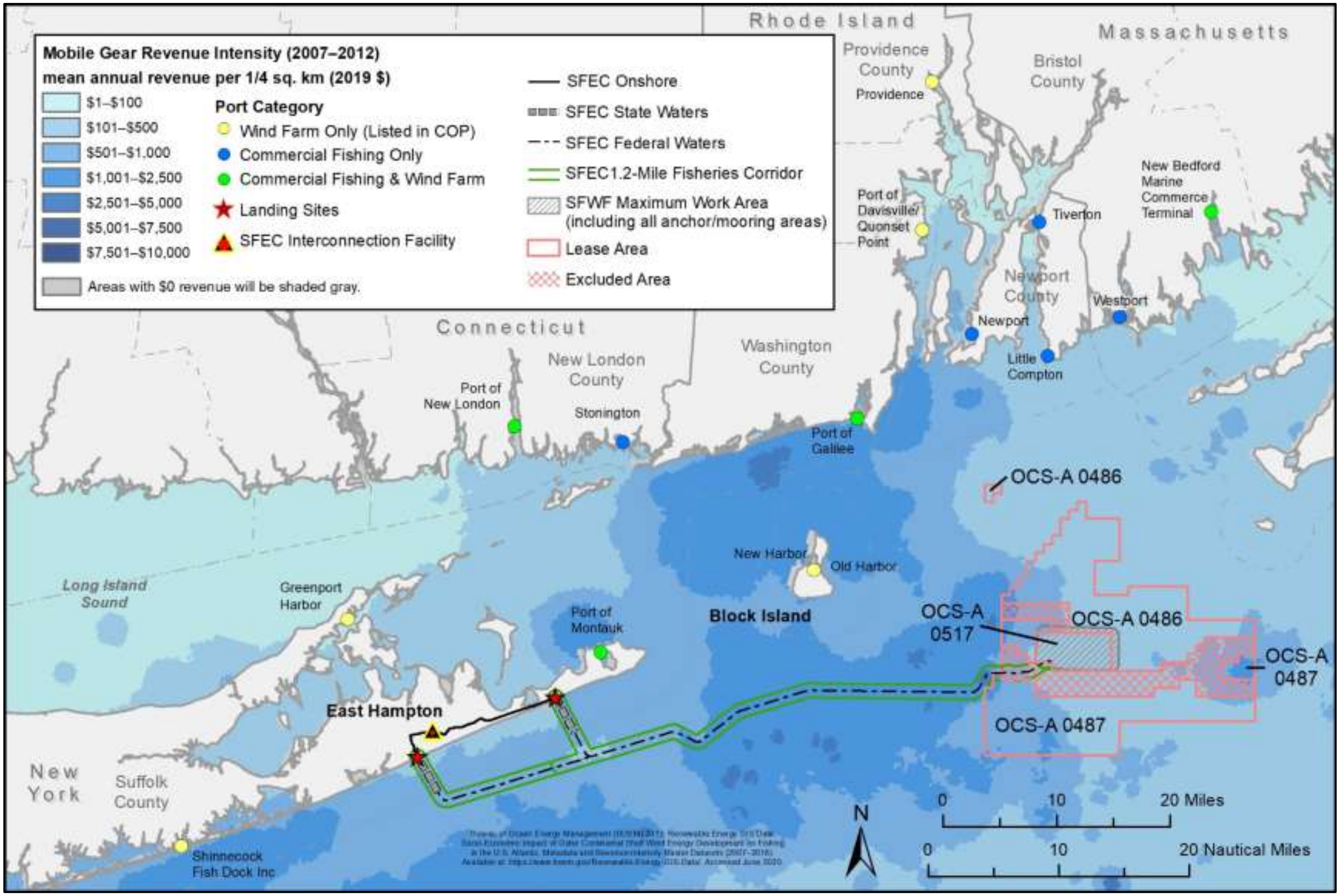

Figure C-18. Intensity of average annual revenue of federally permitted vessels: mobile gears (2007–2012).

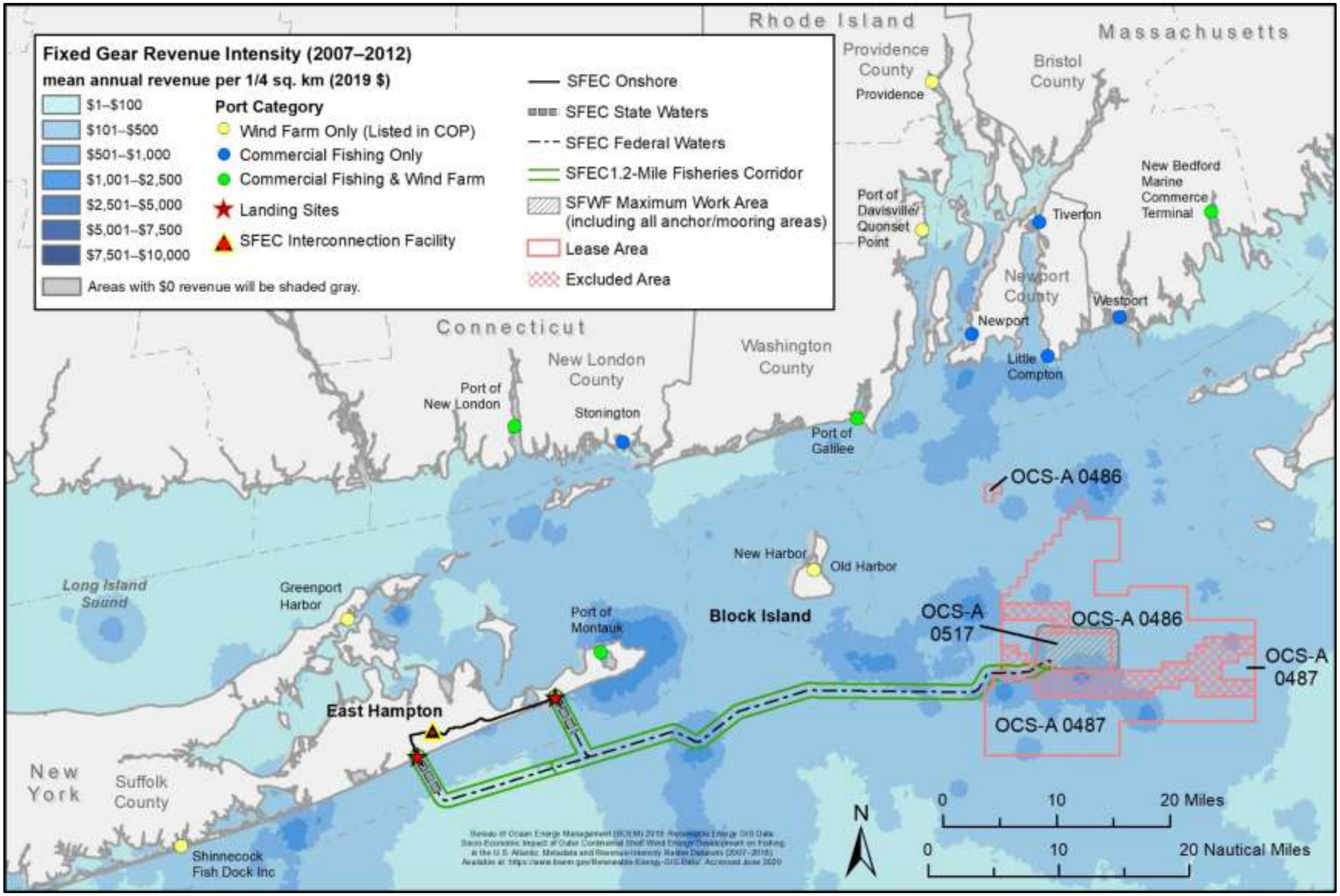

Figure C-19. Intensity of average annual revenue of federally permitted vessels: fixed gears (2007–2012).

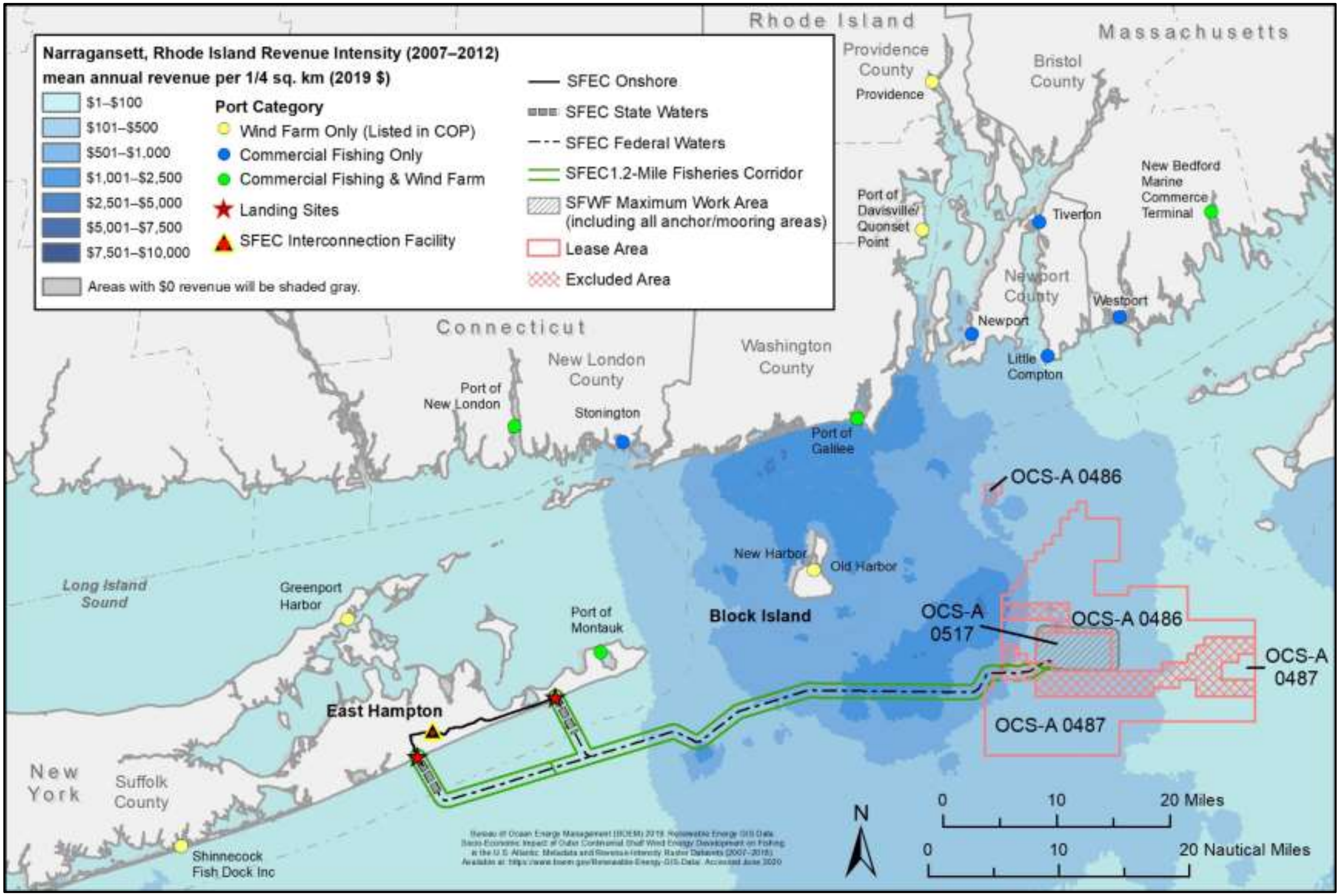

Figure C-20. Intensity of average annual revenue of federally permitted vessels: Narragansett, Rhode Island (2007–2012).

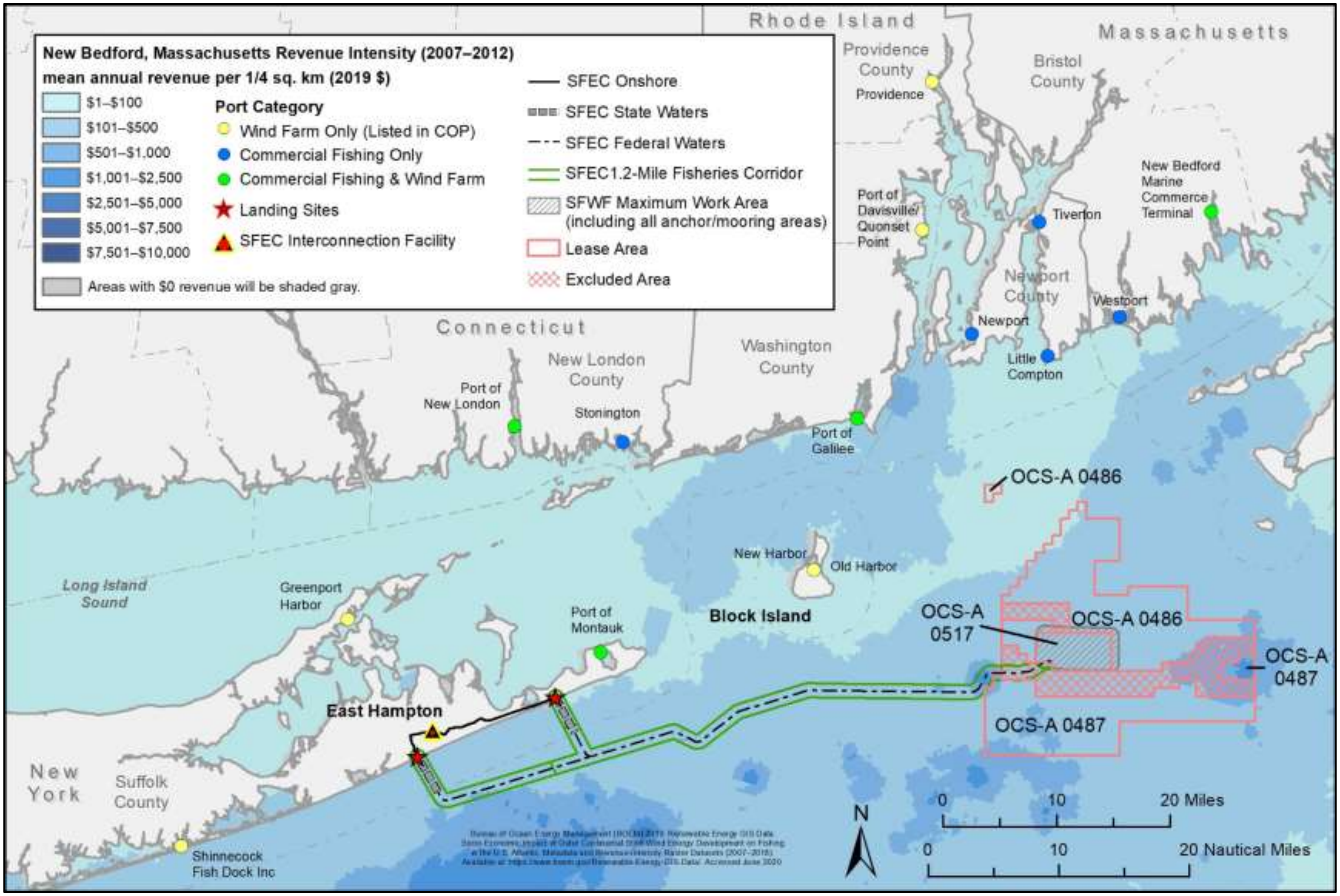

Figure C-21. Intensity of average annual revenue of federally permitted vessels: New Bedford, Massachusetts (2007–2012).

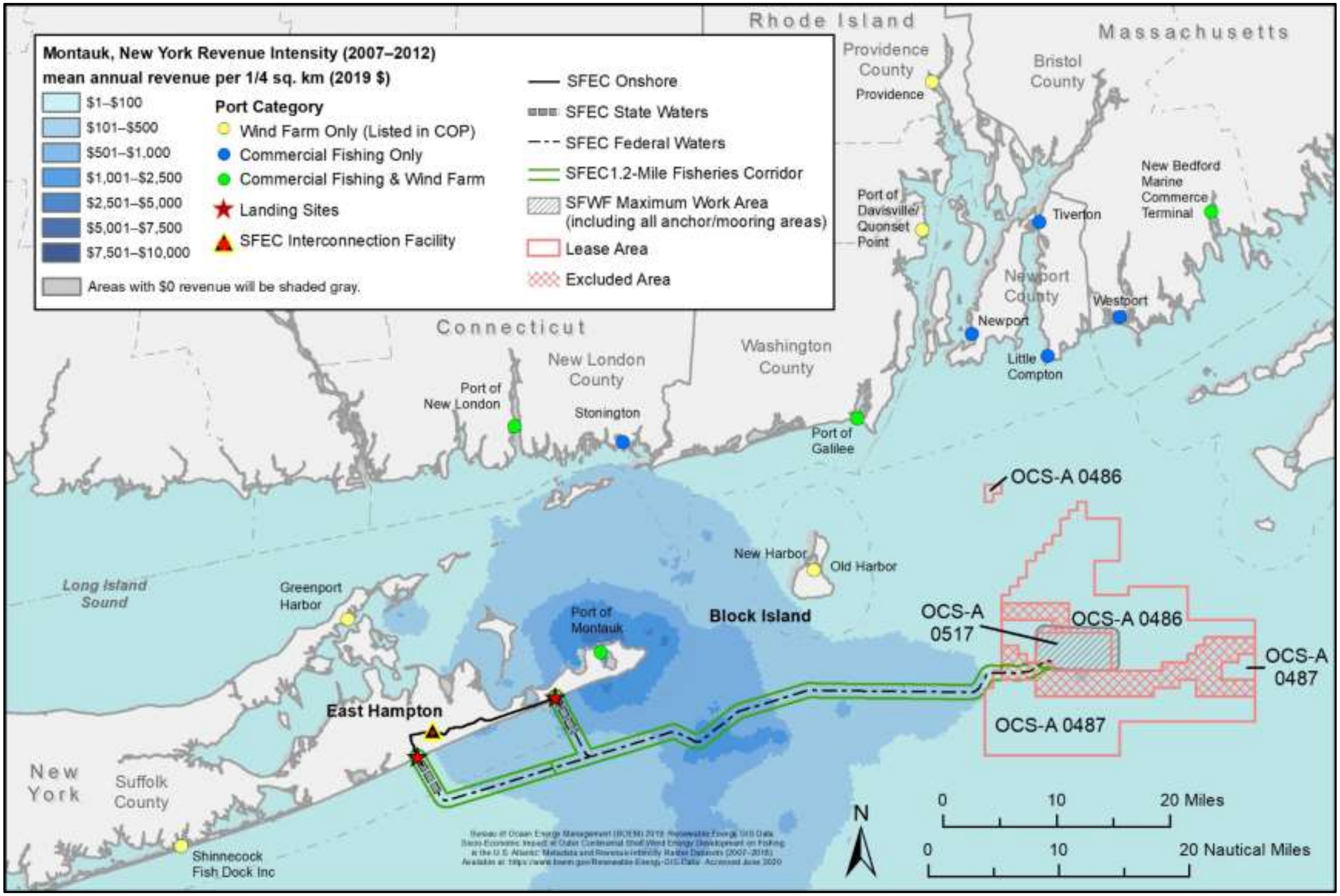

Figure C-22. Intensity of average annual revenue of federally permitted vessels: Montauk, New York (2007–2012).

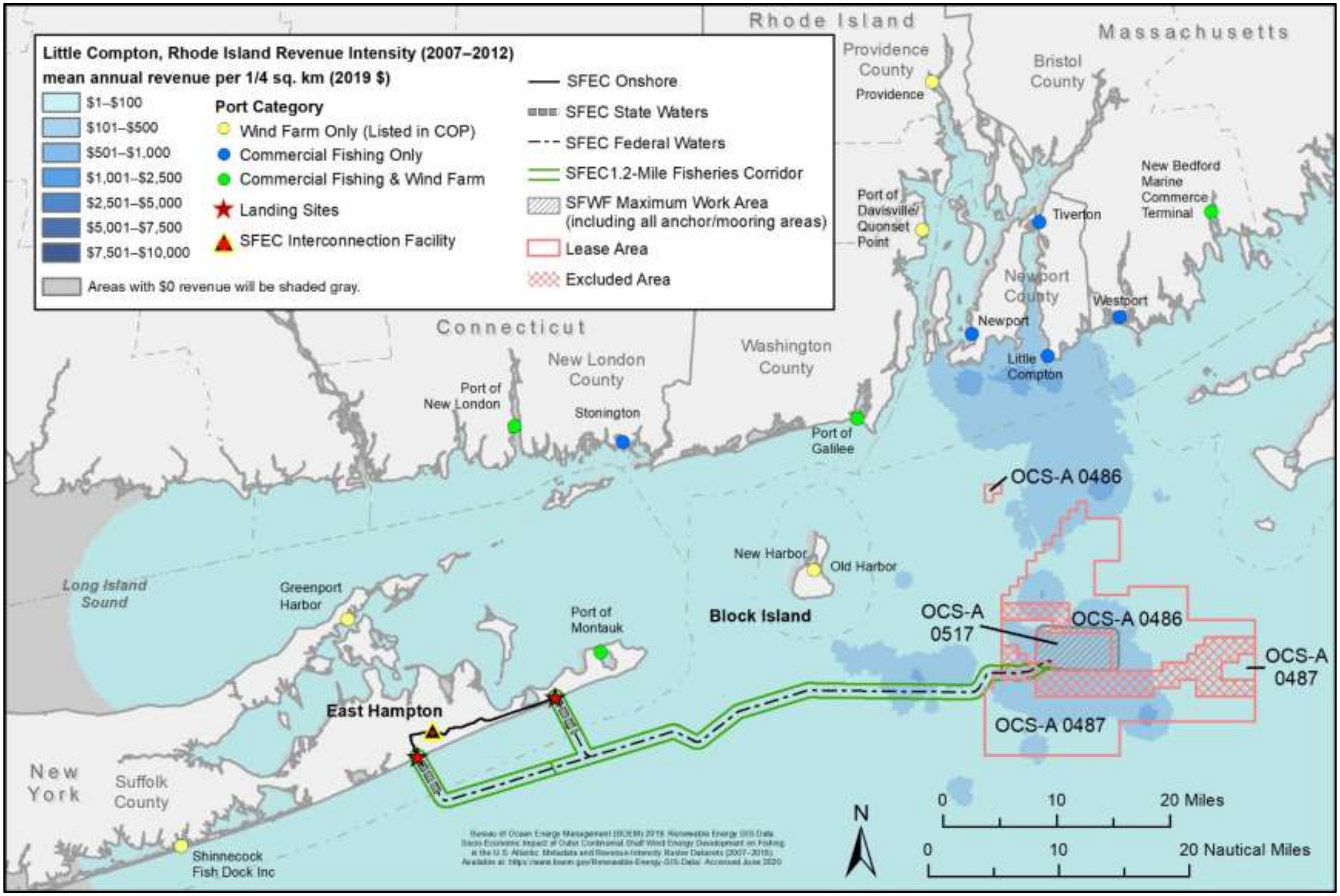

Figure C-23. Intensity of average annual revenue of federally permitted vessels: Little Compton, Rhode Island (2007–2012).

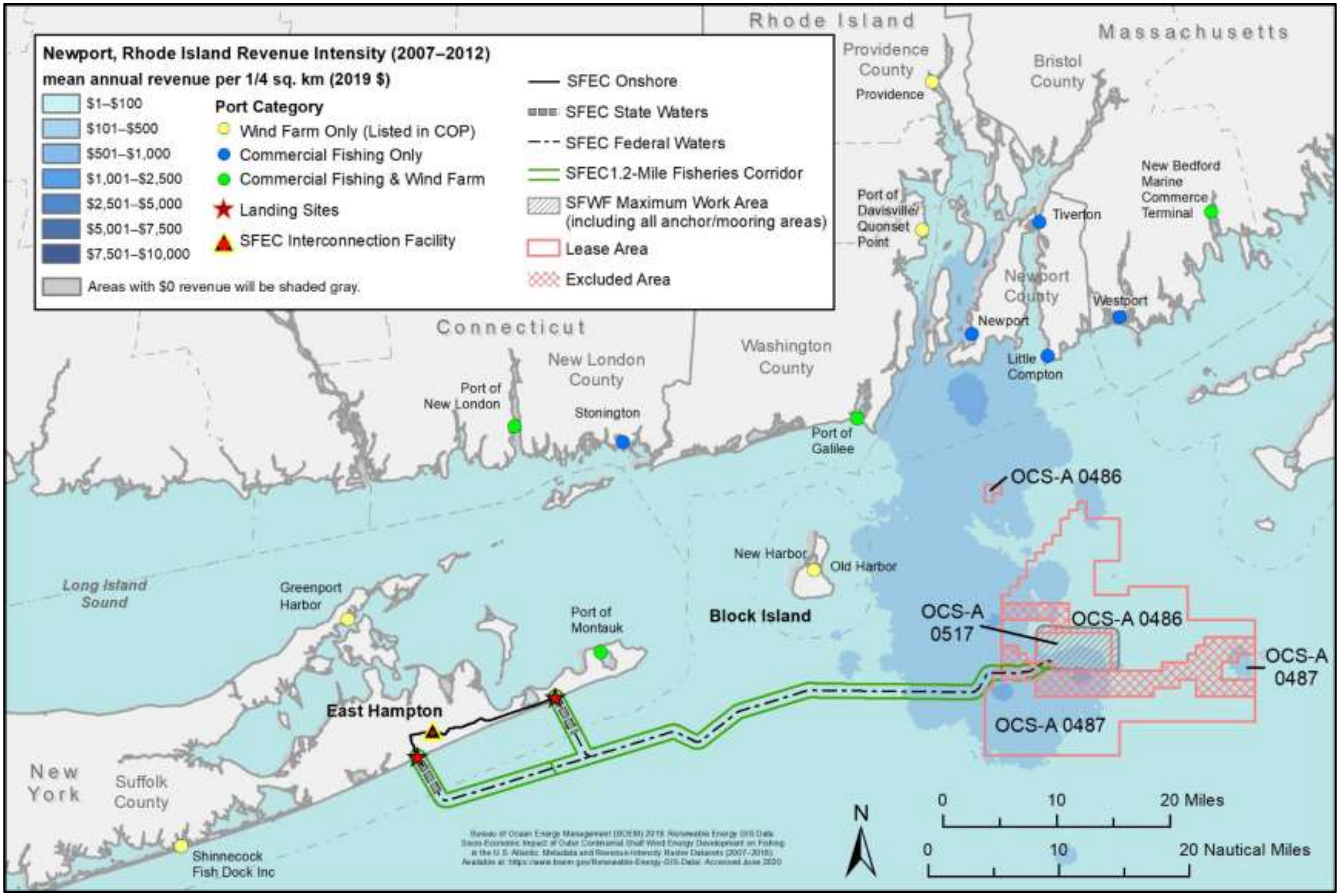

Figure C-24. Intensity of average annual revenue of federally permitted vessels: Newport, Rhode Island (2007–2012).

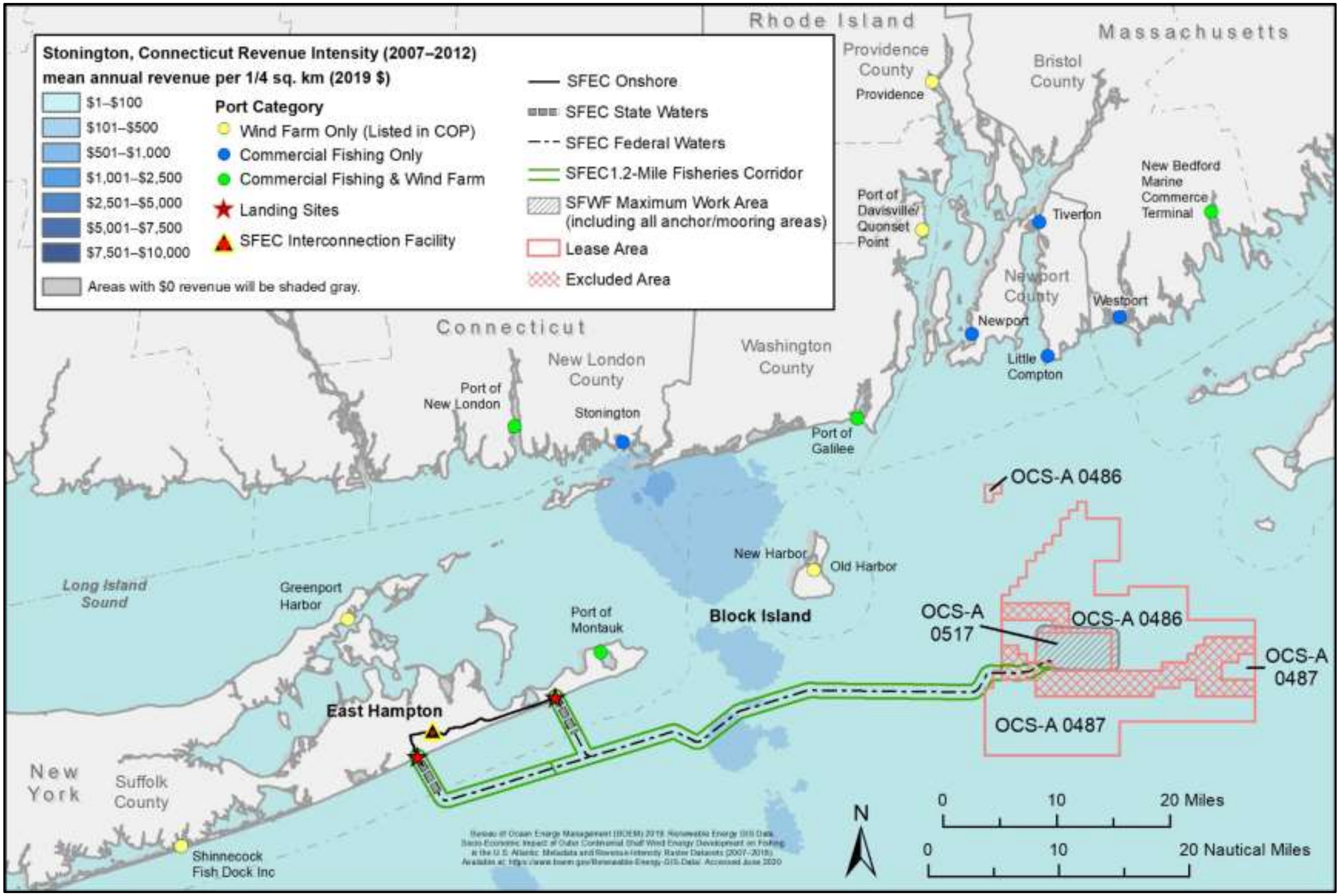

Figure C-25. Intensity of average annual revenue of federally permitted vessels: Stonington, Connecticut (2007–2012).

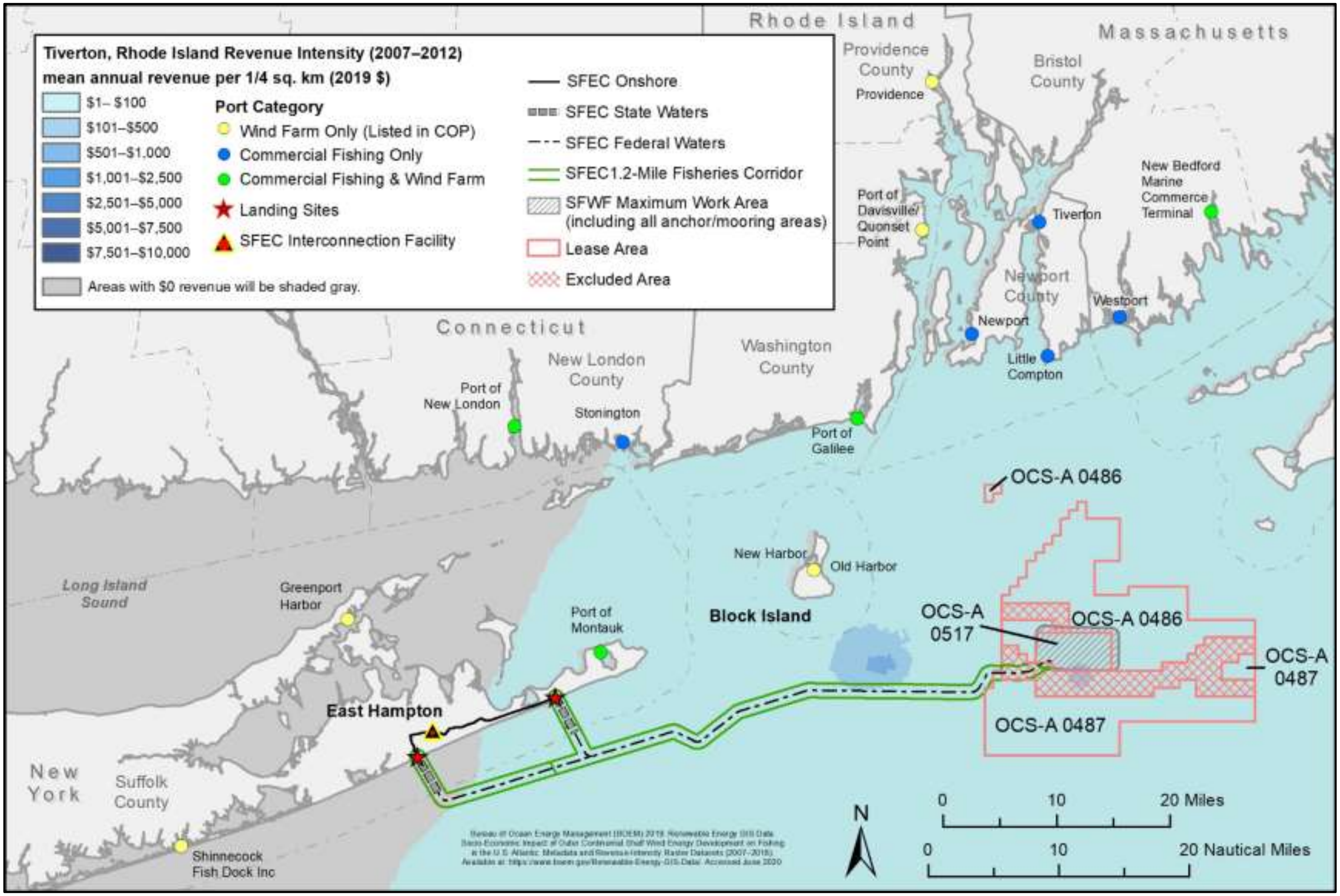

Figure C-26. Intensity of average annual revenue of federally permitted vessels: Tiverton, Rhode Island (2007–2012).

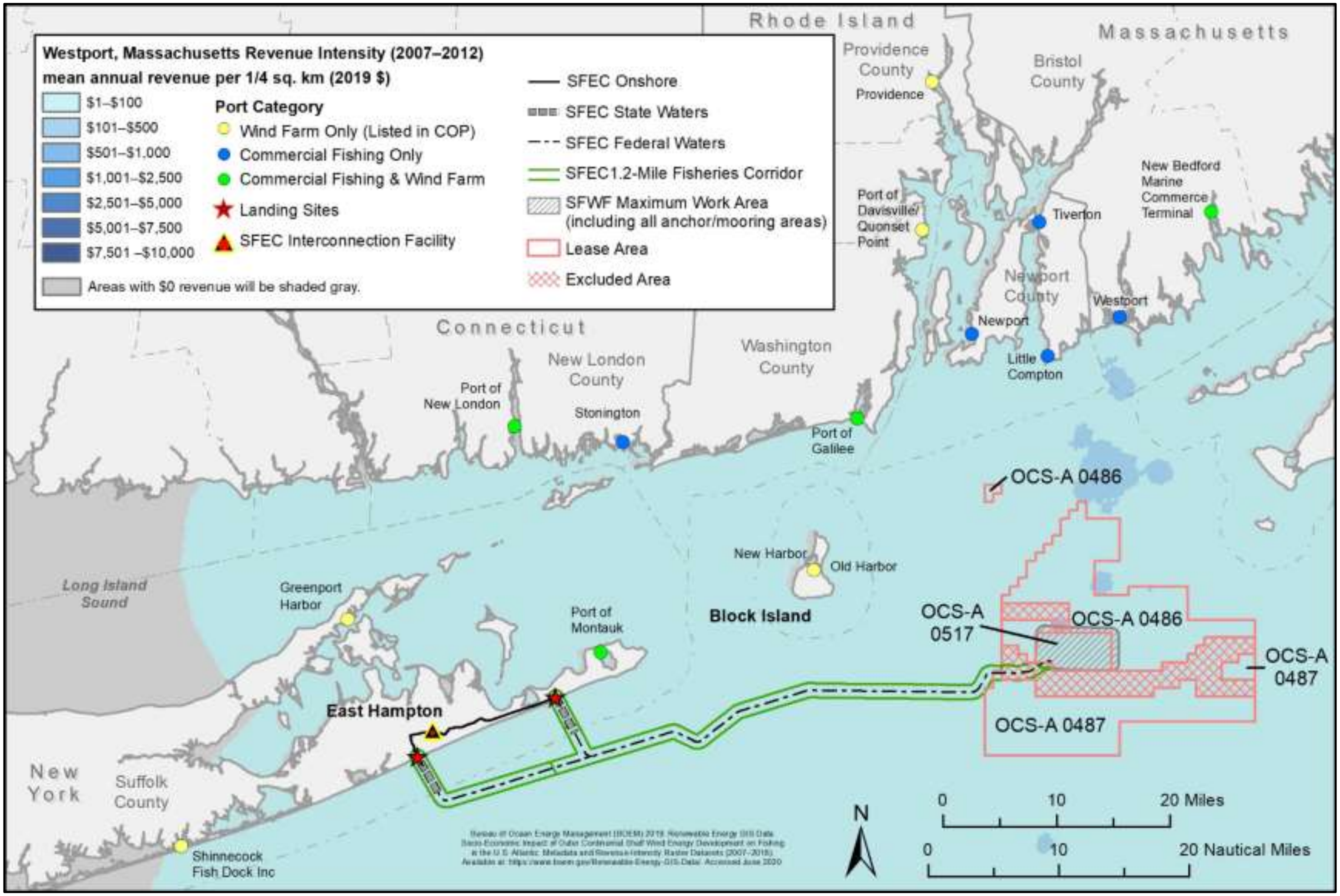

Figure C-27. Intensity of average annual revenue of federally permitted vessels: Westport, Massachusetts (2007–2012).

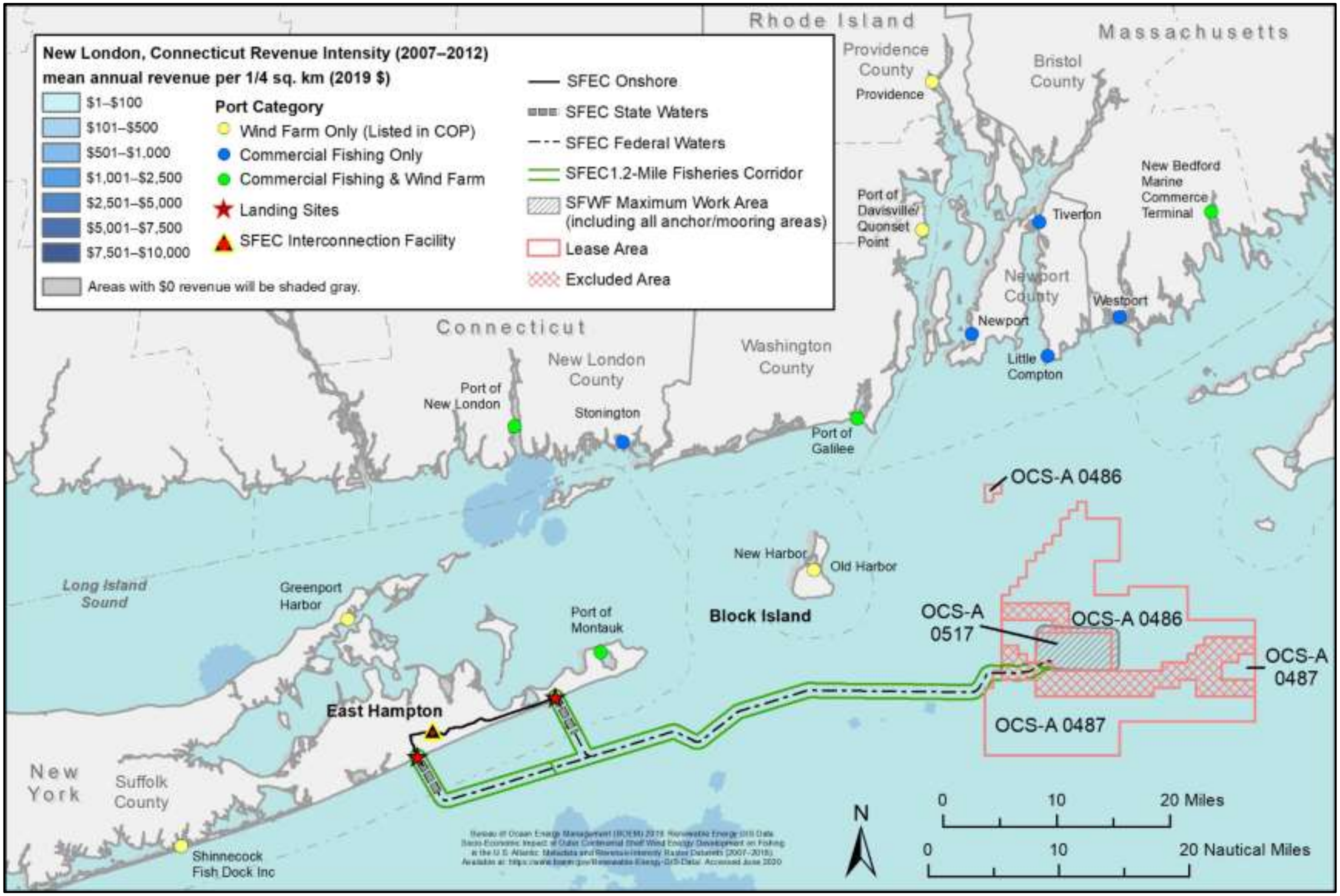

Figure C-28. Intensity of average annual revenue of federally permitted vessels: New London, Connecticut (2007–2012).

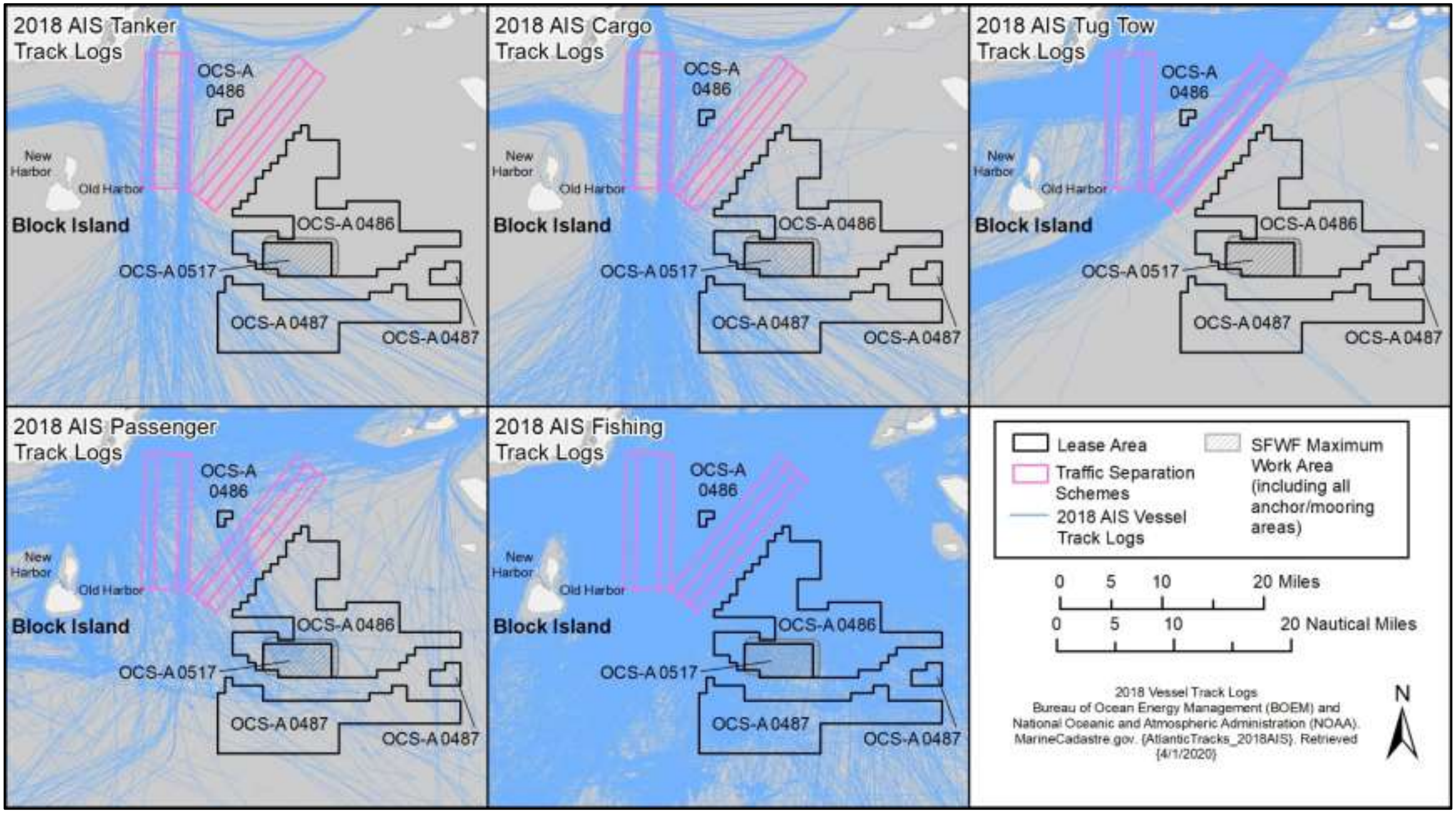

Figure C-29. Vessel traffic near the Lease Area.

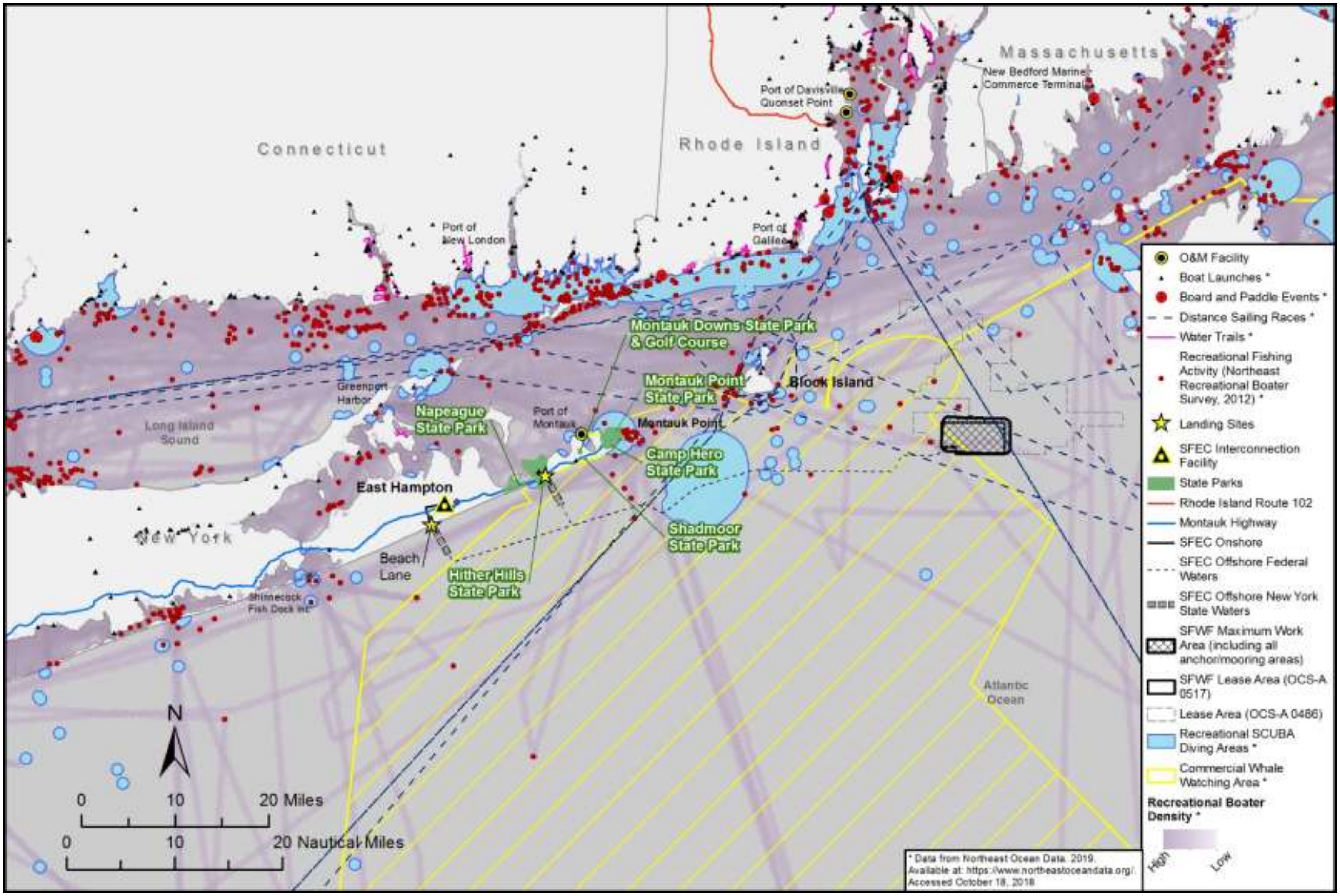

Figure C-30. Recreation and tourism information.

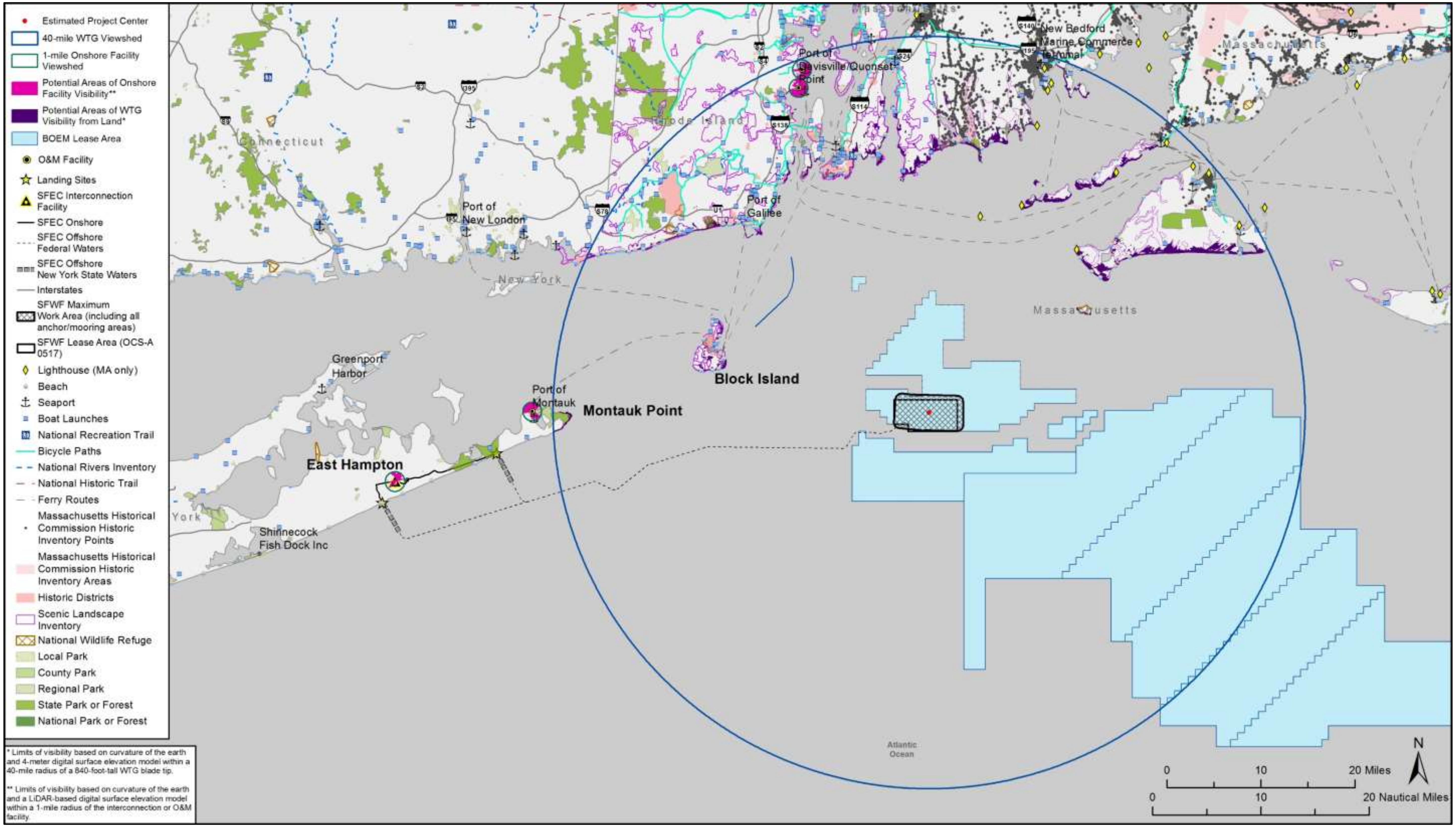

Figure C-31. Visual resources information.

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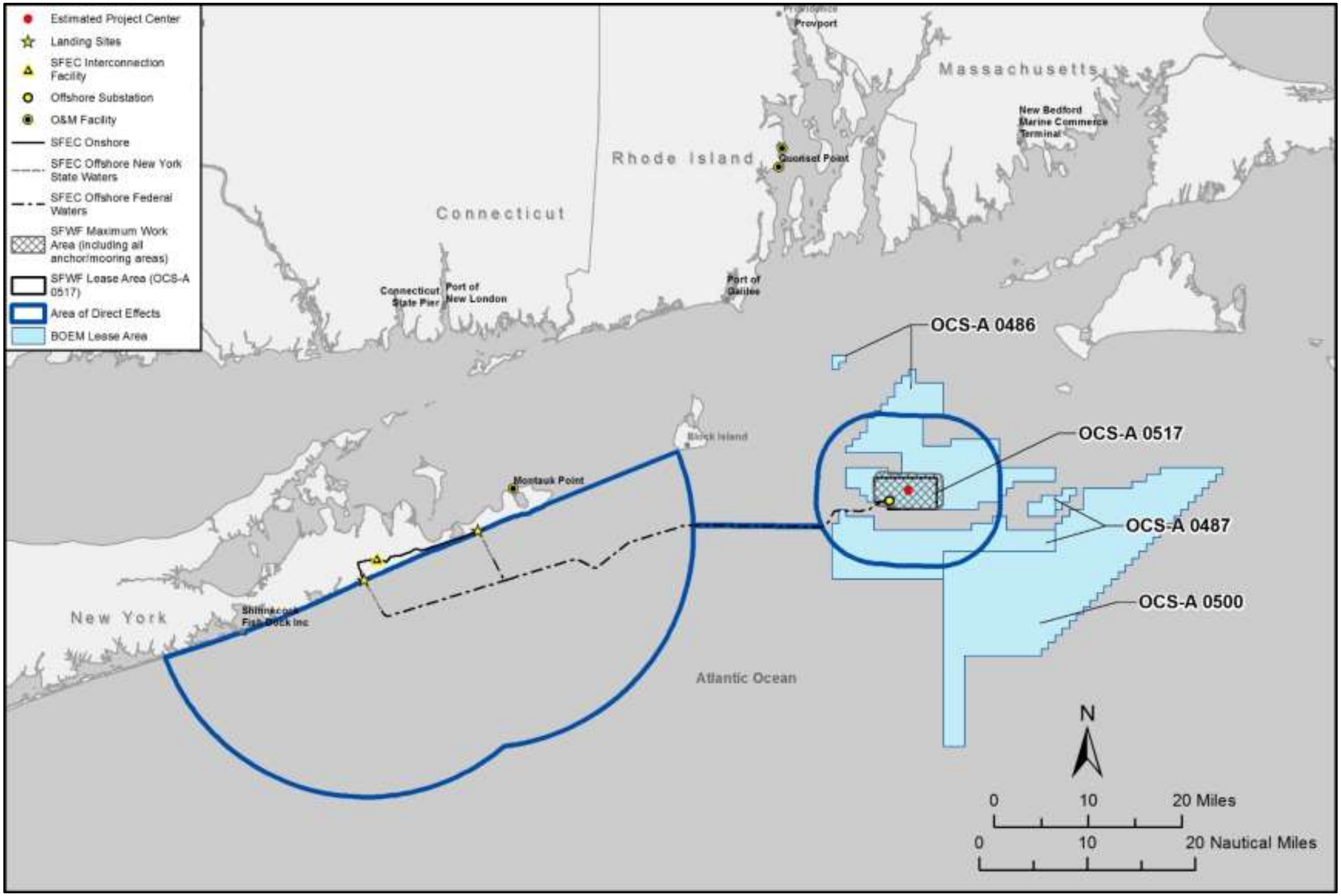

Figure C-32. Area of direct effects for marine mammals.

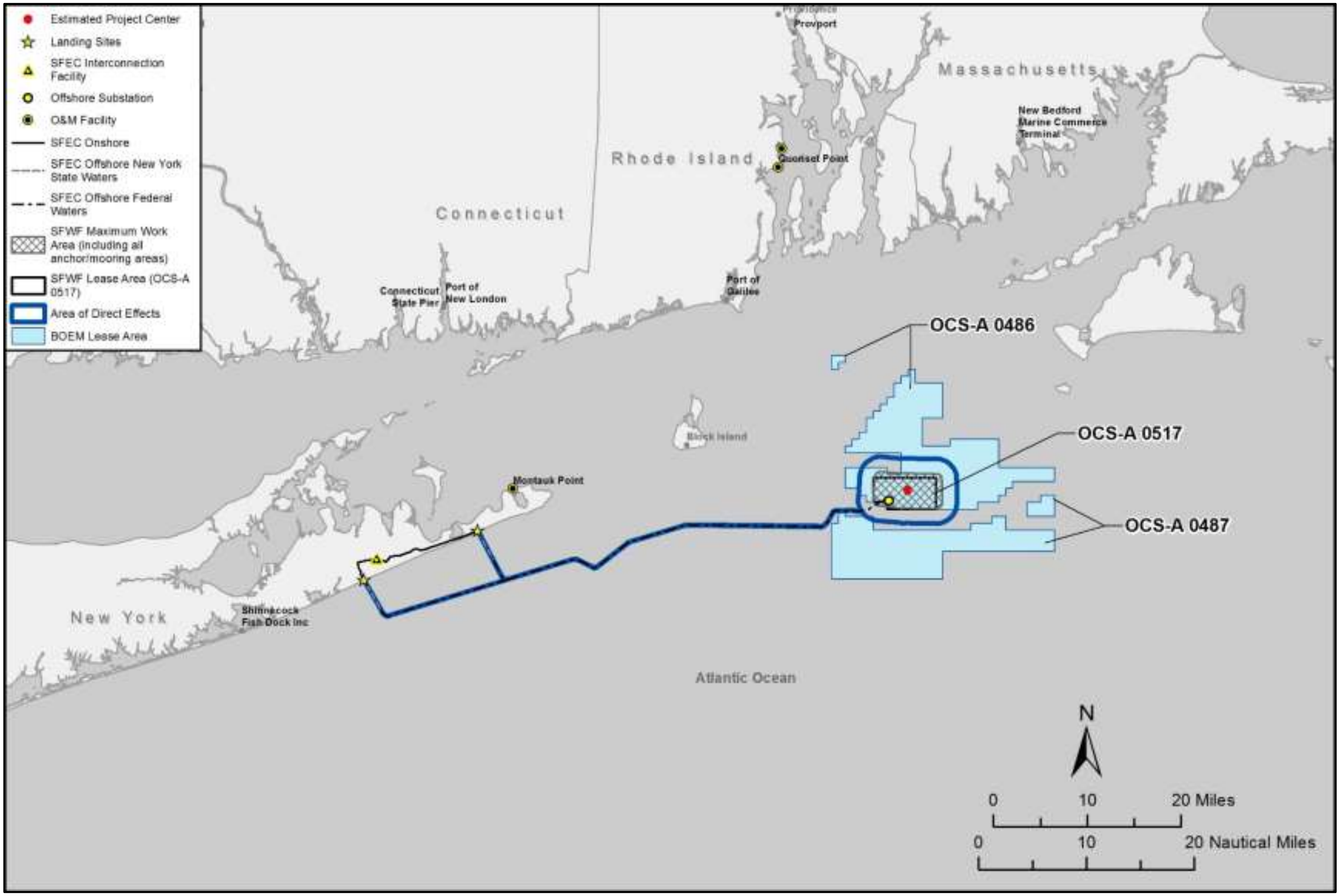

Figure C-33. Area of direct effects for sea turtles.

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Bureau of Ocean Energy Management (BOEM). 2013. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island, Massachusetts, New York, and New Jersey*. Available at: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/Renewable_Energy_Program/State_Activities/BOEM%20RI_MA_Revised%20EA_22May2013.pdf. Accessed September 2020.

Northeast Regional Ocean Council. 2019. Northeast Ocean Data. Available at: https://www.northeastoceandata.org/data-explorer/?birds|stressor-groups. Accessed January 2019.

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APPENDIX D

Project Design Envelope and Maximum-Case Scenario

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Tables

Table D-1. Maximum-Case Scenario List of Parameter Specifications D-1
Table D-2. Maximum-Case Scenario Measurements for South Fork Export Cable Seabed Footprint D-4
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Table D-1. Maximum-Case Scenario List of Parameter Specifications

Design Parameter	Minimum Design Size	Maximum Design Size	3.3.1 Air Quality	3.3.2 Water Quality	3.4.1 Bats	3.4.2 Benthic, Essential Fish Habitat, Invertebrates, and Finfish	3.4.3 Birds	3.4.4 Marine Mammals	3.4.5 Other Terrestrial and Coastal Habitats and Fauna	3.4.6 Sea Turtles	3.4.7 Wetlands and Other Waters of the United States	3.5.1 Commercial Fisheries and For-Hire Recreational Fishing	3.5.2 Cultural, Historical, and Archaeological Resources	3.5.3 Demographics, Employment, and Economics	3.5.4 Environmental Justice	3.5.5 Land Use and Coastal Infrastructure	3.5.6 Navigation and Vessel Traffic	3.5.7 Other Uses (marine, military use, aviation, offshore energy)	3.5.8 Recreation and Tourism	3.5.9 Visual Resources
WIND FARM																				
Wind farm capacity	90 megawatt (MW)	180 MW*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WIND TURBINE GENERATOR (WTG) AND FOUNDATION																				
Turbine size	6 MW	12 MW	X	X	X	X	X	X		X		X	X				X	X	X	X
Number of WTG positions	11	Up to 15	X	X	X	X	X	X		X		X	X				X	X	X	X
Distance between positions	1 nautical mile (nm) between WTGs on an east–west, north–south grid	1 nm between WTGs on an east–west, north–south grid	X	X	X	X	X	X		X		X	X				X	X	X	X
Total tip height	577 feet mean lower low water (MLLW)	840 feet MLLW			X		X					X	X				X	X	X	X
Hub height	331 feet MLLW	472 feet MLLW			X		X					X	X				X	X	X	X
Rotor diameter	492 feet MLLW	735 feet MLLW			X		X					X	X				X	X	X	X
Rotor swept zone area	190,117 square feet	424,173 square feet			X		X					X	X				X	X	X	X
Blade length	246 feet	358 feet			X		X					X	X				X	X	X	X
Platform level/interface level height for monopile	66 feet MLLW	75 feet MLLW			X		X					X	X				X	X	X	X
Tip clearance/air gap	85 feet MLLW	105 feet MLLW			X		X					X	X				X	X	X	X
Foundation construction method	Pile driving	Pile driving	X	X	X	X	X	X		X		X	X				X	X	X	X
Foundation and WTG vessel type	Jack-up vessel or derrick barge, vessel on dynamic positioning with feeder barges	Jack-up vessel or derrick barge, vessel on dynamic positioning with feeder barges	X	X	X	X	X	X		X		X	X				X	X	X	X
WTG coloring	RAL 9010 Pure White	RAL 7035 Light Grey					X						X				X	X	X	X
Federal Aviation Administration aviation obstruction lighting	Two synchronized L-864 aviation red flashing obstruction lights—WTG nacelle; 30 flashes per minute (fpm) will be utilized for air navigation lighting	Two synchronized L-864 aviation red flashing obstruction lights—WTG nacelle; 30 flashes per minute will be utilized for air navigation lighting. For wind turbines above 699 feet: the additional level of lights should consist of a minimum of three L-810 flashing red lights configured to flash in unison with the two L-864 red flashing lights located at the top of the nacelle at a rate of 30 fpm (± 3 fpm).			X		X					X	X				X	X	X	X

Design Parameter	Minimum Design Size	Maximum Design Size	3.3.1 Air Quality	3.3.2 Water Quality	3.4.1 Bats	3.4.2 Benthic, Essential Fish Habitat, Invertebrates, and Finfish	3.4.3 Birds	3.4.4 Marine Mammals	3.4.5 Other Terrestrial and Coastal Habitats and Fauna	3.4.6 Sea Turtles	3.4.7 Wetlands and Other Waters of the United States	3.5.1 Commercial Fisheries and For-Hire Recreational Fishing	3.5.2 Cultural, Historical, and Archaeological Resources	3.5.3 Demographics, Employment, and Economics	3.5.4 Environmental Justice	3.5.5 Land Use and Coastal Infrastructure	3.5.6 Navigation and Vessel Traffic	3.5.7 Other Uses (marine, military use, aviation, offshore energy)	3.5.8 Recreation and Tourism	3.5.9 Visual Resources
U.S. Coast Guard (USCG) marine navigation lighting (MNL)	Two white flashing obstruction lights (color to be determined depending on structure classification) on each turbine approximately 20 to 23 meters above MLLW on opposite corners along the same horizontal plane, each visible from all approach directions to 3 nm	Two white flashing obstruction lights (color to be determined depending on structure classification) on each turbine approximately 20 to 23 meters above MLLW on opposite corners along the same horizontal plane, each visible from all approach directions to 3 nm			X		X					X	X				X	X	X	X
USCG MNL lighting	Flashing white light visible to 1 nm for Class C structure (to be determined by USCG)	Flashing white light visible to 5 nm for Class A structure (to be determined by USCG)			X		X					X	X				X	X	X	X
WTG foundation coloring	Yellow from water line to height of at least approximately 50 feet	Yellow from water line to height of at least approximately 50 feet			X		X					X	X				X	X	X	X
Navigational boating warning tools	Sensor-operated foghorns audible between 0.5 and 2.0 nm and automatic identification system (AIS) transponders	Sensor-operated foghorns audible between 0.5 and 2.0 nm and AIS transponders			X	X	X	X				X					X	X	X	
MONOPILE FOUNDATION																				
Number of monopile foundations	12	Up to 16	X	X	X	X	X	X		X		X	X				X	X	X	X
Monopile diameter	36 feet	36 feet	X	X	X	X	X	X		X		X	X				X	X	X	X
Number of piles per foundation	1	1	X	X		X		X		X		X	X				X	X	X	X
Seabed footprint—no scour protection—per foundation	1,025 square feet	1,025 square feet	X	X		X		X		X		X	X				X	X	X	X
Seabed footprint—with scour protection—per foundation	39,765 square feet	39,765 square feet	X	X		X		X		X		X	X				X	X	X	X
Seabed preparation per foundation	40,365 square feet	40,365 square feet	X	X		X		X		X		X	X				X	X	X	X
Vessel anchoring/mooring per foundation	2,234,089 square feet	2,234,089 square feet	X	X		X		X		X		X	X				X	X	X	X
Hammer size for monopile foundation	4,000 kilojoules (kj)	4,000 kj	X	X		X		X		X		X	X				X	X	X	X
Max penetration depth into seabed	164 feet	164 feet	X	X		X		X		X		X	X				X	X	X	X
Duration of pile driving (hours/pile)	2 to 4 hours	2 to 4 hours	X	X		X		X		X		X	X				X	X	X	X
Duration of installation (days/foundation)	2 to 4 days	2 to 4 days	X	X		X		X		X		X	X				X	X	X	X

Design Parameter	Minimum Design Size	Maximum Design Size	3.3.1 Air Quality	3.3.2 Water Quality	3.4.1 Bats	3.4.2 Benthic, Essential Fish Habitat, Invertebrates, and Finfish	3.4.3 Birds	3.4.4 Marine Mammals	3.4.5 Other Terrestrial and Coastal Habitats and Fauna	3.4.6 Sea Turtles	3.4.7 Wetlands and Other Waters of the United States	3.5.1 Commercial Fisheries and For-Hire Recreational Fishing	3.5.2 Cultural, Historical, and Archaeological Resources	3.5.3 Demographics, Employment, and Economics	3.5.4 Environmental Justice	3.5.5 Land Use and Coastal Infrastructure	3.5.6 Navigation and Vessel Traffic	3.5.7 Other Uses (marine, military use, aviation, offshore energy)	3.5.8 Recreation and Tourism	3.5.9 Visual Resources
OFFSHORE SUBSTATION (OSS)																				
Number of OSS	1	1	X	X	X	X	X	X		X		X	X				X	X	X	X
OSS foundation type	Co-located monopile	Stand-alone monopile	X	X		X		X		X		X	X				X	X	X	X
OSS number of piles per foundation	1	1	X	X		X		X		X		X	X				X	X	X	X
OSS foundation construction method	Pile driving	Pile driving	X	X		X		X		X		X	X				X	X	X	X
OSS max height	Stand-alone monopile at 150 to 200 feet	Stand-alone monopile at 150 to 200 feet			X		X					X	X				X	X	X	X
USCG lighting	See monopile turbine requirements	See monopile turbine requirements			X		X					X	X				X	X	X	X
INTER-ARRAY CABLE																				
Inter-array cable capacity	34.5 kilovolts (kV)	66 kV	X	X		X		X		X		X	X				X	X	X	
Number of foundations per inter-array	Up to 3	5	X	X		X		X		X		X	X				X	X	X	
Inter-array cable length	21.4 miles	21.4 miles	X	X		X		X		X		X	X				X	X	X	
Maximum trench depth	10 feet	10 feet	X	X		X		X		X		X	X				X	X	X	
Burial depth	4 feet	6 feet	X	X		X		X		X		X	X				X	X	X	
Installation advancement (length of cable lay per day)	1 to 2 miles	1 to 2 miles	X	X		X		X		X		X	X				X	X	X	
EXPORT CABLE																				
Export cable capacity	138 kV	138 kV	X	X		X		X		X		X	X				X	X	X	
Number of export cables	1	1	X	X		X		X		X		X	X				X	X	X	
Export cable length (OCS + NYS)	61.1 miles	65.5 miles	X	X		X		X		X		X	X				X	X	X	
Burial depth - offshore	4 feet	6 feet	X	X		X		X		X		X	X				X	X	X	
OPERATIONS AND MAINTENANCE FACILITY																				
Montauk, East Hampton, New York	One or more buildings with up to 1,000 square feet of office space and up to 6,600 square feet of storage space	One or more buildings with up to 1,000 square feet of office space and up to 6,600 square feet of storage space	X	X	X	X	X		X	X	X		X			X			X	X
Quonset Point, North Kingstown, Rhode Island (two potential locations at the same facility)	One or more buildings with up to 1,000 square feet of office space and up to 11,000 square feet of storage space	One or more buildings with up to 1,000 square feet of office space and up to 11,000 square feet of storage space	X	X	X	X	X		X	X	X		X			X			X	X

Note: In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (or nm) (miles used specifically for marine navigation). Statute miles are more commonly used and are referred to simply as miles, whereas nautical miles are referred to by name or by their abbreviation nm.

* Although this EIS evaluates 180 MW as the maximum design feature, it is important to note that interconnection at the East Hampton substation is currently limited to no more than 130 MW, which matches the energy production requirement of the Power Purchase Agreement with Long Island Power Authority.

Table D-2. Maximum-Case Scenario Measurements for South Fork Export Cable Seabed Footprint

Seabed Footprint	Maximum Temporary Seabed Footprint	Maximum Permanent Seabed Footprint	3.3.1 Air Quality	3.3.2 Water Quality	3.4.1 Bats	3.4.2 Benthic, Essential Fish Habitat, Invertebrates, and Finfish	3.4.3 Birds	3.4.4 Marine Mammals	3.4.5 Other Terrestrial and Coastal Habitats and Fauna	3.4.6 Sea Turtles	3.4.7 Wetlands and Other Waters of the United States	3.5.1 Commercial Fisheries and For-Hire Recreational Fishing	3.5.2 Cultural, Historical, and Archaeological Resources	3.5.3 Demographics, Employment, and Economics	3.5.4 Environmental Justice	3.5.5 Land Use and Coastal Infrastructure	3.5.6 Navigation and Vessel Traffic	3.5.7 Other Uses (marine, military use, aviation, offshore energy)	3.5.8 Recreation and Tourism	3.5.9 Visual Resources
INTER-ARRAY CABLE																				
Inter-array cable seabed disturbance (includes cable installation and boulder relocation)	Up to 340 acres	Up to 2.5 acres	X	X		X		X		X		X	X				X	X	X	
Inter-array cable secondary cable protection	Not applicable (N/A)	Up to 10.2 acres	X	X		X		X		X		X	X				X	X	X	
Inter-array cable protection at approach to foundations	N/A	Up to 7.5 acres	X	X		X		X		X		X	X				X	X	X	
Inter-array cable seabed disturbance	Up to 340 acres	Up to 2.5 acres	X	X		X		X		X		X	X				X	X	X	
EXPORT CABLE																				
South Fork Export Cable (SFEC) – trench width	25 to 43 feet	1 foot	X	X		X		X		X		X	X				X	X	X	
SFEC – Outer Continental Shelf (OCS) submarine cable	555.3 acres	7.0 acres	X	X		X		X		X		X	X				X	X	X	
SFEC – OCS cable joints	N/A	0.1 acre	X	X		X		X		X		X	X				X	X	X	
SFEC – OCS cable protection (for up to 7 crossings)	N/A	0.6 acre	X	X		X		X		X		X	X				X	X	X	
SFEC – OCS secondary cable protection	N/A	7.1 acres	X	X		X		X		X		X	X				X	X	X	
SFEC – New York State (NYS) submarine cable	18 acres	0.4 acre	X	X		X		X		X		X	X				X	X	X	
SFEC – NYS secondary cable protection	N/A	0.2 acre	X	X		X		X		X		X	X				X	X	X	
SFEC – NYS sediment excavation (offshore cofferdam)	850 cubic yards	N/A	X	X		X		X		X		X	X				X	X	X	
SFEC – secondary cable protection (estimated 5% OCS + 2% NYS)	N/A	7.3 acres	X	X		X		X		X		X	X				X	X	X	

Table D-3. Maximum-Case Scenario Measurements for South Fork Export Cable Landing Sites

Design Parameter	Beach Land Route A	Hither Hills Route B	3.3.1 Air Quality	3.3.2 Water Quality	3.4.1 Bats	3.4.2 Benthic, Essential Fish Habitat, Invertebrates, and Finfish	3.4.3 Birds	3.4.4 Marine Mammals	3.4.5 Other Terrestrial and Coastal Habitats and Fauna	3.4.6 Sea Turtles	3.4.7 Wetlands and Other Waters of the United States	3.5.1 Commercial Fisheries and For-Hire Recreational Fishing	3.5.2 Cultural, Historical, and Archaeological Resources	3.5.3 Demographics, Employment, and Economics	3.5.4 Environmental Justice	3.5.5 Land Use and Coastal Infrastructure	3.5.6 Navigation and Vessel Traffic	3.5.7 Other Uses (marine, military use, aviation, offshore energy)	3.5.8 Recreation and Tourism	3.5.9 Visual Resources
SUMMARY OF EXPORT CABLE SEGMENT LENGTHS																				
South Fork Export Cable (SFEC) - offshore	61.8 miles	49.9 miles	X	X		X		X		X		X	X				X	X	X	
SFEC - Outer Continental Shelf (OCS)	58.3 miles	46 miles	X	X		X		X		X		X	X				X	X	X	
SFEC - New York State (includes 500 feet of sea-to-shore on land transition)	3.5 miles	3.5 miles	X	X		X		X		X		X	X				X	X	X	
SFEC - onshore	4.1 miles	11.5 miles	X	X	X		X		X		X		X	X	X	X			X	
Total export cable segments length per landing site	65.9 miles	61.4 miles	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
ONSHORE COMPONENTS																				
Landfall sites	Beach Lane	Hither Hills	X	X	X		X		X		X		X	X	X	X			X	X
Landfall transition method	Horizontal directional drilling (HDD) with cofferdam	HDD with cofferdam	X	X	X		X		X		X		X	X	X	X			X	X
Landfall transition	Underground concrete transition vault	Underground concrete transition vault	X	X	X		X		X		X		X	X	X	X			X	X
Onshore construction location	Underground duct banks of polyvinyl chloride (PVC) pipes encased in concrete	Underground duct banks of PVC pipes encased in concrete	X	X	X		X		X		X		X	X	X	X			X	X
Onshore construction method	Open trench (wide enough to accommodate max 4 feet wide × 8 feet deep conduit) with HDD or other trenchless technology as needed	Open trench (wide enough to accommodate max 4 feet wide × 8 feet deep conduit) with HDD or other trenchless technology as needed	X	X	X		X		X		X		X	X	X	X			X	X
Onshore dimensions	4 conduits wide × 2 deep (or vice versa); 1.6 to 3 feet × 1.8 to 3.3 feet	3 conduits wide × 3 deep; 2.25 feet × 2.5 feet	X	X	X		X		X		X		X	X	X	X			X	X
Onshore cable route	Beach Lane to interconnection facility site	Old Montauk Highway to interconnection facility site	X	X	X		X		X		X		X	X	X	X			X	X
Length of onshore cable	4.1 miles	11.5 miles	X	X	X		X		X		X		X	X	X	X			X	X
Onshore interconnection facility location	One location on Cove Hollow Road in East Hampton, New York	One location on Cove Hollow Road in East Hampton, New York	X	X	X		X		X		X		X	X	X	X			X	X
Onshore interconnection facility site size	228 × 313 feet on 2.377 acres of leased area within existing Long Island Power Authority substation property	228 × 313 feet on 2.377 acres of leased area within existing Long Island Power Authority substation property	X	X	X		X		X		X		X	X	X	X			X	X

Note: In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (or nm) (miles used specifically for marine navigation). Statute miles are more commonly used and are referred to simply as miles, whereas nautical miles are referred to by name or by their abbreviation nm.

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APPENDIX E

Cumulative Activities Scenario

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CUMULATIVE ACTIVITIES SCENARIO

Cumulative impacts are the incremental effects of a proposed action on the environment when added to other past, present, or reasonably foreseeable future actions, regardless of which agency or person undertakes the actions (40 Code of Federal Regulations [CFR] 1508.7)[1].

This appendix discusses resource-specific cumulative activities that could occur if Project impacts occur in the same location and timeframe as impacts from other relevant past, present, or reasonably foreseeable future actions. The *Project* here is the construction, operations and maintenance, and conceptual decommissioning of a wind energy project located within the Bureau of Ocean Energy Management's (BOEM's) Renewable Energy Lease Area OCS-A 0517, approximately 18 statute miles southeast of Block Island, Rhode Island, and 34 statute miles east of Montauk Point, New York.

The geographic analysis area for cumulative impacts varies for each resource as shown below in Table E-1 and on Figures E-1 through E-17 in Attachment 1. BOEM anticipates that cumulative impacts could occur between the start of Project construction in 2021 and the completion of Project decommissioning approximately 2052.

In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (miles used specifically for marine navigation). This appendix uses statute miles more commonly and refers to them simply as *miles*, whereas nautical miles are referred to by name.

[1] On July 16, 2020, the Council on Environmental Quality (CEQ), which is responsible for federal agency implementation of NEPA, updated the regulations for implementing the procedural provisions of NEPA (85 CFR 43304-43376). Since BOEM's NEPA review of the proposed Project began prior to the September 14, 2020, effective date of the updated regulations, this draft EIS was prepared under the previous version of the regulations (1978, as amended in 1986 and 2005). However, much of CEQ's updated regulations is an incorporation of the interagency coordination, timing, and page limit elements of the One Federal Decision policy and Secretarial Order 3355, which were already applicable to this EIS process.

Table E-1. Resource-Specific Geographic Analysis Areas

Resource	Geographic Analysis Area	Rationale
Physical Resources		
Air quality	The geographic analysis area for air quality includes the Outer Continental Shelf (OCS) permit area (consisting of the SFWF, portions of the offshore SFEC, and all other potentially affected areas within 25 miles of the Lease Area), plus all lands within a 25-kilometer (km) radius of potential Project on-land construction areas and port locations (Figure E-1).	The geographic analysis area encompasses the geographic region subject to U.S. Environmental Protection Agency (EPA) review as part of an OCS permit for the Project under the Clean Air Act. The geographic analysis area also considers potential air quality impacts associated with the on-land construction areas and the mustering port(s) outside of the OCS permit area. Given the generally low emissions of the sea vessels and equipment that would be used during proposed construction activities, any potential air quality impacts would likely be within a few miles of the source. BOEM selected the 15.5-mile (25-km) distance to provide a reasonable buffer.
Water quality	The geographic analysis area for onshore water quality impacts includes watersheds and groundwater basins that cross or fall within the project. The geographic analysis area for offshore water quality impacts includes coastal and marine waters within a 10-mile radius of Project components, as well as a 15.5-mile (25-km) radius of waterways for ports that may be used during the Project (Figure E-2).	The onshore geographic analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operation activities of the proposed project. The offshore geographic 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.
Biological Resources		
Bats	The United States coastline from Maine to Florida (Figure E-3). The offshore limit is 100 miles (161 km) from the Atlantic shore to capture the migratory movements of most species in this group. The onshore limit is 5 miles (8 km) inland to cover onshore habitats used by the 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 geographic analysis area was established to capture the majority of the movement range for migratory species. Northern long-eared bats and other cave bats do not typically occur on the OCS. Tree bats are long-distance migrants whose ranges include the majority of the Atlantic coast from Florida to northern Quebec.
Benthic habitat, essential fish habitat (EFH), invertebrates, and finfish	The Northeast Shelf Large Marine Ecosystem (LME), which extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras, North Carolina (Figure E-4). Benthic habitat includes a 10-mile (16.1-km) radius around the Rhode Island-Massachusetts Wind Energy Area (RI-MA WEA) and the SFEC.	This area is likely to capture the majority of the movement range for most species in this group.[†] This area would account for some transport of water masses and for benthic invertebrate larval transport due to ocean currents. Although sediment transport beyond 10 miles (16.1 km) is possible, sediment transport related to proposed Project activities would likely to be on a smaller spatial scale than 10 miles (16.1 km).
Birds	The United States coastline from Maine to Florida (see Figure E-3). The offshore limit is 100 miles (161 km) from the Atlantic shore to capture the migratory movements of most species in this group. The onshore limit is 0.5 mile (0.8 km) inland to cover onshore habitats used by the 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 geographic analysis area 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.
Marine mammals	The Scotian Shelf, Northeast Shelf, and Southeast Shelf LMEs (Figure E-5).	This area is likely to capture the majority of the movement range for most species in this group.[†]

Resource	Geographic Analysis Area	Rationale
Terrestrial and coastal habitats and faunas	All onshore Project areas, including a 1.0-mile buffer (Figure E-6).	BOEM expects the resources in this area to have small home ranges. These resources are unlikely to be affected by impacts outside their home ranges.
Sea turtles	The Northeast and Southeast Shelf LMEs (Figure E-7).	This area is likely to capture the majority of the movement range for most species in this group.†
Wetlands and other waters of the United States	The geographic analysis area for wetlands and other waters of the United States encompasses the three subwatersheds that overlap the onshore Project (Figure E-8).	This area encompasses the drainage basin and network of surface waterbodies that could be affected by Project construction and operations and maintenance (O&M) activities.
Socioeconomic and Cultural Resources		
Commercial fisheries and for-hire recreation fishing	The geographic area for cumulative impacts assessment includes waters managed by the New England Fishery Management Council and/or the Mid-Atlantic Fisheries Management Council within the U.S. Exclusive Economic Zone (from 3 to 200 nautical miles from the coastline), plus the state waters of the Commonwealth of Massachusetts, Rhode Island and New York (from 0 to 3 nautical miles from the coastline) (Figure E-9).	The boundaries for the geographic analysis area were developed to consider impacts to federally permitted vessels operating in all fisheries in state and U.S. Exclusive Economic Zone waters.
Cultural resources	The geographic analysis area for terrestrial cultural resources encompasses the footprint of all onshore Project components, plus the viewshed in which Project facilities could be visible (the area of potential effects for visual impacts analysis) (Figure E-10). The geographic analysis area for marine cultural resources includes the SFWF and offshore South Fork Export Cable (SFEC), the adjacent BOEM lease areas OCS-A 0486 and OCS-A 0487, plus a 1,000-foot buffer zone extending from the edge of project components outward and overlapping with the two adjacent lease areas (Figure E-11).	This terrestrial cultural resources geographic analysis area accounts for the footprint of onshore Project development where physical impacts could occur to historic properties and the viewshed within which visibility of the Project could result in an impact on the visual setting of a historic property from construction, O&M, or conceptual decommissioning. The marine cultural resources geographic analysis area encompass offshore locations where BOEM anticipates impacts associated with construction, O&M, and conceptual decommissioning of the Project.
Demographics, employment, and economics	Suffolk County in New York; Providence, Newport, and Washington Counties in Rhode Island; Bristol County in Massachusetts; New London County in Connecticut; Gloucester County in New Jersey; Baltimore County in Maryland; and Norfolk City/County in Virginia. These counties include those with proposed onshore infrastructure, potential port cities, and counties in closest proximity to the Lease Area (Figure E-12).	These counties are the most likely to experience beneficial or negative economic impacts from the proposed Project.
Environmental justice	The same as the socioeconomics geographic analysis area (see Figure E-12).	The geographic analysis area would be the same as the socioeconomics geographic analysis area, as these counties, and environmental justice communities located within, are the most likely to experience impacts from the proposed Project.
Land use and coastal infrastructure	Town of East Hampton and the ports potentially used for Project construction, operations and maintenance, and conceptual decommissioning (Figure E-13).‡	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with proposed onshore facilities and ports.
Navigation and vessel traffic	The geographic analysis area includes coastal and marine waters within a 10-mile radius of Project components, as well as waterways for ports that may be used during the Project (Figure E-14).	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.

Resource	Geographic Analysis Area	Rationale
Other marine uses	Marine mineral extraction: Areas within 0.25 mile of the Project and footprints of other cables and wind lease areas in the RI-MA WEA. National security/military use/ aviation and air traffic/ radar systems: 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 (Figure E-15). Aviation and air traffic: Airspace and airports used by regional air traffic. Radar systems: Includes air space used by regional air traffic. Offshore energy: Other known wind energy project locations. Cables and pipelines: area within 1 mile of the Project and other undersea facilities and wind lease areas in the RI-MA WEA. Scientific research and surveys: Same study area as the aviation and land-based radar.	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.
Recreation and tourism	The geographic analysis area includes all Project components, plus a 40-mile radius from the wind turbine generator (WTG) array (Figure E-16).	This geographic analysis area was selected to coincide with the April 2019 SFWF visual impact assessment visual analysis area to address Project visibility from sensitive resources and encompass all locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.
Visual resources	The area of analysis for cumulative visual impacts uses the 40-mile visual analysis area as defined in the April 2019 SFWF visual impact assessment (Figure E-17).	This geographic analysis area was selected to coincide with the April 2019 SFWF visual impact assessment visual analysis area to address Project visibility from sensitive resources and encompass all locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.

[*] BOEM is not proposing to model impacts at Class I areas because no federal Class I areas are located within the geographic analysis area.

[†] LMEs are delineated based on ecological criteria including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and the National Oceanic and Atmospheric Administration (NOAA) uses them as the basis for ecosystem-based management.

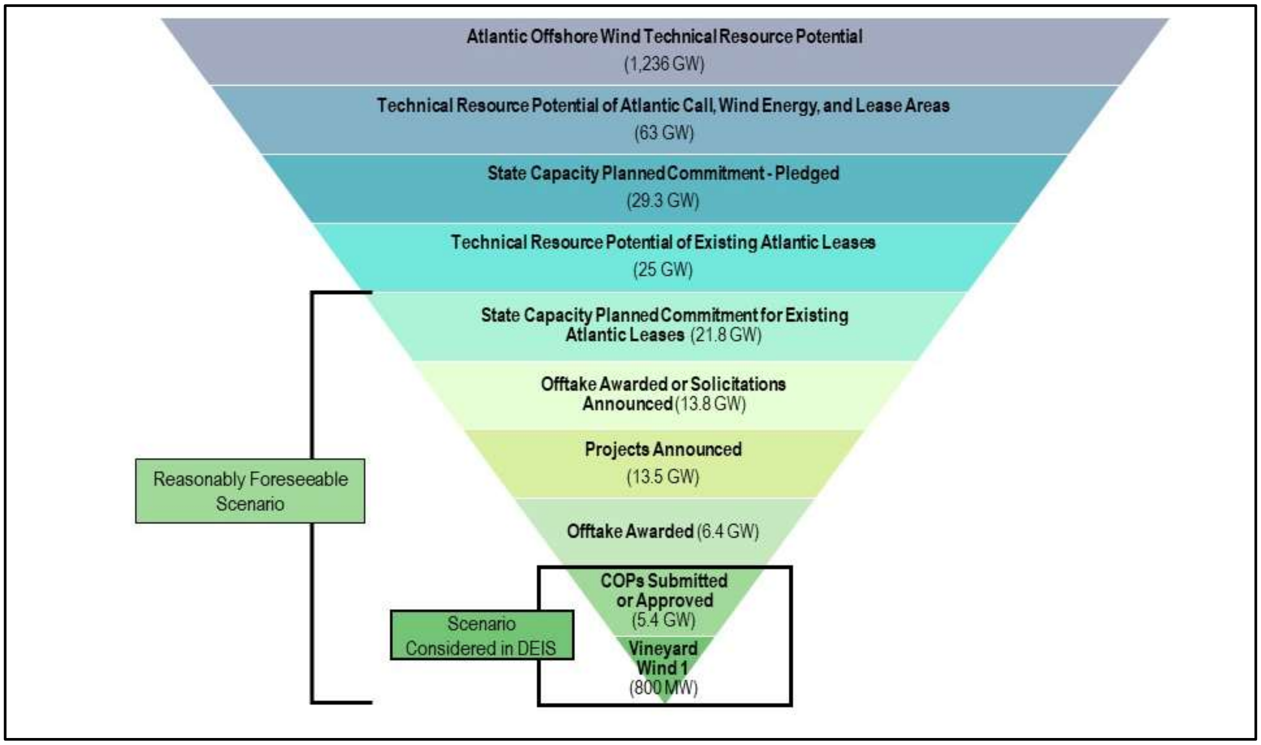
[‡] DWSF plans to finalize the specific ports during the facility design report phase.

PAST, PRESENT, AND FUTURE REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS

This section includes a list and description of past, present, and reasonably foreseeable projects that could contribute to cumulative impacts. Projects or actions that are considered speculative per the definition provided in 43 CFR 46.30[2] are noted in subsequent tables but excluded from the cumulative impact analysis in Chapter 3.

Cumulative projects and activities described in this section consist of 10 types of actions: 1) other offshore wind energy development activities; 2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); 3) tidal energy projects; 4) marine minerals use and ocean-dredged material disposal; 5) military use; 6) marine transportation; 7) fisheries use and management; 8) global climate change; 9) oil and gas activities; and 10) onshore development activities.

BOEM analyzed the possible extent of future other offshore wind energy development activities on the Atlantic Outer Continental Shelf (OCS) to determine reasonably foreseeable cumulative effects measured by installed power capacity. The graph below illustrates BOEM's method for determination of which offshore wind actions are considered reasonably foreseeable.



Scope for Future Possible Development of Offshore Wind

Note: Each category or level includes the entirety of the levels below it. Further, these categories are not mutually exclusive and some of them may include projects that fall under other categories.

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[2] 43 CFR 46.30 – Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a responsible official of ordinary prudence would take such activities into account in reaching a decision. The federal and non-federal activities that BOEM must take into account in the analysis of cumulative impacts include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by BOEM. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

BOEM's cumulative impact analysis concludes that approximately 22 gigawatts (GW) of Atlantic offshore wind development is reasonably foreseeable, encompassing the potential projects listed in Table E-3. These projects include the following and are illustrated on the graph above:

- SFWF
- All projects with COPs approved or submitted (in addition to the proposed Project [previous bullet]), which include Vineyard Wind, Bay State Wind, Skipjack Wind, Ocean Wind, Coastal Virginia Offshore Wind, and Empire Wind.
- All projects with power offtake[3] awarded (with the exception of Bay State Wind[4]), which include all of the projects listed in the previous criteria (previous bullet) as well as Revolution Wind, U.S. Wind, Sunrise Wind, Mayflower Wind, and Vineyard Wind 2 (includes Park City Wind).
- All projects for which the developer has publicly announced development plans, regardless of whether a COP has been approved or submitted or offtake awarded (in addition to the projects identified in the previous criteria [previous bullet]), which includes Liberty Wind and Dominion Energy.
- All announced and scheduled state offtake solicitations, whether or not they are linked to plans or arrangements with particular developers. With the exception of Dominion Energy, this includes all of the projects identified in the previous criterion [previous bullets], as well as the additional development necessary to fulfill the remaining announced offshore wind solicitations (distinct from announced state goals, 2,534 MW[5] beyond what is currently represented by submitted or announced COPs). The development considered here is geographically sensitive and assumes that state interest levels do not shift.
- The remaining planned but unscheduled Atlantic state solicitations for existing lease areas (Massachusetts and Virginia)[6]. There are no submitted COPs for some of the actions considered reasonably foreseeable in this scenario. However, this information is not essential to a reasoned choice among alternatives.

Offshore Wind Energy Development Activities

Site Characterization Studies

A lessee is required to provide the results of site characterization activities with its site assessment plan (SAP) or COP. For the purposes of the cumulative effects analysis, BOEM makes the following assumptions for survey and sampling activities:

- Site characterization would occur on all existing leases.
- Site characterization would likely take place in the first 3 years following execution of a lease, based on the fact that a lessee would likely want to generate data for its COP at the earliest possible opportunity.

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[3] *Offtake* in this document is defined as the offshore wind energy produced and delivered to shore for use by purchasers.

[4] Bay State Wind submitted a COP, but currently has no offtake awarded for the project.

[5] A total of 7,308 MW of procurements have been announced, and 4,240 MW of available capacity identified in submitted or announced COPs. Some states have goals beyond announced procurements. The ability for a project to fulfill a particular procurement is geographically sensitive. Maryland and New Jersey each have announced procurements for which there are currently no nearby announced or submitted COPs with available capacity, though leased areas without an associated COP are available. Should New York announce additional procurements towards its state goal, both New York and New Jersey will have more announced procurements than available lease capacity within the New York Bight.

[6] Approximately 4.7 GW of planned solicitations for the state of New York are not included because BOEM considers them reliant on additional leasing in the New York Bight. Approximately 4 GW of offshore wind goals for the state of New Jersey are not included as BOEM considers them reliant on additional leasing in the New York Bight.

- Lessees would likely survey most or all of the proposed lease area during the 5-year site assessment term to collect required geophysical information for siting of a meteorological tower and/or two buoys and commercial facilities (wind turbines). The surveys may be completed in phases, with the meteorological tower and/or buoy areas likely to be surveyed first.
- Lessee would not use air guns, which are typically used for deep penetration two-dimensional or three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources (BOEM 2016).

Table E-2 describes the typical site characterization surveys, the types of equipment and/or method used, and which resources the survey information would inform.

Table E-2. Site Characterization Survey Assumptions

Survey Type	Survey Equipment and/or Method	Resource Surveyed or Information Used to Inform
High-resolution geophysical surveys	Side-scan sonar, sub-bottom profiler, magnetometer, multi-beam echosounder	Shallow hazards, archaeological, Bathymetric charting, benthic habitat
Geotechnical/ sub-bottom sampling	Vibracores, deep borings, cone penetration tests	Geological
Biological	Grab sampling, benthic sled, underwater imagery/ sediment profile imaging	Benthic habitat
	Aerial digital imaging; visual observation from boat or airplane	Bird
	Ultrasonic detectors installed on survey vessels used for other surveys	Bat
	Visual observation from boat or airplane	Marine fauna (marine mammals and sea turtles)
	Direct sampling of fish and invertebrates	Fish

Source: BOEM (2016)

Site Assessment Activities

After SAP approval, a lessee can evaluate the meteorological conditions, such as wind resources, with the approved installation of meteorological towers and/or buoys. Site assessment activities have been approved or are in the process of being approved for multiple lease areas consisting of one to three meteorological buoys per SAP (Table E-3). Site assessment would likely take place starting within 1 to 2 years of lease execution, because preparation of an SAP (and subsequent BOEM review) takes time. This cumulative analysis considers these site assessment activities.

Construction and Operation of Offshore Wind Facilities

Table E-3 lists all offshore wind leasing activities that BOEM considers reasonably foreseeable by lease areas and projects, their permitting stage/assessment, and anticipated timeline.

Table E-3. Offshore Wind Activities on the United States Atlantic Coast (dates shown as of July 2020 to be updated by BOEM)

Lease Number	States	Lessee/Developer Name	Project Name	Construction Date	Operations Date	Facility Description	BOEM Permitting Stage*	Power Purchase Agreement (PPA)/ Offshore Renewable Energy Certificate (OREC) Status
Active Projects (State)								
N/A (state project)	Maine	Maine Aqua Ventus I, GP, LLC	New England Aqua Ventus I	2022	2022	12 MW, 1–2 WTG	N/A	PPA with ME
N/A (state project)	Rhode Island	Deepwater Wind, LLC (now Orsted)	Block Island Wind Farm	2015	2016	30 MW, 5 WTG	N/A	PPA with RI
Active Projects (Federal)								
OCS-A 0483	Virginia	Virginia Electric and Power Company (dba Dominion Virginia Power)	Virginia Commercial Offshore Wind (per SAP)	2024	2026	2,640 MW; 220 WTG One met buoy	SAP approved COP Expected 2022	No PPAs signed to date
OCS-A 0486	Rhode Island and Connecticut	DWW Rev I, LLC (Orsted and Eversource)	Revolution Wind	2022-2023	2023	704 MW; 88 WTG One met buoy	COP submitted SAP approved	PPA with CT and RI
OCS-A 0487; OCS-A 0500 (portions)	New York	Orsted and Eversource	Sunrise Wind	2022–2023	2024	880 MW; 110 WTG	SAP submitted	OREC awarded by NYSERDA (PPA with NY)
OCS-A 0490 (portion)	Maryland	U.S. Wind Inc.	U.S. Wind (Maryland Offshore Wind Project)	2022–2023	2023	270 MW; 23 WTG One met tower, one seabed mounted current/ CTD platform	SAP approved	OREC awarded by State of Maryland
OCS-A 0497	Virginia	Virginia Department of Mines, Minerals and Energy (Orsted & Dominion Energy)	Coastal Virginia Offshore Wind	2020	2020	12 MW, two WTGs One wave/current buoy	Under construction; Revised Research activities plan (RAP) approved	N/A (Research)
OCS-A 0498 (portion)	New Jersey	Ocean Wind, LLC (Orsted & PSEG)	Ocean Wind	2023	2024	1,100 MW, 92 WTG Two met buoys One met/current buoy	COP in progress SAP approved	PPA with NJ
OCS-A 0500 (portion)	Massachusetts	Bay State Wind LLC (Orsted & Eversource)	Bay State Wind	2025	2026	800 MW Two FLIDAR buoys One met buoy	COP In Progress SAP approved	No PPA signed to date

Lease Number	States	Lessee/Developer Name	Project Name	Construction Date	Operations Date	Facility Description	BOEM Permitting Stage*	Power Purchase Agreement (PPA)/ Offshore Renewable Energy Certificate (OREC) Status
OCS-A 0501 (north)	Massachusetts	Vineyard Wind LLC	Vineyard Wind 1	2021	2022	800 MW, 100 WTG Two met buoys	SEIS issued COP received SAP approved	PPA with MA
OCS-A 0501 (south)	Connecticut	Vineyard Wind LLC	Park City Wind	2024	2025	Up to 804 MW, 101 WTGs	TBD	PPA with CT
OCS-A 0508	North Carolina, Virginia	Avangrid Renewables, LLC	Kitty Hawk Offshore	2026	2027	Up to 1824 MW, 152 WTGs Up to two buoys and up to two platforms	COP In Progress SAP approved	No PPA signed to date
OCS-A 0512 (phase 1)	New York	Equinor Wind US, LLC	Empire Wind Phase 1	2024	2024	816 MW, 68 WTGs Two met buoys, one wave/ met buoy, and one subsea current meter mooring	COP in progress SAP approved	PPA with NY
OCS-A 0517	New York	Deepwater Wind South Fork, LLC (Orsted & Eversource)	South Fork Wind Farm (Proposed Action)	2021	2022	132 MW, 15 WTGs One met buoy	Draft EIS in progress COP received SAP approved	PPA with NY
OCS-A 0519 (portion; includes former OCS-A 0482)	Delaware, Maryland	Skipjack Offshore Energy, LLC (Orsted)	Skipjack	2023	2024	120 MW, 10 WTGs One met buoy	COP received SAP approved	OREC awarded by State of Maryland (connection to PJM grid in Delaware)
OCS-A 0521 (north)	Massachusetts	Mayflower Wind Energy, LLC (Shell & EDP Renewables)	Mayflower (north)	2024	2025	Up to 804 MW, 101 WTGs One met buoy	SAP approved	PPA with MA
Future Projects (Federal)								
OCS-A 0482	Delaware	GSOE I LLC (Orsted & PSEG)	Garden State Offshore Energy	This group may collectively support up to 1,200 MW of development from MD. NJ has almost 4,000 MW in outstanding State goals. Collectively the technical capacity of this group is 1,908 MW (159 turbines). The remaining capacity may be utilized by demand from NJ (60 turbines) (see Attachment 4).			SAP approved	PPA with DE and NJ
OCS-A 0490 (remainder)	Maryland	U.S. Wind Inc.	TBD				SAP approved	No PPAs signed to date
OCS-A 0519 (remainder)	Maryland/Dela ware	Skipjack Offshore Energy, LLC (Orsted)	TBD				SAP approved	No PPAs signed to date

Lease Number	States	Lessee/Developer Name	Project Name	Construction Date	Operations Date	Facility Description	BOEM Permitting Stage*	Power Purchase Agreement (PPA)/ Offshore Renewable Energy Certificate (OREC) Status
OCS-A 0487 (remainder)	Rhode Island	Deepwater Wind New England, LLC	TBD	This group may collectively support up to 5,296 MW of development—for MA (1,600 MW remaining), CT (1,196 MW remaining), and NY (up to 2,500 MW remaining). This would result in a total of 441 turbines based on the assumed 12 MW turbine … Collectively the technical capacity is 7,304 MW (see Attachment 4).			SAP approved	No PPAs signed to date
OCS-A 0500 (remainder)	Massachusetts	Bay State Wind LLC(Orsted & Eversource)	Constitution Wind				SAP approved	No PPAs signed to date
OCS-A 0520	TBD (New England)	Equinor Wind US LLC	Beacon Wind				TBD	No PPA signed to date
OCS-A 0521 (remainder)	Massachusetts	Mayflower Wind Energy, LLC (Shell & EDP Renewables)	TBD				SAP approved	No PPAs signed to date
OCS-A 0522 (portion)	Massachusetts	Vineyard Wind LLC	Liberty Wind (Vineyard Wind 2)				SAP submitted	No PPAs signed to date
OCS-A 0522 (remainder)	Massachusetts	Vineyard Wind LLC	TBD				SAP submitted	No PPAs signed to date
OCS-A 0498 (remainder)	New Jersey	Ocean Wind, LLC (Orsted & PSEG)	TBD	This group may collectively support up to 3,996 MW of development (333 turbines) from NJ and NY. Part of the NY demand is also represented under the MA/RI group as well. Collectively the technical capacity is 3,996 MW. NJ has State goals of nearly 4,000 MW that cannot be fulfilled by existing lease areas (see Attachment 4).			SAP approved	No PPAs signed to date
OCS-A 0499	New Jersey	Atlantic Shores Offshore Wind, LLC	Atlantic Shores				SAP submitted	No PPA signed to date
OCS-A 0512 (phase 2 and 3)	New York	Equinor Wind US, LLC	Empire Wind Phase 2 and 3 (Boardwalk Wind)				SAP approved	No PPA signed to date

Notes: NA = not applicable; TBD = to be determined.

* Under BOEM Permitting Stage, COP status is assumed to be in process, under review, or not yet commenced based on publicly available information.

COMMERCIAL FISHERIES CUMULATIVE FISHERY EFFECTS ANALYSIS

Table E-4 depicts 32 future construction schedules of offshore wind projects from Maine to North Carolina including Block Island Wind Farm, which is currently operating in state waters off Rhode Island, and Aqua Ventus, which is proposed for Maine state waters just south of Monhegan Island. Also included are all of the projects that are currently in various stages of planning within BOEM's offshore leases in the U.S. Exclusive Economic Zone from Massachusetts to North Carolina. If all construction phases are combined into single projects, a total of 18 marine wind projects are projected, all of which will require a NEPA process with an environmental impact statement or environmental assessment.[7]

With the exception of the Block Island and Aqua Ventus projects and a third phase of the U.S. Wind Maryland Project, the projects in Table E-4 match up directly with the projects included in the *FMP Revenue Exposure Analysis*, while accommodating for the three phases of Empire and Dominion Wind projects.

Publicly available information about U.S. Wind Maryland is unclear[8]. The U.S. Wind Maryland web page at http://www.uswindinc.com/maryland-offshore-wind-project/ describes a 270-MW project with 32 turbines, but later indicates that the lease area could accommodate as many as 187 turbines. Another publicly available information source (Foresee Offshore at https://www.4coffshore.com/windfarms/) discusses two projects in the U.S. Wind Maryland lease area: 1) a smaller 268-MW project with 32 turbines, which would be located in the larger OCS-A 0490 Lease Area, and 2) a 718-MW project (MARWIN+) that would occur in the smaller OCS-A 0489 Lease Area and, assuming 12 MW turbines, would require 60 turbines. The two U.S. Wind projects included in the *FMP Revenue Exposure Analysis* appear to apply to these two areas. It appears however, that because the U.S. Wind webpage cites a total of 187, a third project would likely follow the MARWIN + project with an additional 95 turbines in OCS-A 0490 generating 1,140 MW. It is assumed that construction on this third U.S. Wind Maryland lease area phase would begin in 2027 following completion of MARWIN+.

In total, the approximately 20 projects with 32 construction phases are projected to have more than 25 GW of generating capacity with as many as 2,169 turbines/foundations not counting foundations for substations. For those projects where the number of turbines is not listed, but for which there is a total capacity estimate available, the analysts have assumed the use of 12-MW turbines.

The rows at the bottom of Table E-4 summarize 1) the incremental number of construction locations that are active during the year; 2) the number of operational turbines at the beginning of the year; and 3) the sum of active construction locations and operational turbines during the year. Under the assumed construction schedule, in 2026, construction activities will be ongoing at 903 sites during the year.

Other key elements to note include the following:

- The Aqua Ventus webpage indicates plans for a single anchored 10-MW floating turbine. Because this is a floating turbine, it is likely to create less benthic habitat disturbance during construction than standard mounted turbine foundations. However, because the turbine will be anchored in place with a minimum of three anchors attached by cables to the floating turbine, it is likely that the bottom area avoided by fishing vessels using mobile gear will be larger than the bottom area avoided with standard turbines.

[7] The U.S. Department of Energy announced a scoping process for Aqua Ventus in February 2017; however, the *Federal Register* does not include any notices that a NEPA environmental assessment has been completed. NEPA environmental assessments for Block Island and Coastal Virginia Offshore Wind have been completed.

[8] Subsequent to this appendix preparation, U.S. Wind Maryland submitted a COP to BOEM. New project information available in the COP will be incorporated in a future version. BOEM also notes that OCS-A 0489 Lease Area is now defunct, as it has been merged into the larger OCS-A 0490 Lease Area.

- The Kitty Hawk project is included despite its location in National Marine Fisheries Service (NMFS) South Atlantic Region. Fishing vessels operating in fisheries managed by the NMFS Greater Atlantic Regional Office (GARFO) regularly harvest in this area. It is also likely that vessels participating in fisheries managed by NMFS Southeast Regional Office (SERO) will be affected by the Kitty Hawk project, and it appears that revenues from these fisheries may not have been included in the *FMP Revenue Exposure Analysis* spreadsheet. For included fisheries managed by GARFO, the annual average exposed revenue of North and Mid-Atlantic managed fisheries was over $74,000.
- Phase 2 of Mayflower Wind project (remainder of OCS-A 0521) assumes 66 foundations at 12.06-MW/turbine with a total of 796 MW of capacity. See https://www.4coffshore.com/windfarms/united-states/mayflower-wind2b-united-states-us6g.html, which indicates 796 total MW in the remainder of the lease area.
- Liberty Wind Phase 2 (remainder of OCS-A 0522) assumes 32 foundations at 12.32-MW/turbine. 1,200 MW in total is expected from the lease area (https://www.4coffshore.com/windfarms/united-states/liberty-wind-united-states-us4r.html.)
- Bay State Wind Phase 2 (Remainder of OCS-A 0500), assumes 65 foundations at 11.94-MW/turbine. See https://www.4coffshore.com/windfarms/united-states/bay-state-wind-united-states-us4y.html, which indicates 2000MW for the entire lease area.
- Ørsted Remainder Phase (in the remainder of OCS-A 0486/0487) assumes 83 foundations at 12.05-MW/turbine. A total of 1,000 MW of capacity is expected for the remaining areas. See https://www.4coffshore.com/windfarms/united-states/liberty-wind-united-states-us4r.html.

BOEM assumes proposed offshore wind projects will include the same or similar components as the proposed Project: wind turbines, offshore and onshore cable systems, offshore substations, onshore O&M facilities, and onshore interconnection facilities. BOEM further assumes that other potential offshore wind projects will employ the same or similar construction, operations and maintenance, and conceptual decommissioning activities as the proposed Project. However, future offshore wind projects would be subject to evolving economic, environmental, and regulatory conditions. Lease areas may be split into multiple projects, expanded, or removed, and development within a particular lease area may occur in phases over long periods of time. Research currently being conducted in combination with data gathered regarding physical, biological, socioeconomic, and cultural resources during development of initial offshore wind projects in the United States could affect the design and implementation of future projects, as could advancements in technology. For the cumulative impact analysis, all proposed projects included in Table E-3 are analyzed in Chapter 3 of this EIS.

For consideration of cumulative environmental impacts from future offshore wind projects and for a list of best management practices (BMPs) that were considered in the impact analysis in Chapter 3 of this EIS, please see the Project EIS’s Appendix G (Environmental Protection Measures, Mitigation, and Monitoring).

Table E-4. Future Offshore Wind Project Construction Schedule (dates shown as of July 2020 to be updated by BOEM)

Project	2015	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Block Island Wind Farm	5 fdns in RI											
Coastal VA Offshore Wind		2 fdns in VA										
Vineyard Wind			86 fdns in MA/RI									
South Fork Wind			16 fdns in MA/RI									
Aqua Ventus I				1 fdn in ME								
Revolution Wind				89 fdns in MA/RI								
Sunrise Wind				112 fdns in MA/RI								
Skipjack Wind Phase 1				17 fdns in DE/MD								
U.S. Wind Maryland				32 fdns in DE/MD								
Ocean Wind				95 fdns in NY/NJ								
Mayflower Wind Phase 1					68 fdns in MA/RI							
Park City Wind					68 fdns in MA/RI							
Skipjack Remainder					34 fdns in DE/MD							
Empire Wind Phase 1					81 fdns in NY/NJ							
Dominion Phase 1					74 fdns in VA							
Liberty Wind						68 fdns in MA/RI						
U.S. Wind MARWIN+						60 fdns in DE/MD						
Empire Wind Phase 2						81 fdns in NY/NJ						
Dominion Phase 2						74 fdns in VA						
Equinor/Beacon Wind							68 fdns in MA/RI					
Bay State Wind							102 fdns in MA/RI					
Ørsted (RI/MA WEA Phase 3)							83 fdns in MA/RI					
Mayflower Wind Phase 2							66 fdns in MA/RI					
Garden State Offshore Energy							34 fdns in DE/MD					
Empire Wind Phase 3 (Boardwalk Wind)							81 fdns in NY/NJ					
Dominion Phase 3							75 fdns in VA					
Liberty Wind Phase 2								32 fdns in MA/RI				
Atlantic Shores								167 fdns in NY/NJ				
Kitty Hawk Wind								167 fdns in 2030				
Bay State Wind Phase 2									64 fdns in MA/RI			
U.S. Wind Maryland Phase 3									95 fdns in DE/MD			
Ocean Wind +										69 fdns in NJ/DE/MD		
Construction locations active during the year	0	2	102	448	657	583	767	903	566	228	69	0
Total Operating Turbines	5	5	7	7	110	455	767	1,038	1,534	1,941	2,100	2,169
Annual Total Locations: Construction & Ops.	5	7	109	455	767	1,038	1,534	1,941	2,100	2,169	2,169	2,169

Color Codes for Projects	MA/RI Leases	VA Lease	Gulf of Maine	DE/MD Leases	NY/NJ Leases	NC Leases

Note: fdns = foundations.

Incorporation by Reference of Cumulative Impacts Study and the Analyses Therein

BOEM has completed a study of impact-producing factors (IPFs) on the North Atlantic OCS to consider in an offshore wind development cumulative impacts scenario (BOEM 2019). That study is incorporated in this documented by reference. The study identifies cause-and-effect relationships between renewable energy projects and resources potentially affected by such projects. It further classifies those relationships into a manageable number of IPFs through which renewable energy projects could affect resources. It also identifies the types of actions and activities to be considered in a cumulative impacts scenario. The study identifies actions and activities that may affect the same physical, biological, economic, or cultural resources as renewable energy projects and states that such actions and activities may have the same IPFs as offshore wind projects.

The BOEM (2019a) study identifies the relationships between IPFs associated with specific past, present, and reasonably foreseeable actions and activities in the North Atlantic OCS to consider in a NEPA cumulative impacts scenario. These IPFs and their relationships were utilized in the EIS analysis of cumulative impacts and the application of which IPF applied to which resource was decided by BOEM. If an IPF was not associated with the SFWF Project, it was not included in the cumulative impacts analysis.

As discussed in the BOEM (2019a) study, reasonably foreseeable activities other than offshore wind projects may also affect the same resources as the proposed Project or other offshore wind projects, possibly via the same IPFs or via IPFs through which offshore wind projects do not contribute. This Appendix E lists reasonably foreseeable non-offshore wind activities that may contribute to the cumulative impacts of the proposed Project.

Undersea Transmission Lines, Gas Pipelines, and other Submarine Cables

The following existing undersea transmission lines, gas pipelines, and other submarine cables are located near the Project:

- New Shoreham (Block Island), Rhode Island, is served by a submarine power cable from the Deepwater Wind Block Island Wind Farm to New Shoreham (Block Island).
- A submarine power cable connects Block Island to the mainland electrical grid at Narragansett, Rhode Island.
- Service to Martha’s Vineyard is provided by four electric cables from Falmouth, located in three corridors through Vineyard Sound. Two cables are located in the same corridor between Elm Road in Falmouth and West Chop; one is located between Shore Street in Falmouth and Eastville (East Chop), and one connects between Mill Road in Falmouth and West Chop.
- Two cables service Nantucket through Nantucket Sound, from Dennis Port and Hyannis Port to landfall at Jetties Beach.
- Additional submarine cables, including fiber-optic cables and trans-Atlantic cables that originate near Charlestown, Rhode Island; New York City; Long Island, near Trenton, New Jersey; and Wall, New Jersey, are located offshore New England and mid-Atlantic states, but outside the proposed Project area.
- Two natural gas pipelines are located offshore Boston, Massachusetts, in Massachusetts Bay and lead to liquid natural gas (LNG) export facilities: the Neptune pipeline and the Northeast Gateway LNG pipeline.

The offshore wind projects listed in Table E-1 that have a COP under review are presumed to include at least one identified cable route. Cable routes have not yet been announced for the remainder of the projects.

Tidal Energy Projects

The following tidal energy projects have been proposed or studied on the U.S East Coast and are in operation or considered reasonably foreseeable:

- The Bourne Tidal Test Site, located in the Cape Cod Canal near Bourne, Massachusetts, is a testing platform for tidal turbines that was installed in late 2017 by the Marine Renewable Energy Collaborative. The Bourne Tidal Test Site offers a test platform for tidal turbines (MRECo 2017, 2018).
- Cobscook Bay Tidal Project, located in Maine, is a Federal Energy Regulatory Commission-(FERC) licensed tidal project that began operations in 2012. The project owner, Ocean Power Energy Company, has informed FERC that it will not apply for relicensing, and removal and site restoration activities are anticipated to be conducted prior to its current license expiration date in January 2022 (FERC 2012a).
- Western Passage Tidal Energy Project, a proposed tidal energy site in the Western Passage, received a preliminary permit from FERC in 2016. The preliminary permit allows developers to study a project but does not authorize construction.
- The Roosevelt Island Tidal Energy (RITE) Project located in the East Channel of the East River, a tidal strait connecting the Long Island Sound with the Atlantic Ocean in the New York Harbor. In 2005, Verdant Power petitioned FERC for permission to the first U.S. commercial license for tidal power. In 2012, FERC issued a 10-year license to install up to 1 MW of power (30 turbines/10 TriFrames) at the RITE project (FERC 2012b; Verdant Power 2018).

Dredging and Port Improvement Projects

The following dredging projects have been proposed or studied between New York, New York, and Boston, Massachusetts, and are either in operation or are considered reasonably foreseeable:

- The U.S. Army Corps of Engineers (USACE) New England District partnership with Rhode Island Coastal Resources Management Council proposes a project that would dredge approximately 23,700 cubic yards of sandy material from the Point Judith Harbor Federal Navigation Project to widen the existing 15-foot-deep mean lower low water (MLLW) West Bulkhead channel by 50 feet and extend the same channel approximately 1,200 feet into the North Basin area (USACE 2018a).
- The Plymouth Harbor Federal Navigation Project in Plymouth, Massachusetts, includes maintenance dredging of approximately 385,000 cubic yards of sand and silt from approximately 75 acres of the authorized project area in order to restore the project to authorized and maintained dimensions (USACE 2018b).
- The Port of New Bedford was awarded a $15.4 million U.S. Department of Transportation Better Utilizing Investments to Leverage Development grant to improve the port's infrastructure and to help with the removal of contaminated materials. The funding will be used to extend the port's bulkhead, creating room for 60 additional commercial vessels, and additional sites for offshore wind staging (Phillips 2018).
- Proposed New Haven Harbor Improvements would include deepening the main ship channel, maneuvering area, and turning basin to -40 feet MLLW and widening the main channel and turning basin to allow larger vessels to efficiently access the Port of New Haven's terminals. The proposed improvements would remove approximately 4.28 million cubic yards of predominately glacially deposited silts from the federal channel (USACE 2018c).

- The Nature Conservancy seeks a permit to place an artificial reef array in Narraganset Bay at 130 Shore Road in Narragansett Bay in East Providence, Rhode Island. The proposed work involves the construction of a 0.14-acre artificial reef using 91 pre-fabricated reef modules. The artificial reef array would consist of 58 Pallet Balls (4 × 2.9 feet) and 33 Bay Balls (3 × 2 feet). The reef modules would be transported to the project site by barge and lowered to the seafloor by crane (USACE 2019).
- The Rhode Island Coastal Resources Management Council has awarded funding for nine habitat restoration projects comprising four salt marsh restoration and enhancement projects, two projects involving restoration of fish passage, one coastal buffer project, and two projects for technical and support services related to habitat restoration (Rhode Island Coastal Resources Management Council 2018a).
- The Town of Dennis seeks a permit for the selective dredging of multiple navigation and mooring basins within multiple waterways in the towns of Dennis and Yarmouth. Suitable dredged material will be used as nourishment on multiple town-owned beaches in Dennis whereas material that is not deemed suitable for beach nourishment will be disposed of at the Cape Cod Bay Disposal Site and at the South Dennis Landfill. The town is requesting to dredge approximately 434,310 cubic yards from portions of these waterways over 10 years encompassing an area of approximately 96.03 acres (USACE 2018d).

The following port improvement projects have been proposed in Connecticut, Rhode Island, Massachusetts, and/or New Jersey, and are either in operation or are considered reasonably foreseeable:

- The Connecticut Port Authority announced a $93 million public-private partnership to upgrade the Connecticut State Pier in New London to support the offshore wind industry (Sheridan 2019). According to the Connecticut Maritime Strategy 2018 (Connecticut Port Authority 2018b), New London is the only major port between New York and Maine that does not have vertical obstruction and offshore barriers, two factors that are critical for offshore wind turbine assembly. The document includes strategic objectives to manage and redevelop the Connecticut State Pier partially to support the offshore wind industry, which could create a dramatic increase in demand for the Connecticut State Pier and regional job growth. The development partnership, announced in May 2019, includes a 3-year plan to upgrade infrastructure to meet heavy-lift requirements of Ørsted and Eversource offshore wind components (Cooper 2019). Redevelopment of the Connecticut State Pier is considered a reasonably foreseeable activity.
- In Rhode Island, Deepwater Wind has committed to investing approximately $40 million in improvements at the Port of Providence, the Port of Davisville at Quonset Point, and possibly other Rhode Island ports for the Revolution Wind Project (Kuffner 2018). This investment will position Rhode Island ports to participate in construction and operation of future offshore wind projects in the region (Rhode Island Governor's Office 2018). The Port of Davisville has added a 150-megaton mobile harbor crane, which will enable the port to handle wind turbines and heavy equipment, and enables the Port of Davisville to participate in regional offshore wind projects (Port of Davisville 2017). Further improvements at Rhode Island ports to support the offshore wind industry are considered reasonably foreseeable.
- The Massachusetts Clean Energy Center (MassCEC) has identified 18 waterfront sites in Massachusetts that may be available and suitable for use by the offshore wind industry. Potential activities at these sites include manufacturing of offshore wind transmission cables, manufacture and assembly of turbine components, substation manufacturing and assembly, operations and maintenance bases, and storage of turbine components (MassCEC 2020).
- The MassCEC manages the New Bedford Marine Commerce Terminal in New Bedford, Massachusetts. The 29-acre facility was completed in 2015 and is the first in North America designed specifically to support the construction, assembly, and deployment of offshore wind

projects (MassCEC 2018). The New Bedford Port Authority Strategic Plan 2018–2023 contains goals related to expanding the New Bedford Marine Commerce Terminal to improve and expand services to the offshore wind industry, including development of North Terminal with the capacity to handle two separate offshore wind installation projects in the future (Port of New Bedford 2018). Vineyard Wind signed an 18-month lease with the Marine Commerce Terminal in October 2018 (Port of New Bedford 2020) and has supported the New Bedford Port Authority with grants to develop publicly owned facilities to support shore-based operations for offshore wind facilities (Vineyard Wind 2019).

Marine Minerals Use and Ocean Dredged Material Disposal

The closest active lease in BOEM's Marine Minerals Program for sand borrow areas for beach replenishment is located offshore New Jersey near Harvey Cedars, Surf City, Long Beach Township, Ship Bottom, and Beach Haven (Lease Number OCS-A-0505). The Lessee, Long Beach Island, Barnegat Inlet to Little Egg Harbor Inlet (Amendment) has been approved through June 29, 2018, for 12,000,000 cubic yards volume requested (BOEM 2018a).

In addition, reconnaissance and/or design-level OCS studies along the East Coast from Rhode Island to Florida have identified potential future sand resources. Sand resources identified nearest the Project include locations offshore Rhode Island (between Block Island and Charlestown), Long Island (Rockaway Beach, Long Beach, and Fire Island, New York), and Sandy Hook, New Jersey. The closest potential sand borrow location to the Project is the Manasquan Project off the coast of New Jersey, approximately 162 miles from the Project.

The EPA Region 1 is responsible for designating and managing ocean disposal sites for materials offshore in the region of the Project. The USACE issues permits for ocean disposal sites; all ocean sites are for the disposal of dredged material permitted or authorized under the Marine Protection, Research, and Sanctuaries Act (16 USC 1431 et seq. and 33 USC 1401 et seq.). There are nine active projects along the Massachusetts, Rhode Island, Connecticut and New York coasts, with the closest dredge disposal project, the Rhode Island Sound Disposal Site (RISDS) located northeast of Block Island (USACE 2018e).

Military Use

Military activities can include various vessel training exercises, submarine and antisubmarine training, and U.S. Air Force exercises. The U.S. Navy, the U.S. Coast Guard (USCG), and other military entities have numerous facilities in the region. Major onshore regional facilities include Joint Base Cape Cod, Naval Station Newport, Newport Naval Undersea Warfare Center, Naval Submarine Base New London, and USCG Academy (BOEM 2013; Epsilon Associates, Inc 2018; Rhode Island Coastal Resources Management Council 2010). The U.S. Atlantic Fleet also conducts training and testing exercises in the Narraganset Bay Operating Area, and the Newport Naval Undersea Warfare Center routinely performs testing in the area (BOEM 2013).

Marine Transportation

Marine transportation in the region is diverse and sourced from many ports and private harbors from New York to Massachusetts. Commercial vessel traffic in the region includes research, tug/barge, liquid tankers (such as those used for liquid petroleum), cargo, military and search-and-rescue vessels, and commercial fishing vessels. Recreational vessel traffic includes cruise ships, sailboats, and charter boats. A number of federal agencies, state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing research offshore including oceanographic, biological, geophysical, and archaeological surveys. The Northeast Regional Planning Body anticipates that major vessel traffic routes will be relatively stable in the region for the foreseeable future, but that coastal developments and market demands that are unknown at this time could affect them (Northeast Regional Planning Body 2016). One new regional maritime highway project received funding from the Maritime Administration. A new barge service (Davisville/Brooklyn/ Newark Container-on-Barge Service) is proposed to run twice each week in state waters between Newark, New Jersey; Brooklyn, New York; and the Port of Davisville in Rhode Island, which is located on Quonset Point, one of the potential O&M locations.

National Marine Fisheries Service Activities

Research and enhancement permits may be issued for marine mammals protected by the Marine Mammal Protection Act (MMPA) and for threatened and endangered species under the ESA. NMFS is anticipated to continue issuing research permits under section 10(a)(1)(A) of the ESA to allow take of certain ESA-listed species for scientific research. Scientific research permits issued by NMFS currently authorize studies on ESA-listed species in the Atlantic Ocean, some of which occur in portions of the Lease Area.

The regulatory process administered by the NMFS, which includes stock assessments for all marine mammals and 5-year reviews for all ESA-listed species, assists in informing decisions on take authorizations and the assessment of project-specific and cumulative impacts that consider past, present, and reasonably foreseeable future actions in biological opinions. Stock assessments completed regularly under MMPA include estimates of potential biological removal that stocks of marine mammals can sustainably absorb. MMPA take authorizations require that a proposed action have no more than a negligible impact on species or stocks, and that a proposed action impose the least practicable adverse impact on the species. MMPA authorizations are reinforced by monitoring and reporting requirements so that NMFS is kept informed of deviations from what has been approved. Biological opinions for federal and non-federal actions are similarly grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. These processes help to ensure that, through compliance with these regulatory requirements, a proposed action would not have a measurable impact on the conservation, recovery, and management of the resource.

Directed Take Permits for Scientific Research and Enhancement

NMFS issues permits for research on protected species for scientific purposes. These scientific research permits include the authorization of directed take for activities such as capturing animals and taking measurements and biological samples to study their health, tagging animals to study their distribution and migration, photographing and counting animals to get population estimates, taking animals in poor health to an animal hospital, and filming animals. NMFS also issues permits for enhancement purposes; these permits are issued to enhance the survival or recovery of a species or stock in the wild by taking actions that increase an individual’s or population’s ability to recover in the wild. In waters near the Lease Area, scientific research and enhancement permits have been issued previously for satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans, research on reproduction, mortality, health, and conservation issues for North Atlantic Right Whales, and research on population dynamics of harbor and gray seals. Reasonably foreseeable future impacts from scientific research and enhancement permits include physical and behavioral stressors (e.g., restraint and capture, marking, implantable and suction tagging, biological sampling).

Fisheries Use and Management

The National Marine Fisheries Service (NMFS) implements regulations to manage commercial and recreational fisheries in federal waters, including those within which the Project would be located; the State of New York, state of Rhode Island, and Commonwealth of Massachusetts regulate commercial fisheries in state waters (within 3 nautical miles of the coastline). There were no active aquaculture leases or activities within federal or state waters within the Lease Area or along the export cable route as of spring 2018 (Jacobs 2020). The project overlaps two of NMFS' eight regional councils to manage federal fisheries: Mid-Atlantic Fisheries Management Council (MAFMC) which includes New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia and North Carolina; and New England Fishery Management Council (NEFMC), which includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut (NEFMC 2016). The councils manage species with many fishery management plans that are frequently updated, revised, and amended and coordinate with each other to jointly manage species across jurisdictional boundaries (MAFMC 2019). Many of the fisheries managed by the councils are fished for in state waters or outside of the Mid-Atlantic region, so the council works with the Atlantic States Marine Fisheries Commission (ASMFC). ASMFC is composed of the 15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states' marine waters. In addition, the states and NMFS, under the framework of the ASMFC's *Amendment 3 to the Interstate Fishery Management Plan For American Lobster*, cooperatively manage the American lobster resource and fishery (NOAA 1997).

The fishery management plans of the Councils and ASMFC were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the Northeast and the Mid-Atlantic regions.

NOAA Fisheries also manages highly migratory species (HMS), such as tuna and sharks, that can travel long distances and cross domestic boundaries. Table E-5 summarizes other fishery management plans and actions in the region.

Table E-5. Other Fishery Management Plans

Area	Plan and Projects
Atlantic States Marine Fisheries Commission	ASMFC Five-Year Strategic Plan 2014–2018 (ASMFC 2014) Draft 2019 strategic management plan under review Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change (ASMFC 2018)
New York	Ocean Action Plan 2017–2027 – adaptive management plan (New York State Department of Environmental Conservation [NYSDEC] 2017) New York State filed a petition with the NOAA, NMFS, and the MAMFC to demand that commercial fluke allocations be revised to provide fishers with equitable access to summer flounder. New York is also reviewing other species where there is an unfair allocation, including black sea bass and bluefish, and may pursue similar actions (Governor's Office 2018a).
Long Island Regional Development Council (LIRDC)	East Hampton Shellfish Hatchery project to consolidate the hatchery's municipal hatchery and nursing facilities. Haskell's seafood facility in East Quogue is proposed become a fully functioning seafood processing plant. Shinnecock Dock Revitalization to provide better processing and packing facilities for local fishermen (LIRDC 2018).
Suffolk County	Suffolk County Shellfish Aquaculture Lease Program in Peconic Bay and Gardiners Bay (limited to conveyance of shellfish cultivation); a complete review of the Lease Program is required to determine if and/or how the program should be changed and implemented in 2020 and beyond (Suffolk County 2018).

Global Climate Change

Section 7.6.1.4 of the Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf (Minerals Management Service 2007) describes global climate change with respect to assessing renewable energy development. Climate change is predicted to affect Northeast fishery species differently (Hare et al. 2016), and the NMFS biological opinion discusses in detail the potential impacts of global climate change on protected species that occur within the proposed action area (NMFS 2013).

The Intergovernmental Panel on Climate Change (IPCC) released a special report in October 2018 that compared risks associated with an increase of global warming of 1.5 degrees Celsius (°C) and an increase of 2°C. The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2°C was associated with greater risks associated with climatic changes such as extreme weather and drought; global sea level rise; impacts to terrestrial ecosystems; impacts to marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts to health, livelihoods, food security, water supply, and economic growth (IPCC 2018).

Table E-6 summarizes regional plans and policies that are in place to address climate change, and Table E-7 summarizes resiliency plans.

Table E-6. Climate Change Plans and Policies

Plans and Policies	Summary/Goal
New York	
Reforming the Energy Vision (New York State 2014)	State's energy policy to build integrated energy network; Clean energy goal to reduce greenhouse gases (GHG) 40% by 2030 and 80% by 2050.
Order Adopting a Clean Energy Standard (State of New York Public Service Commission 2016)	Requirement that 50% of New York's electricity come from renewable energy sources by 2030.
New York State Energy Plan 2015; 2017 Biennial Report to 2015 Plan (New York State Energy Research Development Authority [NYSERDA] 2015, 2017a)	Requires 40% reduction in GHG from 1990 levels; 50% electricity will come from renewable energy resources; and 600 trillion British thermal units (Btu) increase in statewide energy efficiency.
Governor Cuomo State of State Address 2017, 2018	2017: Set offshore wind energy development goal of 2,400 MW by 2030 (Governor's Office 2017a). 2018: Procurement of at least 800 MW of offshore wind power between two solicitations in 2018 and 2019; new energy efficiency target for investor-owned utilities to more than double utility energy efficiency progress by 2025; energy storage initiative to achieve 1,500 MW of storage by 2025 and up to 3,000 MW by 2030 (Governor Office 2018b, 2018c).
New York State Offshore Wind Master Plan (2017) (NYSERDA 2017b)	Grants NYSERDA ability to award 25-year long-term contracts for projects ranging from approximately 200 MW to approximately 800 MW, with an ability to award larger quantities if sufficiently attractive proposals are received. Each proposer is also required to submit at least one proposal of approximately 400 MW. Bids are due in February 2019, awards are expected in spring 2019; and contracts are expected to be executed thereafter.
Massachusetts	
Global Warming Solutions Act (GWSA) of 2008	Framework to reduce GHG emissions by requiring 25% reduction in emissions from all sectors below 1990 baseline emission level in 2020, at least 80% reduction in 2050. Full implementation of these policies is projected to result in total net reduction of 25.0 million metric tons of carbon dioxide equivalent, or 26.4% below 1990 baseline level (Commonwealth of Massachusetts 2018a).
Massachusetts Clean Energy and Climate Plan (CECP) for 2020; 2015 CECP Update	Policies that aim to reduce GHG emissions in the commonwealth across all sectors; full implementation of policies would result in reducing emissions by at least 25% below 1900 level in 2020 (Commonwealth of Massachusetts 2015).
Executive Order 569, Establishing an Integrated Climate Strategy for the Commonwealth and "Act to Promote Energy Diversity" (2016)	Calls for large procurements of offshore wind and hydroelectric resources (Commonwealth of Massachusetts 2016).
Environmental Bond Bill and An Act to Advance Clean Energy (2018)	Sets new targets for offshore wind, solar, and storage technologies; expands Renewable Portfolio Standard requirements for 2020–2029; establishes a Clean Peak Standard; and permits fuel switching in energy efficiency programs (Commonwealth of Massachusetts 2018a).
Massachusetts State Hazard Mitigation and Climate Adaption Plan 2018	Updated 2013 plan to comprehensively integrate climate change impacts and adaptation strategies with hazard mitigation planning while complying with federal requirements for state hazard mitigation plans and maintaining eligibility for federal disaster recovery and hazard mitigation funding under the Stafford Act. The plan will next be submitted to the Federal Emergency Management Agency (FEMA) for approval. In 2020, a new 2030 emissions limit and CECP for 2030 will be published (Commonwealth of Massachusetts 2018a, 2018b).

Plans and Policies	Summary/Goal
Rhode Island	
Governor's Climate Priorities (2018) Executive Order 15-17, 17-06	Increasing in-state renewable energy tenfold by 2020 (to 1,000 MWs) through new development and regional procurement (State of Rhode Island 2015a, 2017, 2018a).
Resilient Rhode Island Act (2014)	Established the Executive Climate Change Coordinating Council (EC4) and set specific GHG reduction targets; incorporates consideration of climate change impacts into the powers and duties of all state agencies (State of Rhode Island 2014).
Rhode Island Greenhouse Gas Emissions Reductions Plan (2016)	Targets for GHG reductions: 10% below 1990 levels by 2020; 45% below 1990 levels by 2035; 80% below 1990 levels by 2040 (State of Rhode Island 2016).
Energy 2035 Rhode Island State Energy Plan (2015)	Long-term comprehensive strategy for energy services across all sectors using a secure, cost-effective, and sustainable energy system; plan to increase sector fuel diversity, produce net economic benefits, and reduce GHG emissions by 45% by the year 2035 (State of Rhode Island 2015b).
Resilient Rhody (2018)	Planning document outlining climate resiliency actions; focuses on leveraging emissions reduction targets and adaptation (State of Rhode Island 2018b).

Table E-7. Resiliency Plans and Policies in the Project Area

Plans and Policies	Summary
New York	
Part 490 of Community Risk and Resiliency Act (CRRA) of 2014	Establishes statewide science-based sea-level rise projections for coastal regions of the state. As of 2019, DEC is in the process of developing a State Flood Risk Management Guidance document for state agencies (NYSDEC n.d. [2019]).
NY Rising Community Reconstruction (NYRCR) (2018)	$20.4 million in projects on Long Island to help flood-prone communities plan and prepare for extreme weather events as they continue projects to recover from Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. Three projects were announced for Suffolk County and five for Nassau County (Governor's Office 2018c).
Massachusetts	
Municipal Vulnerability Preparedness grant program (MVP) (2017)	Provides support for cities and towns to plan for resiliency and implement key climate change adaptation actions for resiliency. The City of New Bedford has received MVP designation as of November 1, 2018 (Commonwealth of Massachusetts 2019a).
Coastal Grant and Resilience Program	Provides financial and technical support for local efforts to increase awareness and understanding of climate impacts, identify and map vulnerabilities, conduct adaptation planning, redesign vulnerable public facilities and infrastructure, and implement non-structural approaches that enhance natural resources and provide storm damage protection (Commonwealth of Massachusetts 2019b).
Rhode Island	
Nantucket's Coastal Resilience Plan	The plan is currently under development, and while no actions have been identified to date, potential shoreline management activities could include sediment management, construction of seawalls and similar structures, and other activities (Town and County of Nantucket 2018a, 2018b).
Shoreline Change Special Area Management Plan (Beach SAMP)	Rhode Island Coastal Resources Management Council is developing the Shoreline Change Special Area Management Plan (Beach SAMP) to improve the state's resilience and manage the shoreline (Town and County of Nantucket 2018b) (Rhode Island Coastal Resources Management Council 2018b).

Oil and Gas Activities

The proposed Project area is located in the North Atlantic Planning Area of the OCS Oil and Gas Leasing Program (National OCS Program). On September 8, 2020, the White House issued a presidential memorandum for the Secretary of the Interior on the withdrawal of certain areas of the United States OCS from leasing disposition for 10 years, including the areas currently designated by BOEM as the South Atlantic and Straits of Florida Planning Areas (The White House 2020). The South Atlantic Planning Area includes the OCS off South Carolina, Georgia, and northern Florida. On September 25, the White House issued a similar memorandum for the Mid-Atlantic Planning Area that lies south of the northern administrative boundary of North Carolina (The White House 2020b). This withdrawal prevents consideration of these areas for any leasing for purposes of exploration, development, or production during the 10-year period beginning July 1, 2022, and ending June 30, 2032. However, at this time, there has been no decision by the Secretary of the Interior regarding future oil and gas leasing in the North Atlantic or remainder of the Mid-Atlantic Planning Areas. Existing leases in the withdrawn areas are not affected.

BOEM issues geological and geophysical (G&G) permits to obtain data for hydrocarbon exploration and production; locate and monitor marine mineral resources; aid in locating sites for alternative energy structures and pipelines; identify possible manmade, seafloor, or geological hazards; and locate potential archeological and benthic resources. G&G surveys are typically classified into categories by equipment type and survey technique.

There are currently no such permits under review for areas offshore Massachusetts and Rhode Island; areas under consideration for G&G surveys are located in federal waters offshore Delaware to Georgia (BOEM 2018b).

Several liquefied natural gas ports are located on the East Coast of the United States. Table E-8 lists existing, approved, and proposed LNG ports on the East Coast of the United States that provide (or may in the future provide) services such as natural gas export, natural gas supply to the interstate pipeline system or local distribution companies, or storage of LNG for periods of peak demand, or production of LNG for fuel and industrial use (FERC 2018).

Table E-8. LNG Terminals Located in Northeastern United States

Terminal Name	Type	Company	Jurisdiction	Distance from Project (approximate)	Status
Everett, MA	Import terminal	GDF SUEZ—DOMAC	FERC	90 miles north	Existing
Offshore Boston, MA	Import terminal	Neptune LNG	U.S. Department of Transportation Maritime Administration (MARAD)/USCG	100 miles north	Existing
Offshore Boston, MA	Import terminal, authorized to re-export delivered LNG	Excelerate Energy—Northeast Gateway	MARAD/USCG	95 miles north (Buoy B)	Existing
Cove Point, MD (Chesapeake Bay)	Import terminal	Dominion—Cove Point LNG	FERC	340 miles southwest	Existing
Elba Island, GA (Savannah River)	Import terminal	El Paso—Southern LNG	FERC	835 miles southwest	Existing
Elba Island, GA (Savannah River)	Export terminal	Southern LNG Company	FERC	835 miles southwest	Approved
Jacksonville, FL	Export terminal	Eagle LNG Partners	FERC	960 miles southwest	Proposed

Source: FERC (2018).

Onshore Development Activities

Onshore development activities that may contribute to cumulative impacts include visible infrastructure such as onshore wind turbines and cell towers, port development, and other energy projects such as transmission and pipeline projects. Coastal development projects permitted through regional planning commissions and towns may also contribute to cumulative impacts. These may include residential, commercial, and industrial developments spurred by population growth in the region (Table E-9).

Table E-9. Existing, Approved, and Proposed Onshore Development Activities

Type	Description
Local planning documents	• Suffolk County Master Plan (Suffolk County 2015) • A City Master Plan: New Bedford 2020 (City of New Bedford 2010) • Town of North Kingstown Comprehensive Plan Update 2008 (Town of North Kingston 2008)
Onshore wind projects	• According to the U.S. Geological Survey, there are nine onshore wind projects located within the 41-mile viewshed of the project (U.S. Geological Survey 2018).
Communications towers	• There are numerous communications towers located in Suffolk County, on offshore islands, and within the viewshed of the proposed Project components. Within the recreation/tourism geographic analysis area, there are 864 communications towers, 10 of which exceed the Federal Aviation Administration height limit for marking/lighting requirements (Federal Aviation Administration 2016). • The East Hampton Town Board is replacing its aging 800-megahertz frequency emergency communication system tower to a 700-megahertz system with updated equipment. This will require the replacement of a 150-foot communication tower with a 300-foot lattice tower and the raising of a 55-foot monopole to 85 feet. This upgrade also requires replacing antennas at towers near the East Hampton Airport in Wainscott, at the Amagansett firehouse, and at the East Hampton Town Hall complex (Chinese 2018).
Development projects	• As a part of New York State's $100 billion infrastructure project, $5.6 billion will go to transform the Long Island Railroad (LIRR) to improve system connectivity. Within Suffolk County, the following stations will receive funds for upgrades: Brentwood, Deer Park, East Hampton, Northport, Ronkonkoma, Stony Brook, Port Jefferson, and Wyandanch. The East Hampton historic LIRR station will undergo upgrades and modernizations (Metropolitan Transit Authority 2017; Governor's Office 2017b). Additional plans for transit-oriented design (TOD) and highway improvements are planned in Suffolk County in state and county planning documents. • Fire Island Inlet to Montauk Point (FIMP) Project is a $1.2 billion project by the USACE, NYDEC, and Long Island, NY municipalities to engage in inlet management; beach, dune and berm construction; breach response plans; raising and retrofitting 4,400 homes; road-raising; groin modifications; and coastal process features. Within Suffolk County, portions of the Towns of Babylon, Islip, Brookhaven, Southampton, and East Hampton; 12 incorporated villages along Long Island's south shore (mainland);Fire Island National Seashore; and the Poospatuck and Shinnecock Indian Reservations will be involved in this project (USACE 2018f). • The USACE is working to remediate and cleanup a former defense site (former NIKE Battery PR-58 and Disaster Village Training Area) at Quonset Development Corporation in North Kingstown, RI. A feasibility study was performed from 2014 to 2016, and the final remedial investigation/feasibility study was published in 2016. Pre-design investigations, followed by remedial designs and engineering plans, and remedial action is proposed for 2021 (USACE 2018g). • The Massachusetts Department of Environmental Protection Bureau of Air and Waste approved National Grid's application for the construction and operation of a diesel generator and a battery electric storage system at an existing electric generating facility located at 32 Bunker Road in Nantucket, approximately 1 mile north of the coastline. The facilities are anticipated to be operational in 2019 (MassDEP 2017; Utility Dive 2018).

<table>
<tr><th>Type</th><th>Description</th></tr>
<tr><td>Port upgrades</td><td>Ports in New York, Connecticut, Rhode Island, and Massachusetts may require upgrades to support the offshore wind industry developing in the northeastern United States. Upgrades may include onshore developments or underwater improvements (such as dredging).
• In December 2017, NYSERDA issued an offshore wind (OSW) master plan that assessed 54 distinct waterfront sites along the New York Harbor and Hudson River and 11 distinct areas with multiple small sites along the Long Island coast. Twelve waterfront areas and five distinct areas were singled out for “potential to be used or developed into facilities capable of supporting OSW projects” (Table 26; NYSERDA 2017b). Nearly all identified sites would require some level of infrastructure upgrade (from minimal to significant) depending on OSW activities intended for the site. Particular sites of interest include Red Hook-Brooklyn, South Brooklyn Marine Terminal, and the Port of Coeymans (NYSERDA 2017b). For additional information regarding specific proposed improvements to these ports, see DockNYC 2018, Capital Region Economic Development Council 2018, American Association of Port Authorities 2016, Rulison 2018, and NYCEDC 2018.
• The Connecticut Port Authority is currently evaluating proposals from parties to develop, finance, and manage the Connecticut State Pier in New London under a long-term operating agreement (Connecticut Port Authority 2018a). According to the Connecticut Maritime Strategy 2018 (Connecticut Port Authority 2018b), New London is the only major port between New York and Maine that does not have vertical obstruction and offshore barriers, two factors that are critical for offshore wind turbine assembly. The document includes strategic objectives to manage and redevelop the Connecticut State Pier partially to support the offshore wind industry, which could create a dramatic increase in demand for the Connecticut State Pier and regional job growth. Redevelopment of the State Pier is considered a reasonably foreseeable activity, though specific redevelopment plans are not yet available.
• In Rhode Island, DWW has committed to investing approximately $40 million in improvements at the Port of Providence, the Port of Davisville at Quonset Point, and possibly other Rhode Island ports for the Revolution Wind Project (Kuffner 2018). The Port of Davisville has added a 150-megaton mobile harbor crane, which will enable the port to handle wind turbines and heavy equipment, and enables the Port of Davisville to participate in regional offshore wind projects (Port of Davisville 2017). Further improvements at Rhode Island ports to support the offshore wind industry are considered reasonably foreseeable.
• The Massachusetts Clean Energy Center (MassCEC) has identified 18 waterfront sites in Massachusetts that may be available and suitable for use by the offshore wind industry. Potential activities at these sites include manufacturing of offshore wind transmission cables, manufacture and assembly of turbine components, substation manufacturing and assembly, operations and maintenance bases, and storage of turbine components (MassCEC 2017a, 2017b). The Draft New Bedford Port Authority Strategic Plan 2018 – 2023 contains goals related to expanding the New Bedford Marine Commerce Terminal to improve and expand services to the offshore wind industry (Port of New Bedford 2018; MassCEC 2018), but no new improvements were identified.</td></tr>
</table>

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ATTACHMENT 1

Geographic Analysis Area Maps

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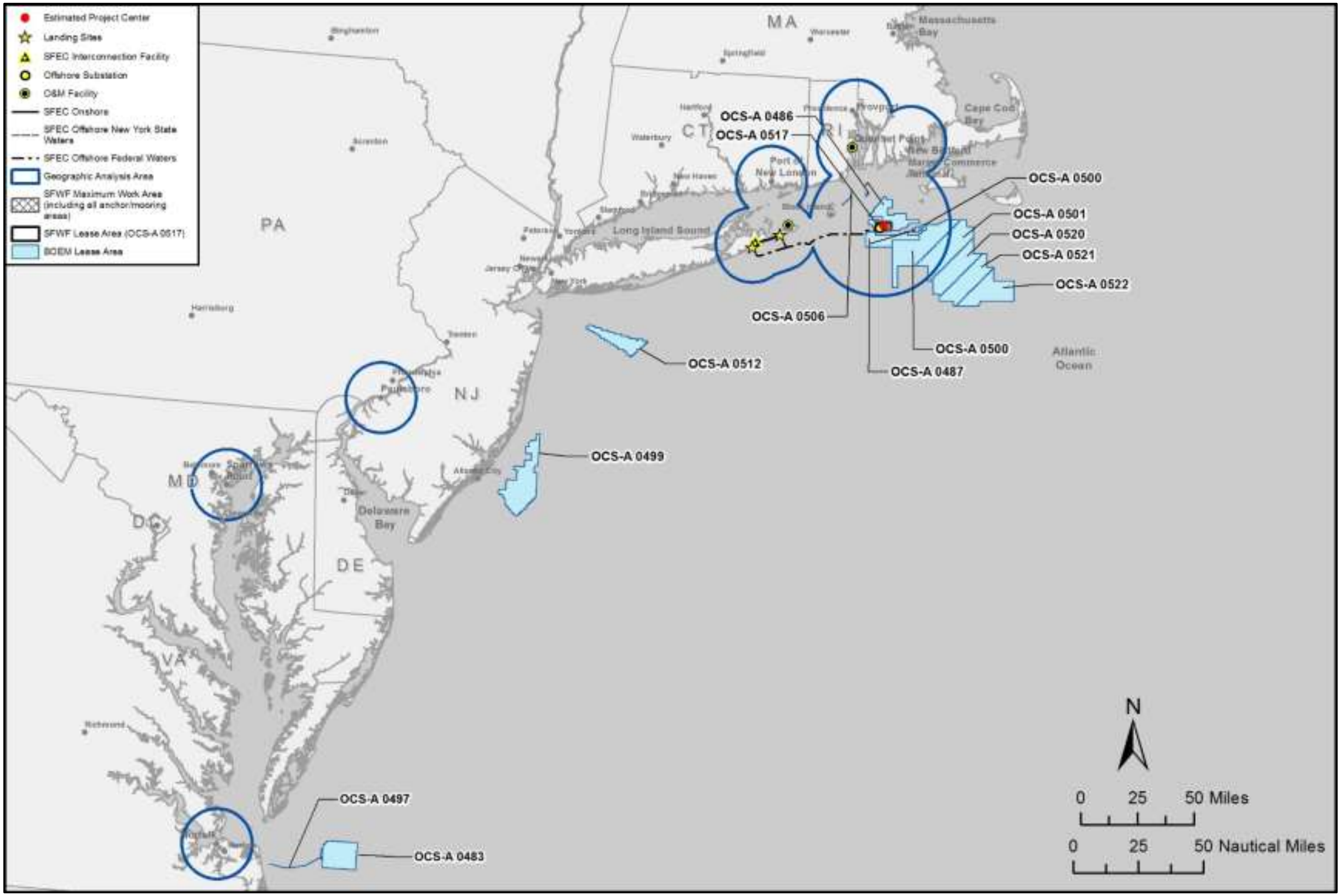

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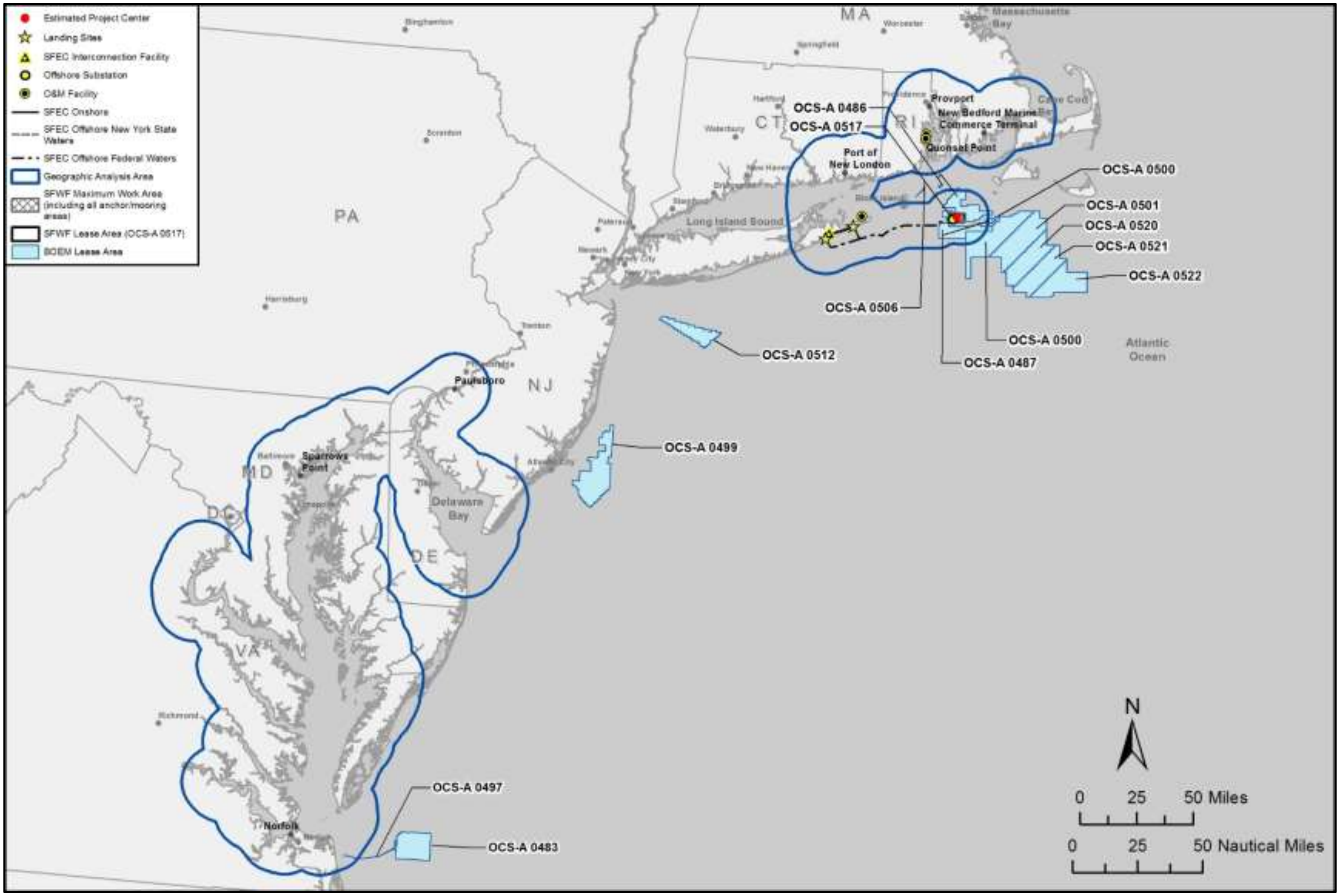

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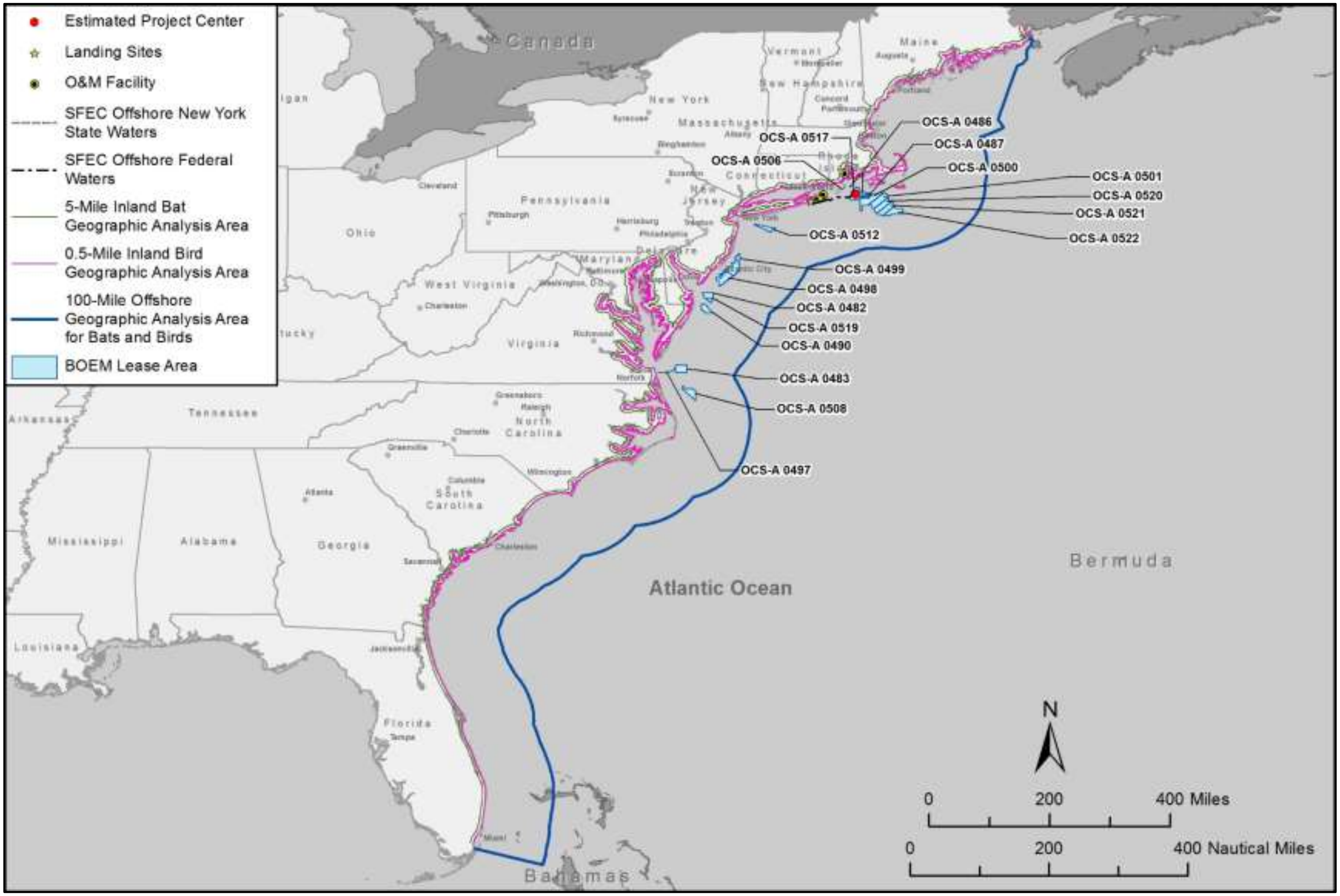

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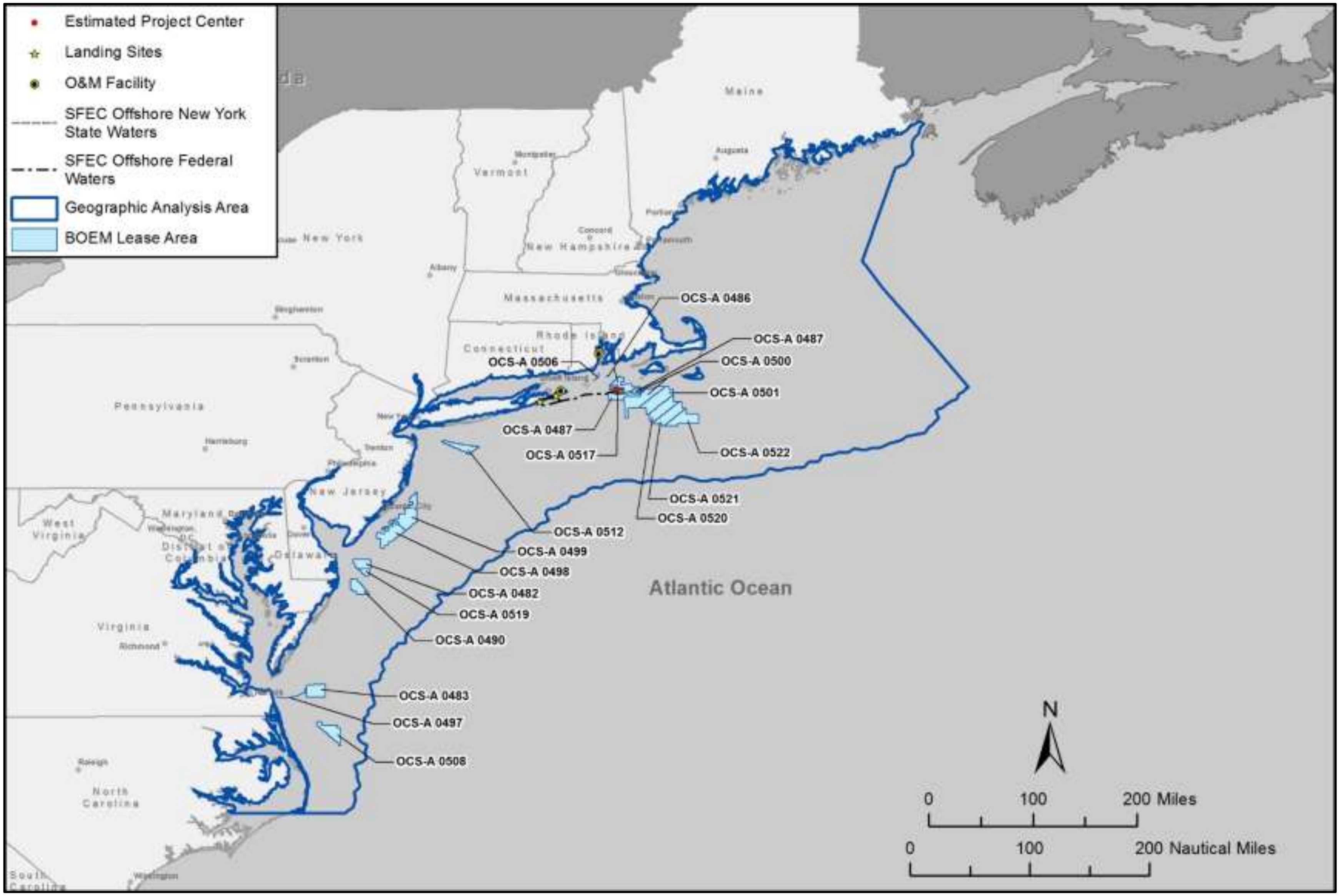

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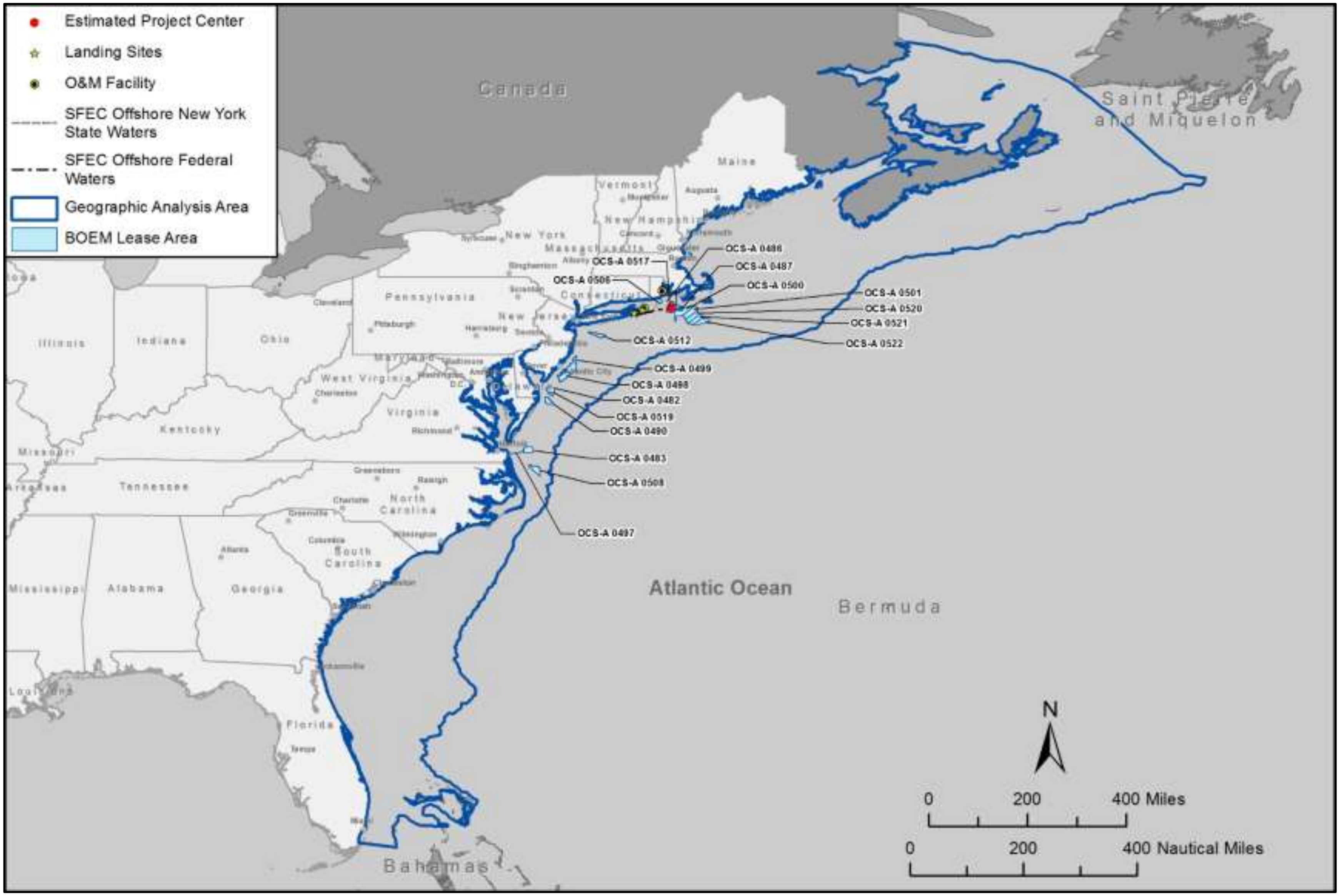

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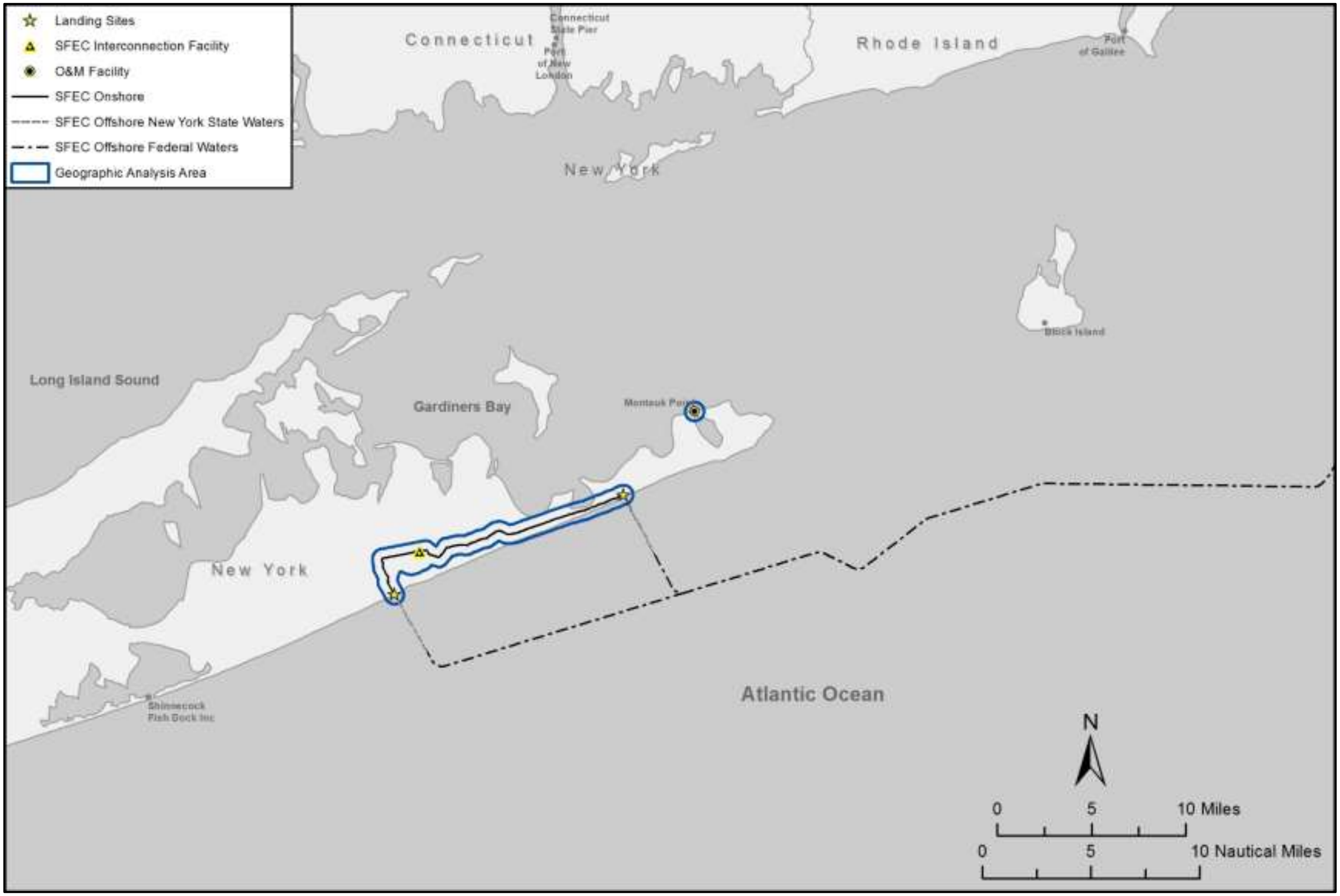
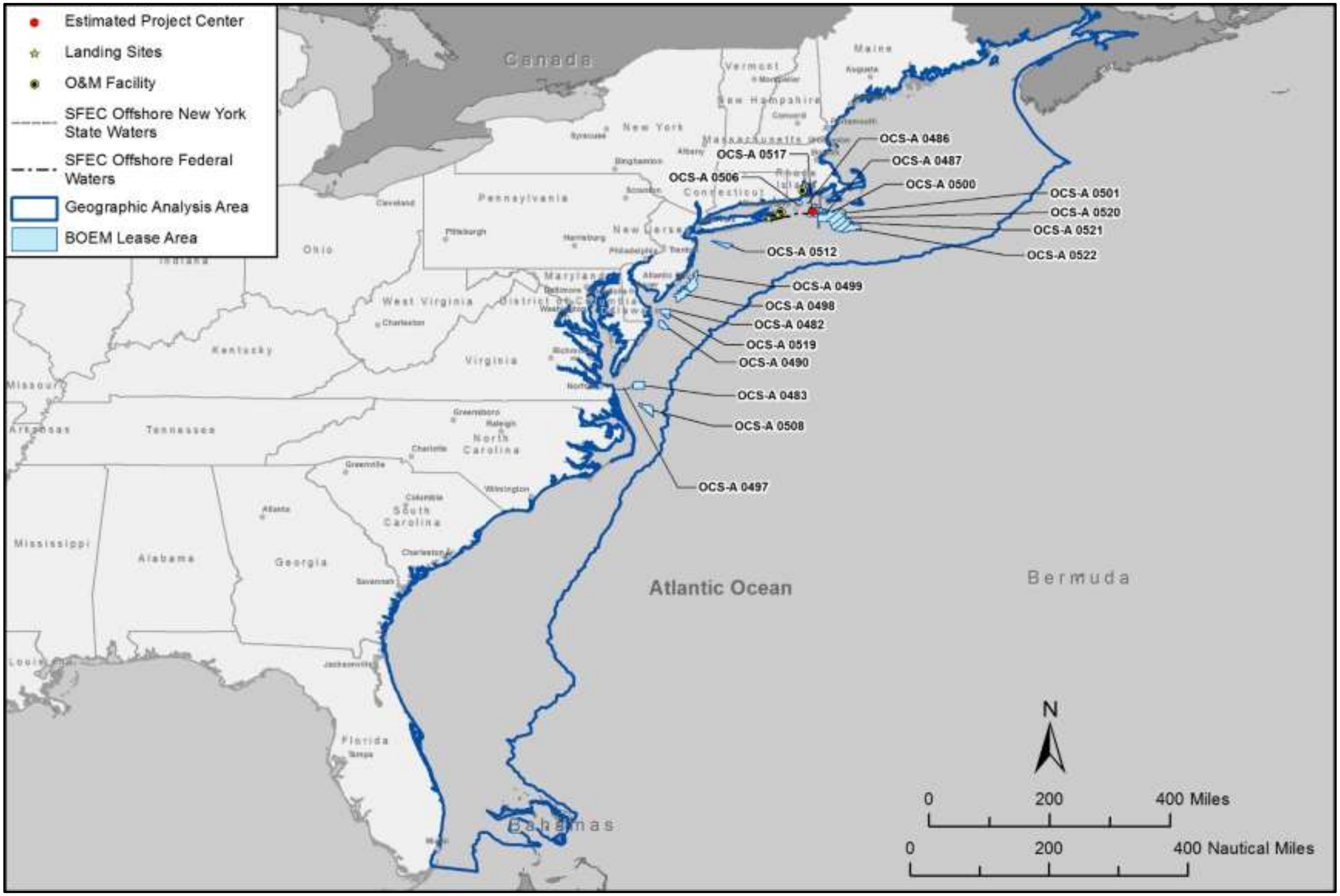


Figure E-6. Terrestrial and coastal habitats and faunas geographic analysis area.



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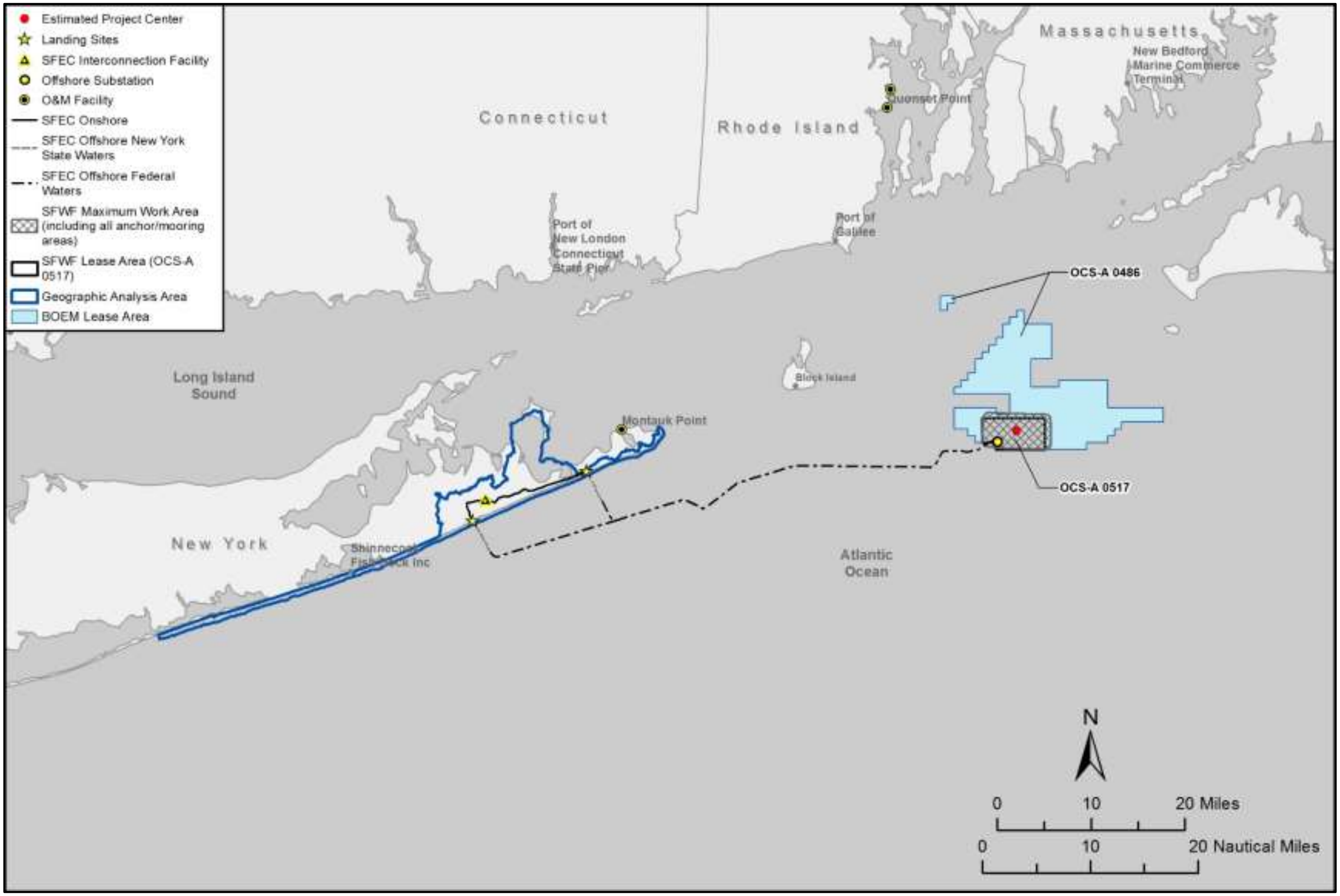

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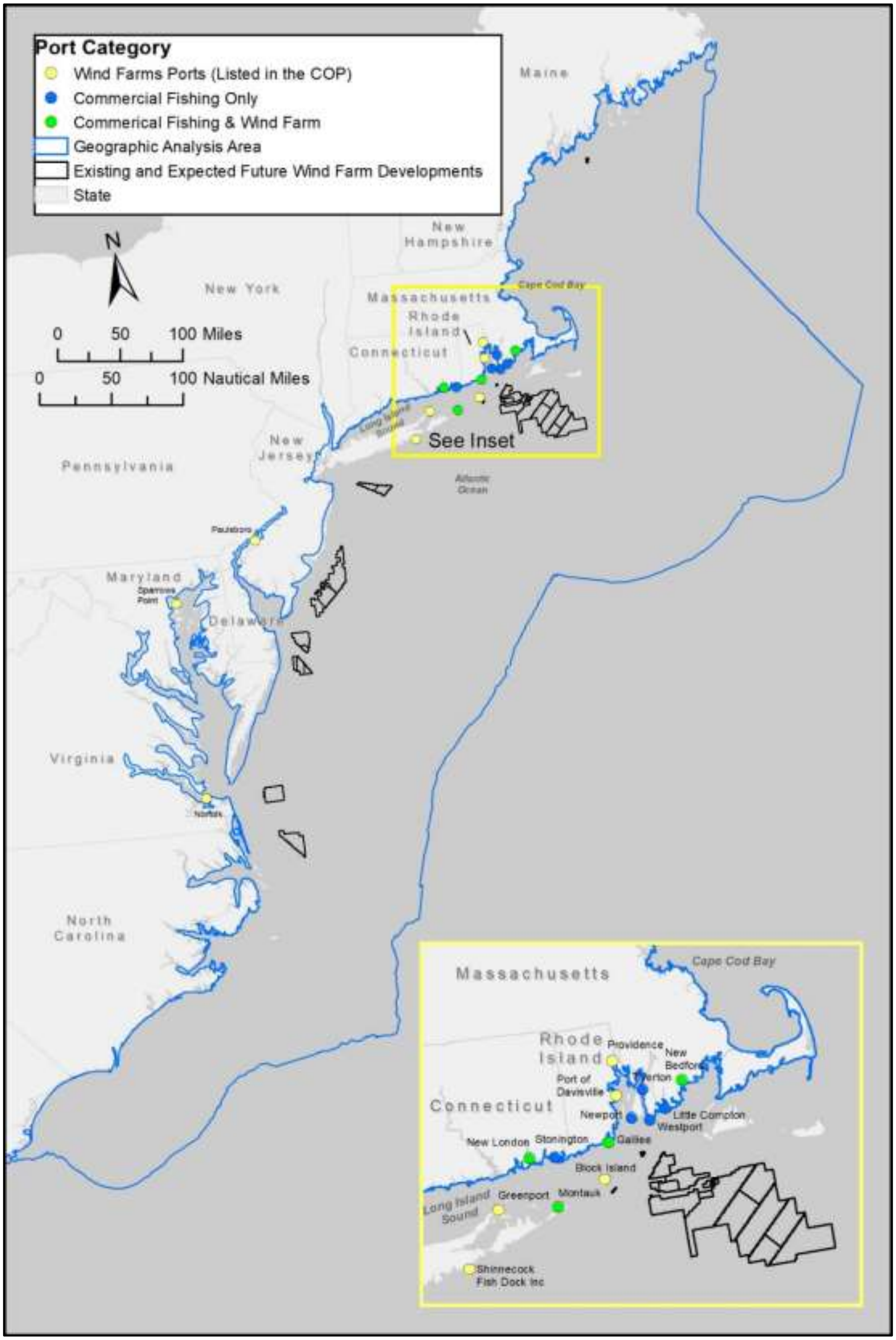

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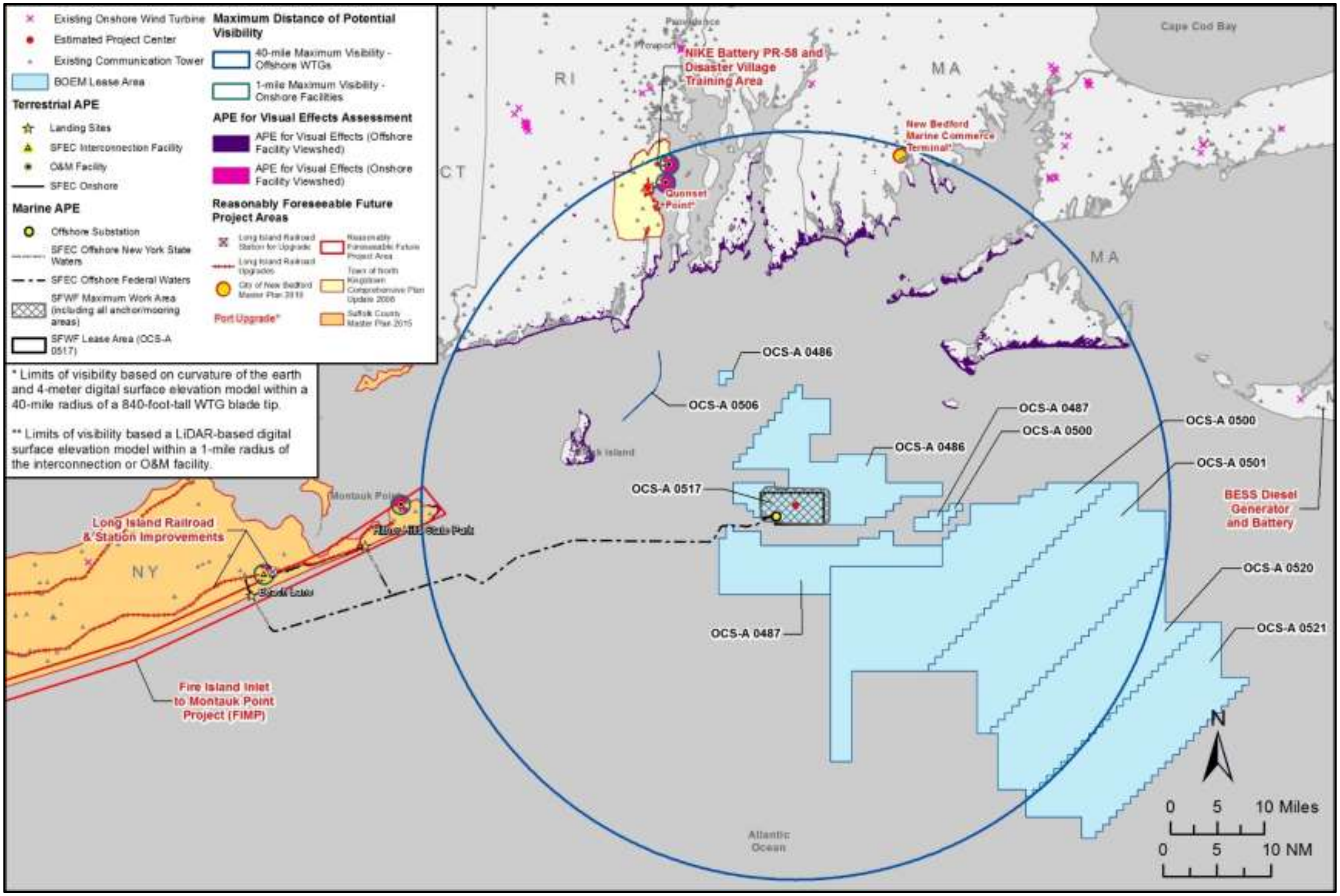

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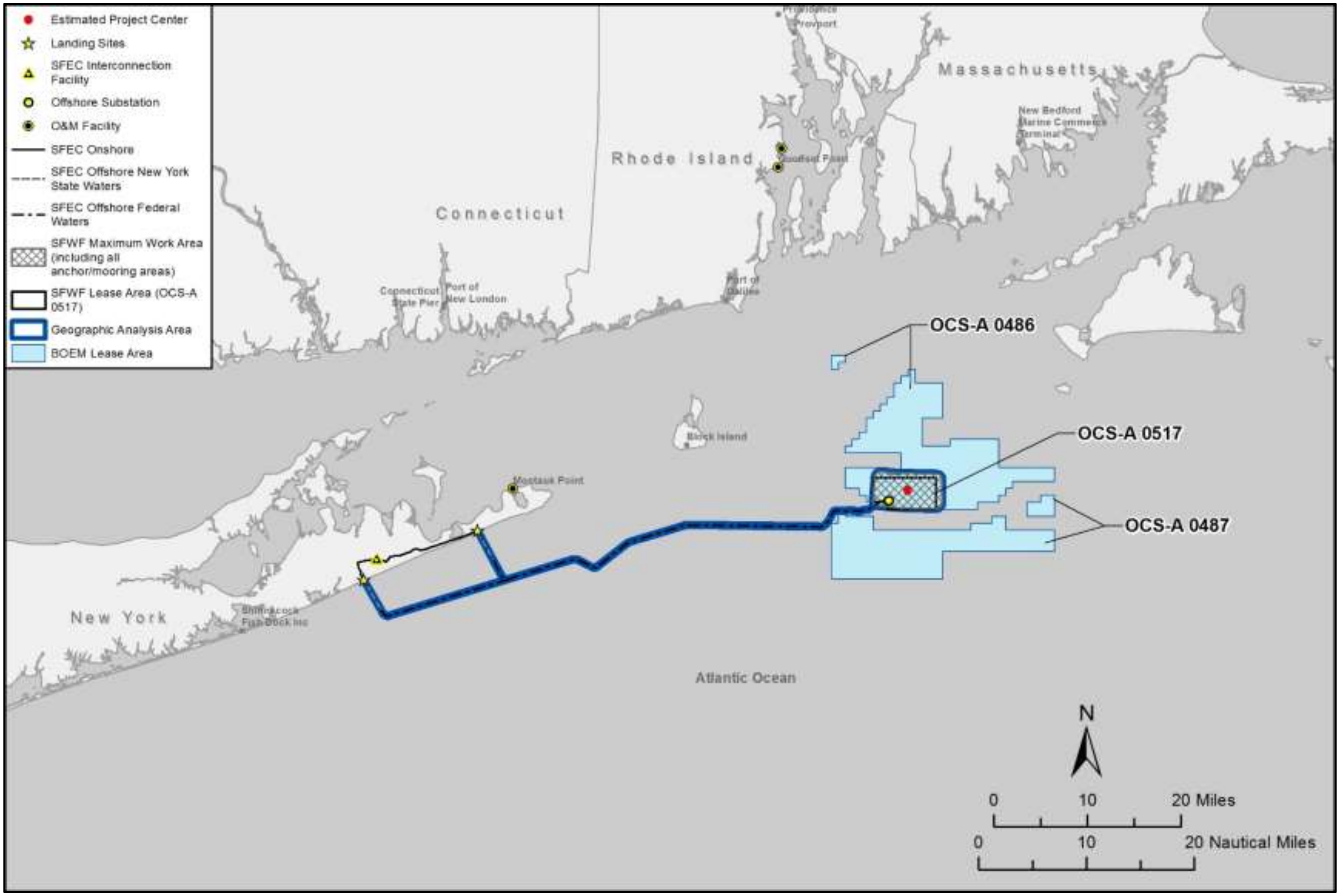

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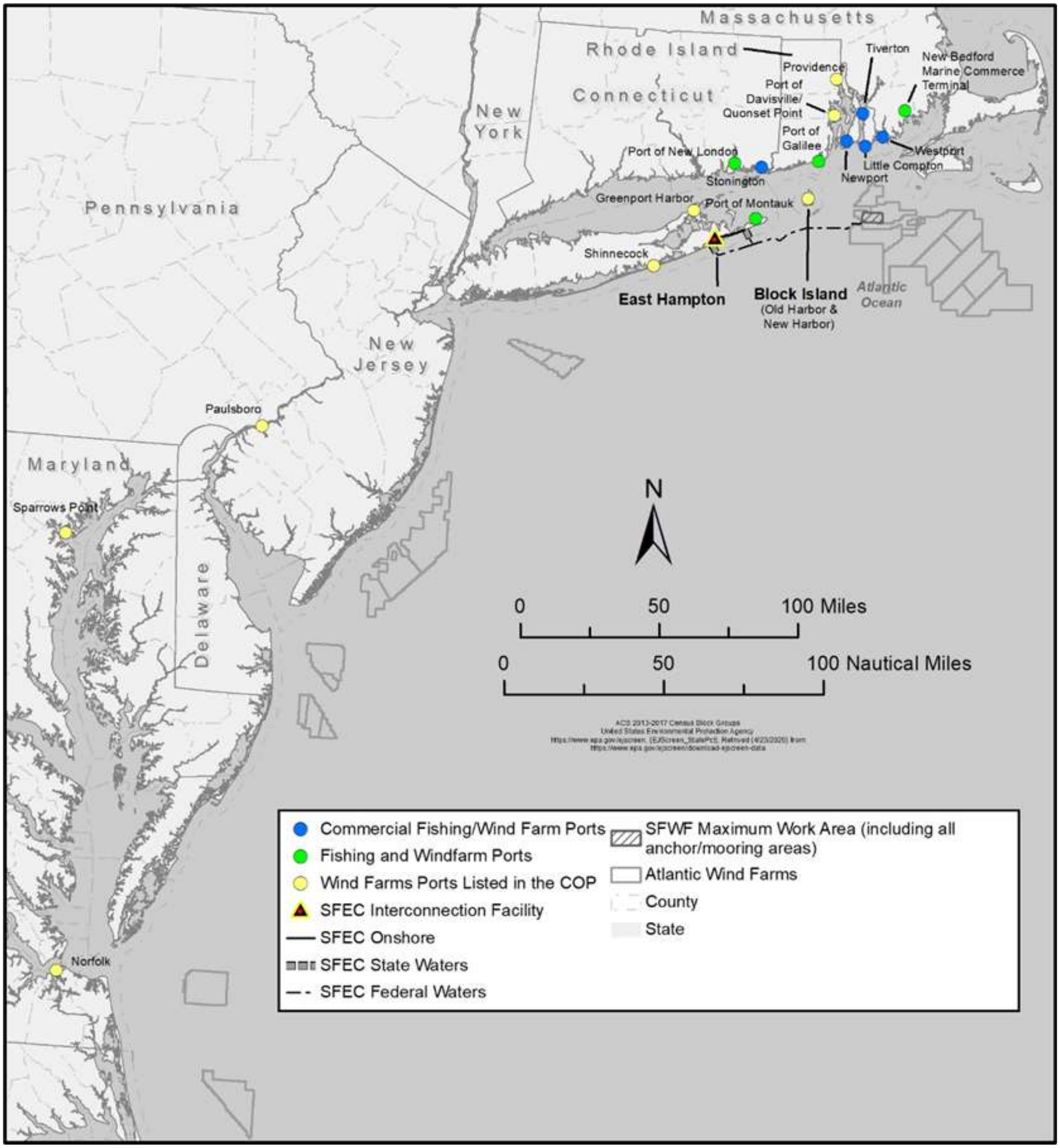

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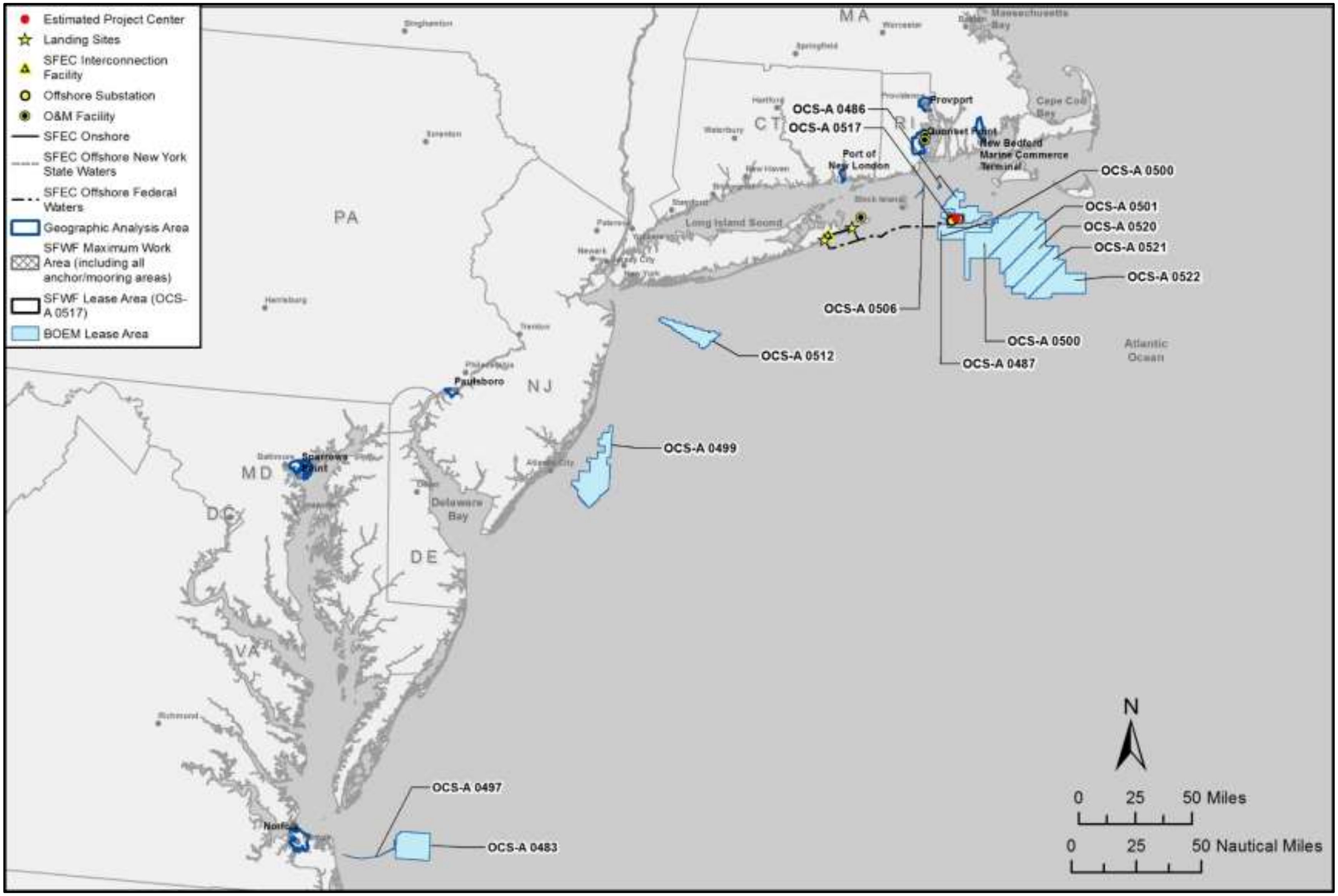

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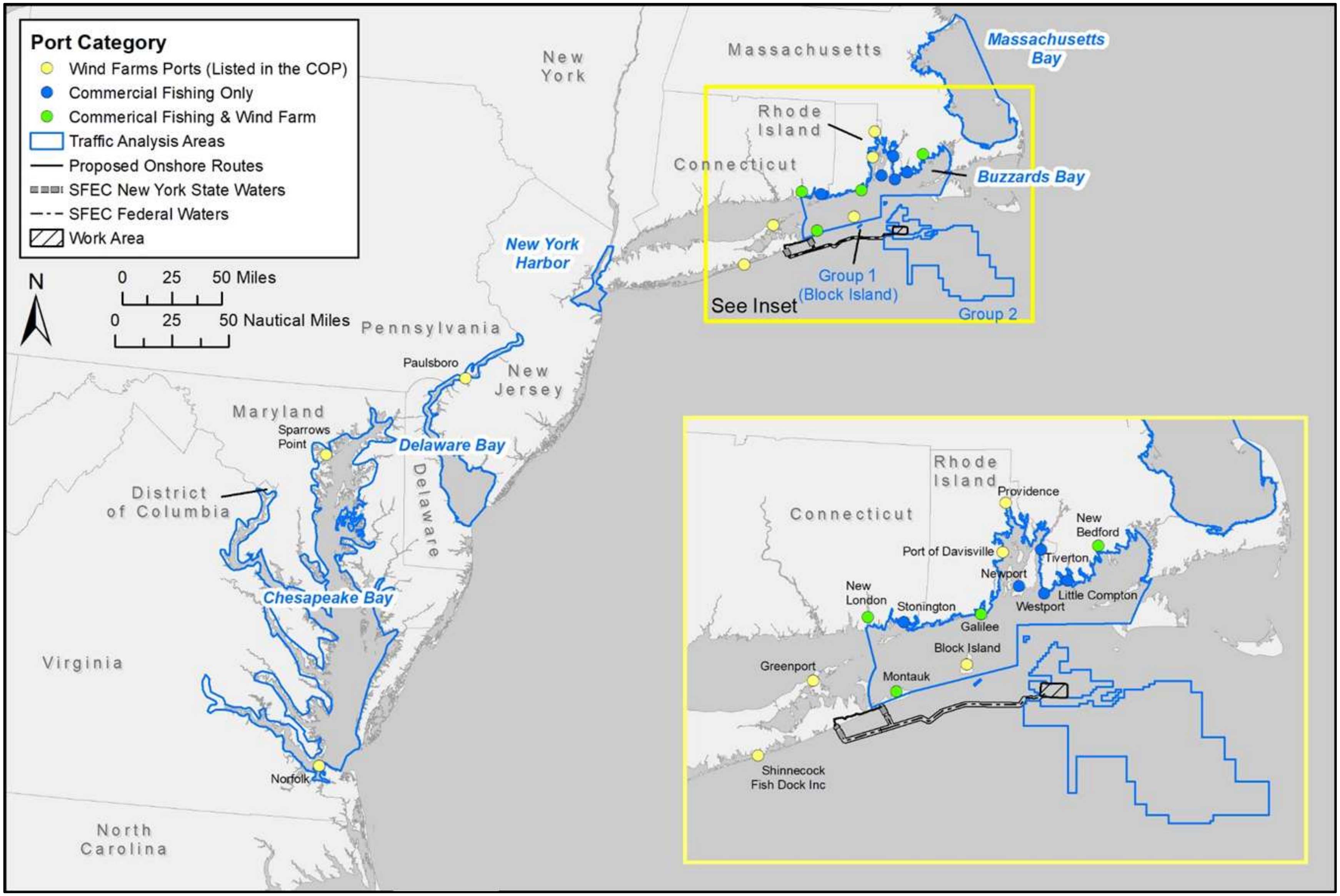


Figure E-14. Navigation and vessel traffic geographic analysis area.

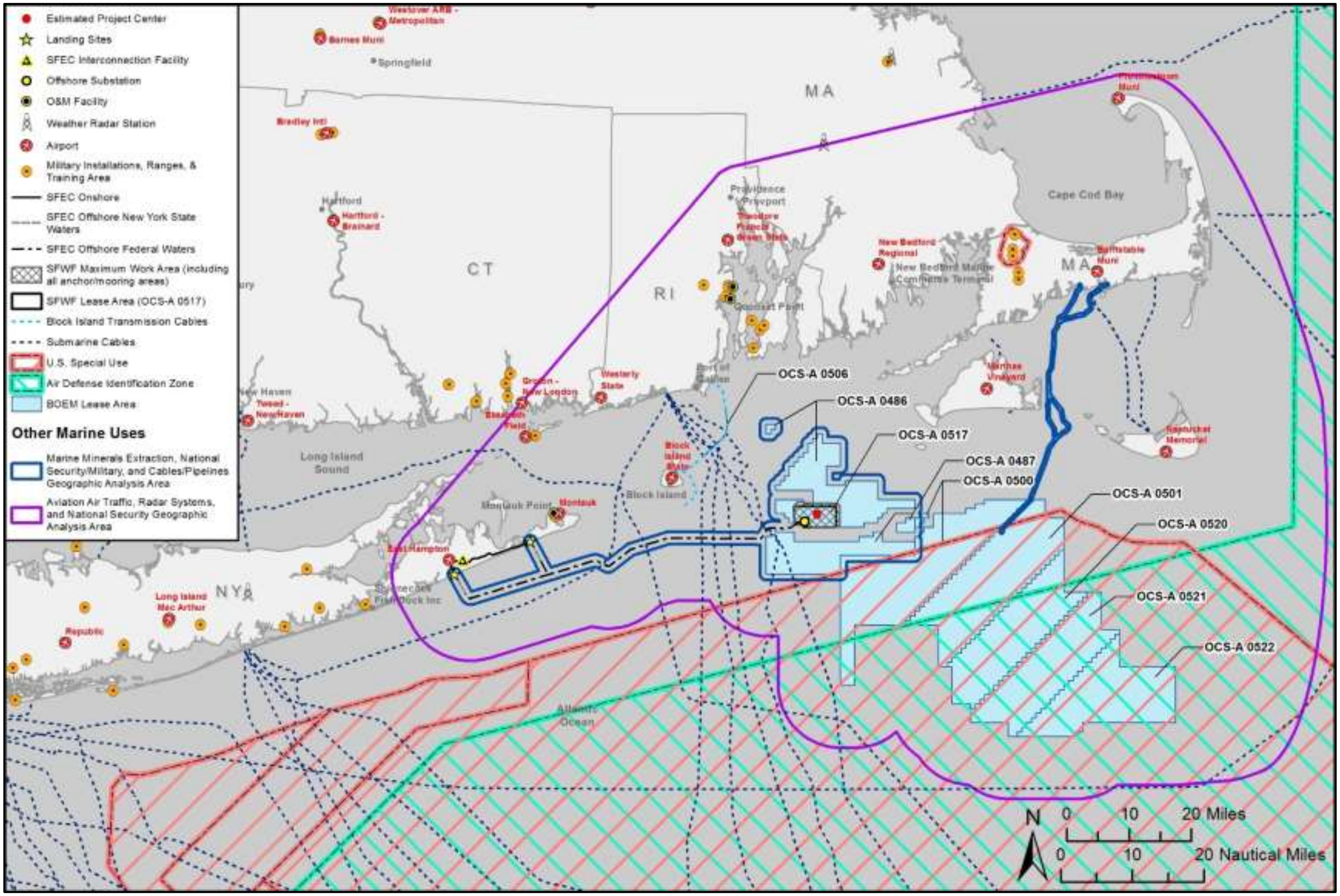
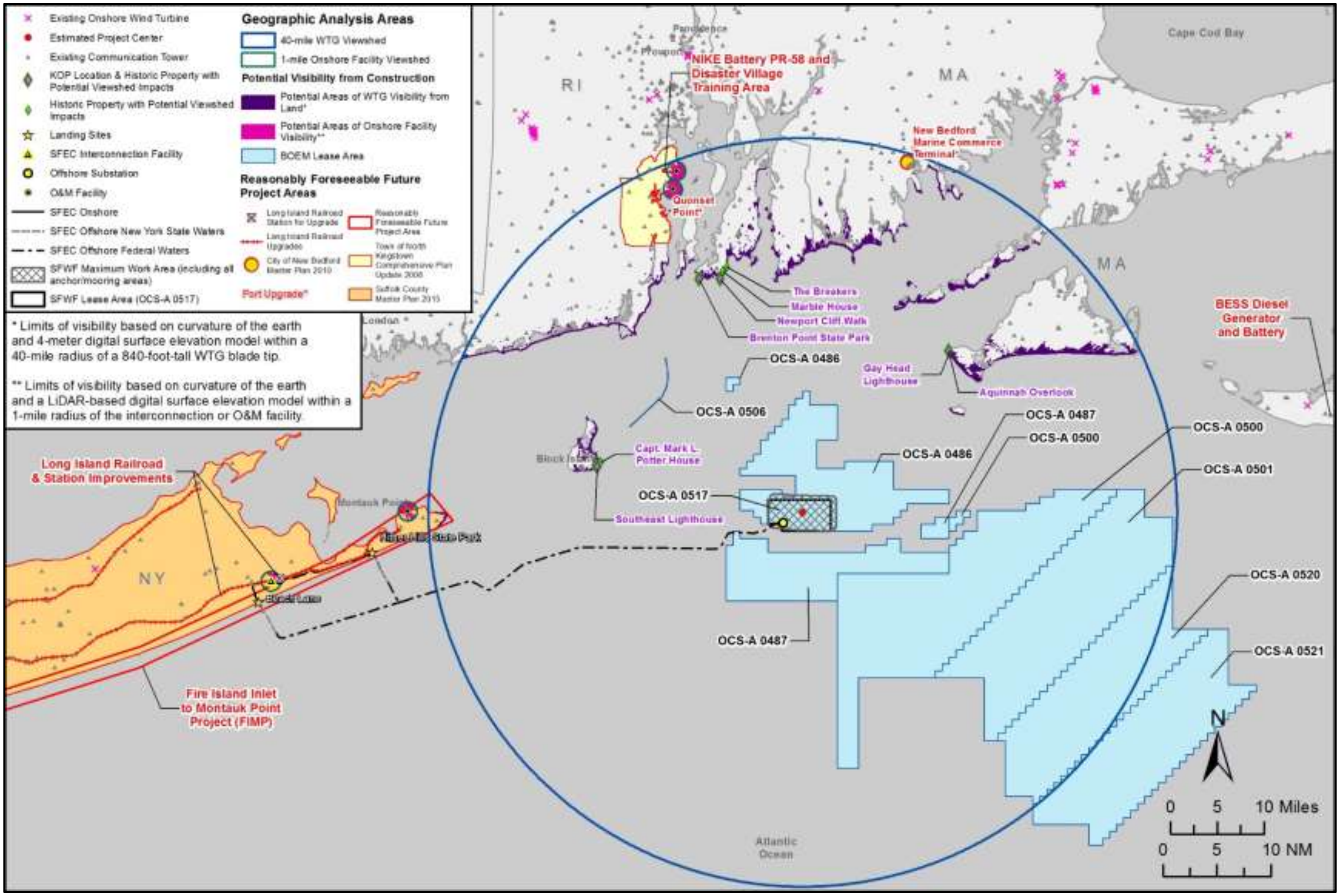


Figure E-15. Other marine uses geographic analysis area.



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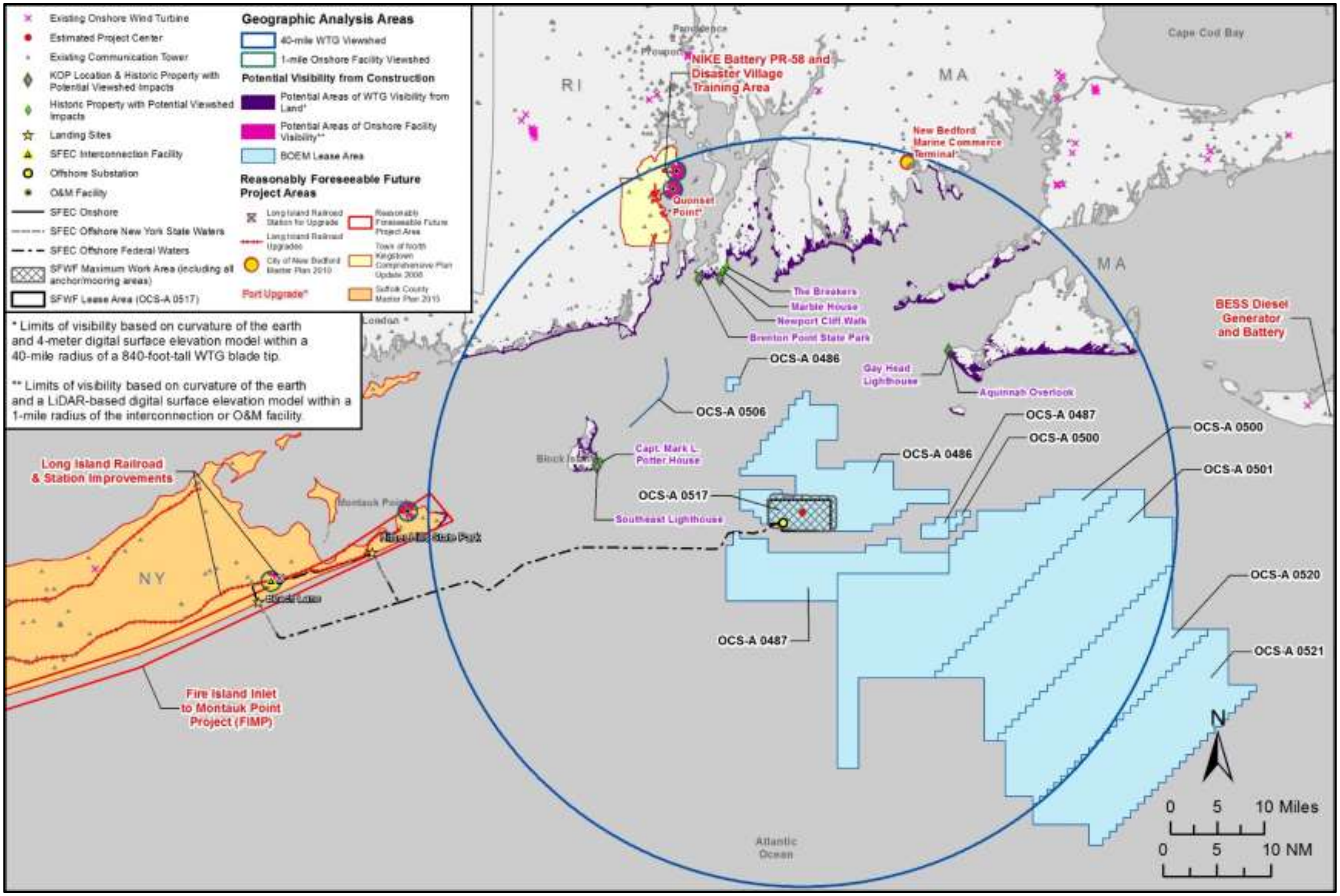

Figure E-17. Visual geographic analysis area.

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ATTACHMENT 2

Ongoing and Future Non-Offshore Wind Activity Analysis (Part 1)

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BOEM developed the following tables 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), which evaluates potential impacts associated with ongoing and future non-offshore wind activities. The content of these tables has been vetted and approved by cooperating agencies to the SFWF EIS and therefore has been included in whole for their use in impact and cumulative analyses, and for ease in reference by the reader.

Table A-7: Summary of Activities and the Associated Impact-Producing Factors for Air Quality

<table>
<tr><th>Associated IPFs: Sub-IPFs</th><th>Ongoing Activities</th><th>Future Non-Offshore Wind Activities Intensity/Extent</th></tr>
<tr><td>Accidental releases: Fuel/fluids/ hazmat</td><td>Accidental releases of air toxics HAPS are due to potential chemical spills. Ongoing releases occur in low frequencies. These may lead to short-term periods of toxic pollutant emissions through surface evaporation. According to the U.S. Department of Energy, 31,000 barrels (4.9 million liters) of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels (6.4 billion liters) of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and offshore it was up to less than 70,000 barrels.</td><td>Accidental releases of air toxics or HAPS will be due to potential chemical spills. See Table A-8 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. These may lead to short-term periods of toxic pollutant emissions through evaporation. Air quality impacts will be short-term and limited to the local area at and around the accidental release location.</td></tr>
<tr><td>Air emissions: Construction and decommissioning</td><td rowspan="2">Air emissions originate from combustion engines and electric power generated by burning fuel. These activities are regulated under the CAA to meet set standards. Air quality has generally improved over the last 30 years; however, some areas in the Northeast have experienced a decline in air quality over the last 2 years. Some areas of the Atlantic coast remain in nonattainment for ozone, with the source of this pollution from power generation. Many of these states have made commitments toward cleaner energy goals to improve this, and offshore wind is part of these goals. Primary processes and activities that can affect the air quality impacts are expansions and modifications to existing fossil fuel power plants, onshore and offshore activities involving renewable energy facilities, and various construction activities.</td><td>The largest air quality impacts over the next 30 years will occur during the construction phase of any one project; however, projects will be required to comply with the CAA. During the limited construction and decommissioning phases, emissions may occur that are above de minimis thresholds and will require offsets and mitigation. Primary emission sources will be increased commercial vehicular traffic, air traffic, public vehicular traffic, and combustion emissions from construction equipment and fugitive emissions from construction-generated dust. As projects come online, power generation emissions overall will decline and the industry as a whole will have a net benefit on air quality.</td></tr>
<tr><td>Air emissions: O&M</td><td>Activities associated with operation and maintenance of onshore wind projects will have a proportionally very small contribution to emissions compared to the construction and decommissioning activities over the next 30 years. Emissions will largely be due to commercial vehicular traffic and operation of emergency diesel generators. Such activity will result in short-term, intermittent, and widely dispersed emissions and small air quality impacts.</td></tr>
</table>

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Air emissions: Power generation emissions reductions		Many Atlantic states have committed to clean energy goals, with offshore wind being a large part of that. Other reductions include transitioning to onshore wind and solar. The No Action Alternative without implementation of other future offshore wind projects would likely result in increased air quality impacts regionally due to the need to construct and operate new energy generation facilities to meet future power demands. These facilities may consist of new natural-gas-fired power plants, coal-fired, oil-fired, or clean-coal-fired plants. These types of facilities would likely have larger and continuous emissions and result in greater regional scale impacts on air quality.
Climate change	The construction, operation, and decommissioning of offshore wind projects would produce GHG emissions (nearly all CO_2) that can contribute to climate change; however, these contributions would be minuscule compared to aggregate global emissions. CO_2 is relatively stable in the atmosphere and generally mixed uniformly throughout the troposphere and stratosphere. Hence the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects will likely decrease GHGs emissions by replacing energy from fossil fuels.	Development of future onshore wind projects will produce a small overall increase in GHG emissions over the next 30 years. However, these contributions would be very small compared to the aggregate global emissions. The impact on climate change from these activities would be very small. As more projects come online, some reduction in GHG emissions from modifications of existing fossil fuel facilities to reduce power generation. Overall, it is anticipated that there would be no cumulative impact on global warming as a result of onshore wind project activities.

% = percent; BOEM = Bureau of Ocean Energy Management; CAA = Clean Air Act; CO = carbon monoxide; Draft EIS = Draft Environmental Impact Statement; EIS = Environmental Impact Statement; GHG = greenhouse gas; HAP = hazardous air pollutant; IPF = impact producing factor; NAAQS = National Ambient Air Quality Standards; NO2 = nitrogen dioxide ; NOx = nitrogen oxides; O&M = operations and maintenance; PM2.5 = particulate matter with diameters 2.5 microns or smaller; PM10 = particulate matter with diameters 10 microns or smaller; ppb = parts per billion; SO2 = sulfur dioxide; USC = United States Code; USEPA = U.S. Environmental Protection Agency; VOC = volatile organic compounds

Table A-8: Summary of Activities and the Associated Impact-Producing Factors for Water Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	Accidental releases of fuels and fluids occur during vessel usage for dredge material ocean disposal, fisheries use, marine transportation, military use, survey activities, and submarine cable lines, and pipeline laying activities. According to the DOE, 31,000 barrels (4.9 million liters) of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels (6.4 billion liters) of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and into the offshore was <70,000 barrels. Impacts on water quality would be expected to brief and localized from accidental releases.	Future accidental releases from offshore vessel usage, spills, and consumption will likely continue on a similar trend. Impacts are unlikely to affect water quality.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, and cables, lines, and pipeline laying. Accidental releases of trash and debris are expected to be low probability events. BOEM assumes operator compliance with federal and international requirements for management of shipboard trash; such events also have a relatively limited spatial impact.	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. However, there does not appear to be evidence that the volumes and extents anticipated would have any effect on water quality.
Anchoring	Impacts from anchoring occur due to ongoing military use and survey, commercial, and recreational activities.	Impacts from anchoring may occur semi-regularly over the next 30 years due to offshore military operations or survey activities. These impacts would include increased seabed disturbance resulting in increased turbidity levels. All impacts would be localized, short-term, and temporary.
New cable emplacement/ maintenance	Elevated suspended sediment concentrations can occur under natural tidal conditions and increase during storms, trawling, and vessel propulsion. Survey activities, and new cable and pipeline laying activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be short-term and either be limited to the emplacement corridor or localized.	Suspension of sediments may continue to occur infrequently over the next 30 years due to survey activities, and submarine cable, lines, and pipeline-laying activities. Future new cables would occasionally disturb the seafloor and cause short-term increases in turbidity and minor alterations in localized currents resulting in local short-term impacts. The FCC has two pending submarine telecommunication cable applications in the North Atlantic. If the cable routes enter the water quality geographic analysis area, short-term disturbance in the form of increased suspended sediment and turbidity would be expected.
Port utilization: Expansion	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications, which, along with additional vessel traffic, could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.	The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly over the next 30 years. Port modifications and channel deepening activities are being undertaken to accommodate the increase in vessel traffic and deeper draft vessels that transit the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.
Presence of structures	The installation of onshore and offshore structures leads to alteration of local water currents. These disturbances would be local but, depending on the hydrologic conditions, have the potential to impact water quality through the formation of sediment plumes.	Impacts associated with the presence of structures includes temporary sediment disturbance during maintenance. This sediment suspension would lead to interim and localized impacts.
Discharges	Discharges impact water quality by introducing nutrients, chemicals, and sediments to the water. There are regulatory requirements related to prevention and control of discharges, the prevention and control of accidental spills, and the prevention and control of nonindigenous species.	Increased coastal development is causing increased nutrient pollution in communities. In addition, ocean disposal activity in the North and Mid-Atlantic is expected to gradually decrease or remain stable. Impacts of ocean disposal on water quality are minimized because USEPA has established dredge spoil criteria and regulate the disposal permits issued by USACE. The impact on water quality from sediment suspension during these future activities would be short-term and localized.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: erosion and sedimentation	Ground disturbance activities may lead to un-vegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to un-vegetated or unstable soils. Precipitation events could mobilize these soils leading to erosion and sedimentation effects and turbidity. The impacts for future offshore wind through this IPF would be staggered in time and localized. The impacts would be short term and localized with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to un-vegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

BOEM = Bureau of Ocean Energy Management; DO = dissolved oxygen; DOE = U.S. Department of Energy; EIS = Environmental Impact Statement; ESP = electrical service platform; FCC = Federal Communications Commission; gal = gallon; IPF = impact-producing factors; L = liter; m² = square meters; mg/L = milligrams per liter; NASA = National Aeronautics and Space Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; USACE = U.S. Army Corps of Engineers; USCG = U.S. Coast Guard; USEPA = Environmental Protection Agency; WDA = Wind Development Area; WTG = wind turbine generator

Table A-11: Summary of Activities and the Associated Impact-Producing Factors for Birds

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table A-8 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Ingestion of hydrocarbons can lead to morbidity and mortality due to decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997, Haney et al. 2017, Paruk et al. 2016). Additionally, even small exposures that result in feather oiling can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). These impacts rarely result in population-level impacts.	See Table A-8 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the potential risk of accidental releases and associated impacts, including mortality, decreased fitness, and health effects on individuals. Impacts are unlikely to affect populations.
Accidental releases: Trash and debris	Trash and debris are accidentally discharged through onshore sources; fisheries use; dredged material ocean disposal; marine minerals extraction; marine transportation, navigation, and traffic; survey activities; and cables, lines, and pipeline laying on an ongoing basis. In a study from 2010, students at sea collected more than 520,000 bits of plastic debris per square mile. In addition, many fragments come from consumer products blown out of landfills or tossed out as litter. (Law et al. 2010). Birds may accidentally ingest trash mistaken for prey. Mortality is typically a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019).	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. This may result in increased injury or mortality of individuals. However, there does not appear to be evidence that the volumes and extents would have any impact on bird populations.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Light: Vessels	Ocean vessels have an array of lights including navigational lights, deck lights, and interior lights. Such lights can attract some birds. The impact is localized and temporary. This attraction would not be expected to result in an increased risk of collision with vessels. Population-level impacts would not be expected.	Gradually increasing vessel traffic over the next 30 years would increase the potential for bird and vessel interactions. While birds may be attracted to vessel lights, this attraction would not be expected to result in increased risk of collision with vessels. No population-level impacts would be expected.
Light: Structures	Buoys, towers, and onshore structures with lights can attract birds. Onshore structures like houses and ports emit a great deal more light than offshore buoys and towers. This attraction has the potential to result in an increased risk of collision with lighted structures (Huppop et al. 2006). Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in proportion with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Cable emplacement and maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be temporary and generally limited to the emplacement corridor. Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances will be temporary and limited to the emplacement corridor. Suspended sediment could impair the vision of diving birds that are foraging in the water column (Cook and Burton 2010). However, given the localized nature of the potential impacts, individuals would be expected to successfully forage in nearby areas not affected by increased sedimentation and no biologically significant impacts on individuals or populations would be expected.	Future new cables, would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in localized, short-term impacts. The FCC has two pending submarine telecommunications cable applications in the North Atlantic. Impacts would be temporary and localized, with no biologically significant impacts on individuals or populations.
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for birds. With the possible exception of rescue operations and survey aircraft, no ongoing aircraft flights would occur at altitudes that would elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.	Aircraft noise is likely to continue to increase as commercial air traffic increases; however, very few flights would be expected to be at a sufficiently low altitude to elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities could result in diving birds leaving the local area. Non-diving birds would be unaffected. Any displacement would only be temporary during non-migratory periods, but impacts could be greater if displacement were to occur in preferred feeding areas during seasonal migration periods.	Same as ongoing activities, with the addition of possible future oil and gas surveys.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water could result in intermittent, temporary, localized impacts on diving birds due to displacement from foraging areas if birds are present in the vicinity of pile-driving activity. The extent of these impacts depends on pile size, hammer energy, and local acoustic conditions. No biologically significant impacts on individuals or populations would be expected.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Onshore construction	Onshore construction is routinely used in generic infrastructure projects. Equipment could potentially cause displacement. Any displacement would only be temporary and no individual fitness or population-level impacts would be expected.	Onshore construction will continue at current trends. Some behavior responses could range from escape behavior to mild annoyance, but no individual injury or mortality would be expected.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Sub-surface noise from vessels could disturb diving birds foraging for prey below the surface. The consequence to birds would be similar to noise from G&G but likely less because noise levels are lower.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Presence of structures: Entanglement, gear loss, gear damage	Each year, 2,551 seabirds die annually from interactions with U.S. commercial fisheries on the Atlantic (Sigourney et al. 2019). Even more die due to abandoned commercial fishing gear (nets).In addition, recreational fishing gear (hooks and lines) is periodically lost on existing buoys, pilings, hard protection, and other structures and has the potential to entangle birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various hard protections atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these objects. These impacts are local and can be short-term to permanent. These fish aggregations can provide localized, short-term to permanent, beneficial impacts to some bird species because it could increase prey species availability.	New cables, installed incrementally in the geographic analysis area for birds over the next 20 to 30 years, would likely require hard protection atop portions of the cables (see New cable emplacement/maintenance row). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are expected to be local and may be short-term to permanent. These fish aggregations can provide localized, short-term to permanent beneficial impacts on some bird species due to increased prey species availability.
Presence of structures: Migration disturbances	A few structures may be scattered about the offshore geographic analysis area for birds, such as navigation and weather buoys and light towers (NOAA 2020). Migrating birds can easily fly around or over these sparsely distributed structures.	The infrequent installation of future new structures in the marine environment over the next 30 years would not be expected to result in migration disturbances.
Presence of structures: Turbine strikes, displacement, and attraction	A few structures may be in the offshore geographic analysis area for birds, such as navigation and weather buoys, turbines, and light towers (NOAA 2020). Given the limited number of structures currently in the geographic analysis area, individual- and population-level impacts due to displacement from current foraging habitat would not be expected. Stationary structures in the offshore environment would not be expected to pose a collision risk to birds. Some birds like cormorants and gulls may be attracted to these structures and opportunistically roost on these structures.	The installation of future new structures in the marine environment over the next 30 years would not be expected to result in an increase in collision risk or to result in displacement. Some potential for attraction and opportunistic roosting exists, but would be expected to be limited given the anticipated number of structures.
Traffic: Aircraft	General aviation accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Additionally, aircraft are used for scientific and academic surveys in marine environments.	Bird fatalities associated with general aviation would be expected to increase with the current trend in commercial air travel. Aircraft will continue to be used to conduct scientific research studies as well as wildlife monitoring and pre-construction surveys. These flights would be well below the 100,000 flights and no bird strikes would be expected to occur.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Land disturbance: Onshore construction	Onshore construction activity will continue at current trends. There is some potential for indirect impacts associated with habitat loss and fragmentation.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss, but would not be expected to result in injury or mortality of individuals.
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency and severity during the breeding season can reduce productivity of bird nesting colonies and kill adults, eggs, and chicks.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Ocean acidification	Increasing ocean acidification may affect prey species upon which some birds feed and could lead to shifts in prey distribution and abundance. Intensity of impacts on birds is speculative.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 30 years, influencing the distribution of bird prey resources.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered migration patterns	Birds rely on cues from the weather to start migration. Wind direction and speed influence the amount of energy used during migration. For nocturnal migrants, wind assistance is projected to increase across eastern portions of the continent (0.32 m/s; 9.6%) during spring migration by 2091, and wind assistance is projected to decrease within eastern portions of the continent (0.17 m/s; 6.6%) during autumn migration (La Sorte et al. 2018).	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, property/ infrastructure damage	This sub-IPF would have no impacts on birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, seawalls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence, impacts on bird nesting habitat.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 30 years, influencing the frequencies and distributions of various diseases of birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

ADLS = Aircraft Detection Light System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; EIS = Environmental Impact Statement; ESP = electrical service platform; FAA = Federal Aviation Administration; FCC = Federal Communications Commission; G&G = Geological and Geophysical; GHG = Greenhouse gas; IPF = impact-producing factors; km² = square kilometers; mg/L = milligrams per liter; m/s = meter per second; NOAA = National Oceanic and Atmospheric Administration; OCS = outer continental shelf; ROW = right-of-way; USCG = U.S. Coast Guard; WDA = wind development area; WTG = wind turbine generator

Table A-12: Summary of Activities and the Associated Impact-Producing Factors for Bats

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded and would result in high-intensity, low-exposure level, long-term, but localized intermittent risk to bats in nearshore waters. Direct impacts are not expected to occur as recent research has shown that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al. 2016). Indirect impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized.	Similar to ongoing activities, noise associated with pile driving activities would be limited to nearshore waters, and these high-intensity, but low-exposure risks would be not be expected to result in direct impacts. Some indirect impacts (i.e., displacement from potentially suitable foraging habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized and no population-level effects would be expected.
Noise: Construction	Onshore construction occurs regularly for generic infrastructure projects in the bats geographic analysis area. There is a potential for displacement caused by equipment if construction occurs at night (Schaub et al. 2008). Any displacement would only be temporary. No individual or population level impacts would be expected. Some bats roosting in the vicinity of construction activities may be disturbed during construction, but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts as frequent roost switching is a common component of a bat's life history (Hann et al. 2017; Whitaker 1998).	Onshore construction is expected to continue at current trends. Some behavioral responses and avoidance of construction areas may occur (Schaub et al. 2008). However, no injury or mortality would be expected.
Presence of structures: Migration disturbances	There may be few structures scattered throughout the offshore bats geographic analysis area, such as navigation and weather buoys and light towers (NOAA 2020). Migrating bats can easily fly around or over these sparsely distributed structures, and no migration disturbance would be expected. Bat use of offshore areas is very limited and generally restricted to spring and fall migration. Very few bats would be expected to encounter structures on the OCS and no population-level effects would be expected.	The infrequent installation of future new structures in the marine environment of the next 30 years is expected to continue. As described under Ongoing Activities, These structures would not be expected to cause disturbance to migrating tree bats in the marine environment.
Presence of structures: Turbine strikes	There may be few structures in the offshore bats geographic analysis area, such as navigation and weather buoys, turbines, and light towers (NOAA 2020). Migrating tree bats can easily fly around or over these sparsely distributed structures, and no strikes would be expected.	The infrequent installation of future new structures in the marine environment of the next 30 years is expected to continue. As described under Ongoing Activities, these structures would not be expected to result in increased collision risk to migrating tree bats in the marine environment.
Land disturbance: onshore construction	Onshore construction activities are expected to continue at current trends. Potential direct effects on individuals may occur if construction activities include tree removal when bats are potentially present. Injury or mortality may occur if trees being removed are occupied by bats at the time of removal. While there is some potential for indirect impacts associated with habitat loss, no individual or population-level effects would be expected.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss and could result in injury or mortality of individuals.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, storm severity/frequency	Storms during breeding and roosting season can reduce productivity and increase mortality. Intensity of this impact is speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.
Climate change: Ocean acidification; Warming and sea level rise, altered habitat/ecology; Warming and sea level rise, altered migration patterns; Warming and sea level rise, property/ infrastructure damage; Warming and sea level rise, protective measures (barriers, sea walls); Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	These sub-IPFs would have no impacts on bats.	No future activities were identified within the bats geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Disease can weaken, lower reproductive output, and/or kill individuals. Some tropical diseases will move northward. Extent and intensity of this impact is highly speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.

EIS = Environmental Impact Statement; ESP = electrical service platform; IPF = impact-producing factors; NOAA = National Oceanic and Atmospheric Administration; OCS = outer continental shelf; ROW = right-of-way; WTG = wind turbine generator

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ATTACHMENT 3

Ongoing and Future Non-Offshore Wind Activity Analysis (Part 2)

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BOEM developed the following tables 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), which evaluates potential impacts associated with ongoing and future non-offshore wind activities. The content of these tables has been vetted and approved by cooperating agencies to the SFWF EIS and therefore has been included in whole for their use in impact and cumulative analyses, and for ease in reference by the reader .

Table 3.1-1: Summary of Activities and the Associated Impact-Producing Factors for Terrestrial and Coastal Fauna

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Periodic ground-disturbing activities contribute to elevated levels of erosion and sedimentation, but usually not to a degree that affects terrestrial and coastal fauna, assuming that industry standard BMPs are implemented.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore construction	Periodic clearing of shrubs and tree saplings along existing utility ROWs causes disturbance and temporary displacement of mobile species and may cause direct injury or mortality of less-mobile species, resulting in short-term impacts that are less than noticeable. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, and cell tower projects also causes disturbance, displacement, and potential injury and/or mortality of fauna, resulting in small temporary impacts.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore, land use changes	Periodically, undeveloped parcels are cleared and developed for human uses, permanently changing the condition of those parcels as habitat for terrestrial fauna. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, transportation infrastructure, sewer infrastructure, and cell tower projects could permanently convert various areas.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by greenhouse gas emissions, is altering the seasonal timing and patterns of species distributions and ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 30 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

BMPs = best management practices; BOEM = Bureau of Ocean Energy Management; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meter; ROW = right-of-way; WMA = wildlife management area

Table 3.2-1: Summary of Activities and the Associated Impact-Producing Factors for Coastal Habitats

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Attachment 2/Appendix A for a discussion of ongoing accidental releases. Accidental releases of fuel/fluids/hazmat have the potential to cause habitat contamination and harm to the species that build biogenic coastal habitats (e.g., eelgrass, oysters, mussels, slipper limpets, salt marsh cordgrass) from releases and/or cleanup activities. Only a portion of the ongoing releases contact coastal habitats in the geographic analysis area. Impacts are small, localized, and temporary.	See Attachment 2/Appendix A for a discussion of accidental releases.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occur from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. As population and vessel traffic increase, accidental releases of trash and debris may increase. Such materials may be obvious when they come to rest on shorelines; however, there does not appear to be evidence that the volumes and extents would have any detectable impact on coastal habitats.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
Anchoring	Vessel anchoring related to ongoing military, survey, commercial, and recreational activities will continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and potential for direct contact to cause physical damage to coastal habitats. All impacts are localized; turbidity is short-term and temporary; physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
EMF	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the analysis area. The extent of impacts is likely less than 50 feet (15.2 meters) from the cable, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
Light: Vessels	Navigation lights and deck lights on vessels would be a source of ongoing light. The extent of impacts is limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	Light is expected to continue to increase gradually with increasing vessel traffic over the next 30 years. The extent of impacts would likely be limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats would likely be undetectable.
Light: Structures	Ongoing lights from navigational aids and other structures onshore and nearshore. The extent of impacts is likely limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
New cable emplacement/ maintenance	Ongoing cable maintenance activities infrequently disturb bottom sediments; these disturbances are local and limited to the emplacement corridor (see the Sediment deposition and burial IPF).	No future activities were identified within the geographic analysis area other than ongoing activities.
Noise: Onshore/offshore construction	Ongoing noise from construction occurs frequently near shores of populated areas in New England and the mid-Atlantic, but infrequently offshore. Noise from construction near shore is expected to gradually increase over the next 30 years in line with human population growth along the coast of the geographic analysis area. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Site characterization surveys and scientific surveys are ongoing. The intensity and extent of the resulting impacts are difficult to generalize, but are local and temporary.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can reach coastal habitats. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Cable laying/trenching	Rare but ongoing trenching for pipeline and cable laying activities emits noise; cable burial via jet embedment also causes similar noise impacts. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines may occur in the geographic analysis area infrequently over the next 30 years. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.
Presence of structures: Habitat conversion	Various structures, including pilings, piers, towers, riprap, buoys, and various means of hard protection, are periodically added to the seascape, creating uncommon relief in a mostly flat seascape and converting previously existing habitat (whether hard-bottom or soft-bottom) to a type of hard habitat, although it differs from the typical hard-bottom habitat in the analysis area, namely, coarse substrates in a sand matrix. The new habitat may or may not function similarly to hard-bottom habitat typical in the region (Kerckhof et al. 2019; HDR 2019). Soft bottom is the dominant habitat type on the OCS, and structures do not meaningfully reduce the amount of soft-bottom habitat available (Guida et al. 2017; Greene et al. 2010). Structures can also create an artificial reef effect, attracting a different community of organisms.	Any new cable or pipeline installed in the geographic analysis area would likely require hard protection atop portions of the route (see cells to the left). Such protection is anticipated to increase incrementally over the next 30 years. Where cables would be buried deeply enough that protection would not be used, presence of the cable would have no impact on coastal habitats.
Presence of structures: Transmission cable infrastructure	Various means of hard protection atop existing cables can create uncommon hard-bottom habitat. Where cables are buried deeply enough that protection is not used, presence of the cable has no impact on coastal habitats.	See above.
Land disturbance: Erosion and sedimentation	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term erosion and sedimentation of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore construction	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term to permanent degradation of onshore coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Land disturbance: Onshore, land use changes	Ongoing development of onshore properties, especially shoreline parcels, periodically causes the conversion of onshore coastal habitats to developed space.	No future activities were identified within the geographic analysis area other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized, short-term impacts on coastal habitats through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little effect on the general character of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition within coastal habitats. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. No dredged material disposal sites were identified within the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Ocean acidification	Ongoing CO_2 emissions causing ocean acidification may contribute to reduced growth or the decline of reefs and other habitats formed by shells.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by ongoing greenhouse gas emissions, is expected to continue to contribute to a widespread loss of shoreline habitat from rising seas and erosion. In submerged habitats, warming is altering ecological relationships and the distributions of ecosystem engineer species, likely causing permanent changes of unknown intensity gradually over the next 3 years.	See above.

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = Environmental Impact Statement; EMF = electromagnetic field; G&G = Geological and Geophysical; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meter; mg/L = milligrams per liter; OCS = Outer Continental Shelf; OECC = offshore export cable corridor; SSU = special, sensitive, and unique

Table 3.3-1: Summary of Activities and the Associated Impact-Producing Factors for Benthic Resources

Associated IPFs: Sub-IFPs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Accidental releases: Fuel/fluids/ hazmat	See Attachment 2/Appendix A Table A-8 for a discussion of ongoing accidental releases. Accidental releases of hazmat occur periodically, mostly consisting of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they rarely contact benthic resources. The chemicals with potential to sink or dissolve rapidly often dilute to non-toxic levels before they affect benthic resources. The corresponding impacts on benthic resources are rarely noticeable.	Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. See previous cell and Attachment 2/Appendix A Table A-8 on Water Quality for details.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on benthic resources (e.g., competitive disadvantage, smothering) depend on many factors, but can be noticeable, widespread, and permanent.	No future activities were identified within the geographic analysis area other than ongoing activities.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occurs from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. However, there does not appear to be evidence that ongoing releases have detectable impacts on benthic resources.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Regular vessel anchoring related to ongoing military, survey, commercial, and recreational activities continues to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and the potential for direct contact to cause injury and mortality of benthic resources, as well as physical damage to their habitats. All impacts are localized; turbidity is temporary; injury and mortality are recovered in the short term; and physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area other than ongoing activities.
EMFs	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the geographic analysis area. Some benthic species can detect EMFs, although EMFs do not appear to present a barrier to movement. The extent of impacts (behavioral changes) is likely less than 50 feet (15.2 meters) from the cable and the intensity of impacts on benthic resources is likely undetectable.	No future activities were identified within the geographic analysis area other than ongoing activities.
New cable emplacement/ maintenance	Cable maintenance activities infrequently disturb benthic resources and cause temporary increases in suspended sediment; these disturbances would be local and limited to the emplacement corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities injure and kill benthic resources, and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPFs of Seabed profile alterations and Sediment deposition and burial.)	No future activities were identified within the geographic analysis area other than ongoing activities.
Noise: Onshore/offshore construction	See Table 3.4-1 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table 3.4-1 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: G&G	See Table 3.4-1 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table 3.4-1 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: O&M	See Table 3.4-1 on finfish, invertebrates, and EFH.	See Table 3.4-1 on finfish, invertebrates, and EFH.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Cable laying/trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area. These disturbances would be infrequent over the next 30 years, local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Port utilization: Expansion	See Table 3.4-1 on finfish, invertebrates, and EFH.	See Table 3.4-1 on finfish, invertebrates, and EFH.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear are periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb, injure, or kill benthic resources, creating small, short-term, localized impacts.	Future new cables would present additional risk of gear loss, resulting in small, short-term, localized impacts (disturbance, injury).
Presence of structures: Hydrodynamic disturbance	See Table 3.4-1 on finfish, invertebrates, and EFH.	See Table 3.4-1 on finfish, invertebrates, and EFH.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes can adversely affect populations and communities of benthic resources. These impacts are local and permanent.	New cables installed in the geographic analysis area over the next 30 years would likely require hard protection atop portions of the route (see the "new cable emplacement/maintenance" row in this table). Any new towers, buoy, or piers would also create uncommon relief in a mostly flat, sandy seascape. Structure-oriented fishes could be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect populations and communities of benthic resources. These impacts are expected to be local and to be permanent as long as the structures remain.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously provide uncommon hard-bottom habitat. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Benthic species dependent on hard-bottom habitat can benefit on a constant basis, although the new habitat can also be colonized by invasive species (e.g., certain tunicate species). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	See above for quantification and timing. Any new towers, buoy, piers, or cable protection structures would create uncommon relief in a mostly sandy seascape. Benthic species dependent on hard-bottom habitat could benefit, although the new habitat could also be colonized by invasive species (e.g., certain tunicate species). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Transmission cable infrastructure	The presence of transmission cable infrastructure, especially hard protection atop cables, causes impacts through entanglement/gear loss/damage, fish aggregation, and habitat conversion. Therefore, see those sub-IPFs within Presence of structures.	See other sub-IPFs within Presence of structures.
Discharges	The gradually increasing amount of vessel traffic is increasing the cumulative permitted discharges from vessels. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. However, there does not appear to be evidence that the volumes and extents have any impact on benthic resources.	There is the potential for new ocean dumping/dredge disposal sites in the Northeast. Impacts (disturbance, reduction in fitness) of infrequent ocean disposal to benthic resources are short-term because spoils are typically recolonized naturally. In addition, the USEPA has established dredge spoil criteria and it regulates the disposal permits issued by the USACE; these discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated.
Regulated fishing effort	Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, towns, and/or NOAA, depending on jurisdiction, affect benthic resources by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, injury, and mortality) on benthic resources through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little impact on benthic resources in the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season/time of year. Where dredged materials are disposed, benthic resources are smothered. However, such areas are typically recolonized naturally in the short term. Most sediment dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.	The USACE and/or private ports may undertake dredging projects periodically. Where dredged materials are disposed, benthic resources are buried. However, such areas are typically recolonized naturally in the short term. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.
Climate change: Ocean acidification	Ongoing CO_2 emissions causing ocean acidification may contribute to reduced growth or the decline of benthic invertebrates that have calcareous shells, as well as reefs and other habitats formed by shells.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by ongoing greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the distributions of benthic species and altering ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 30 years.	See above.
Climate change: Warming and sea level rise, altered migration patterns	See above.	See above.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by ongoing greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of benthic species, and likely causing permanent changes of unknown intensity over the next 30 years.	See above.

BMP = best management practice; BOEM = Bureau of Ocean Energy Management; CO_2 = carbon dioxide; COP = Construction and Operations Plan; EFH = Essential Fish Habitat; EIS = Environmental Impact Statement; EMF = electromagnetic field; ESP = electrical service platform; G&G = Geological and Geophysical; hazmat = hazardous materials; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meter; met = meteorological; NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); USACE = U.S. Army Corps of Engineers; USEPA = U.S. Environmental Protection Agency; WTG = wind turbine generator

Table 3.4-1: Summary of Activities and the Associated Impact-Producing Factors for Finfish, Invertebrates, and Essential Fish Habitat

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table A-8 in Attachment 2/Appendix A for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Impacts, including mortality, decreased fitness, and contamination of habitat, are localized and temporary, and rarely affect populations.	See Table A-8 in Attachment 2/Appendix A for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Impacts are unlikely to affect populations.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on finfish, invertebrates, and EFH depend on many factors, but can be widespread and permanent.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Anchoring	Vessel anchoring related to ongoing military use, and survey, commercial, and recreational activities continues to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, and sedentary shellfish).	Impacts from anchoring may occur on a semi-regular basis over the next 30 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. These impacts would include increased turbidity levels and potential for direct contact causing mortality of benthic species and, possibly, degradation of sensitive habitats. All impacts would be localized; turbidity would be temporary; impacts from direct contact would be recovered in the short term. Degradation of sensitive habitats such as certain types of hard bottom (e.g., boulder piles), if it occurs, could be long-term.
EMF	EMF emanates continuously from installed telecommunication and electrical power transmission cables. Biologically significant impacts on finfish, invertebrates, and EFH have not been documented for AC cables (CSA Ocean Sciences, Inc. and Exponent 2019 and see Thomsen et al. 2015), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts are localized and affect the animals only while they are within the EMF. There is no evidence to indicate that EMF from undersea AC power cables negatively affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences, Inc. and Exponent 2019).	During operation, future new cables would produce EMF. (See cell to the left.) Submarine power cables in the geographic analysis area for this resource are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any two sources would not overlap (even for multiple cables within a single OECC). Although the EMF would exist as long as a cable was in operation, impacts, on finfish, invertebrates, and EFH would likely be difficult to detect.
Light: Vessels	Marine vessels have an array of lights including navigational lights and deck lights. There is little downward-focused lighting, and therefore only a small fraction of the emitted light enters the water. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts.	See cell to the left.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Light: Structures	Offshore buoys and towers emit light, and onshore structures, including buildings and ports, emit a great deal more on an ongoing basis. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts. Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances are local, limited to the cable corridor. New cables are infrequently added near shore. Cable emplacement/ maintenance activities disturb, displace, and injure finfish and invertebrates and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPF of Sediment deposition and burial.)	Future new cables would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in local short-term impacts. The FCC has two pending submarine telecommunication cable applications in the North Atlantic. If the cable routes enter the geographic analysis area for this resource, short-term disturbance would be expected. The intensity of impacts would depend on the time (season) and place (habitat type) where the activities would occur.
Noise: Aircraft	Noise from aircraft reaches the sea surface on a regular basis. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH, as very little of the aircraft noise propagates through the water.	Aircraft noise is likely to continue to increase as commercial air traffic increases. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH.
Noise: Onshore/offshore construction	Noise from construction occurs frequently in near shores of populated areas in New England and the mid-Atlantic but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. See also sub-IPF for Noise: Pile driving.	Noise from construction near shores is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource.
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb finfish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: O&M	Some finfish and invertebrates may be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Farm, this low frequency noise barley exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015), sound pressure levels would be expected to be at or below ambient levels at relatively short distances (approximately 164 feet [50 meters]) from WTG foundations. These low levels of elevated noise likely have little to no impact. Noise is also created by operations and maintenance of marine minerals extraction and commercial fisheries, each of which has small local impacts.	New or expanded marine minerals extraction and commercial fisheries may intermittently increase noise during their operations and maintenance over the next 30 years. Impacts would likely be small and local.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile, and can cause short-term stress and behavioral changes to individuals over a greater area. Eggs, embryos, and larvae of finfish and invertebrates could also experience developmental abnormalities or mortality resulting from this noise, although thresholds of exposure are not known (Weilgart 2018, Hawkins and Popper 2017). Potentially injurious noise could also be considered as rendering EFH temporarily unavailable or unsuitable for the duration of the noise. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area for this resource. These disturbances would be infrequent over the next 30 years, temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Noise: Vessels	While ongoing vessel noise may have some effect on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	See cell to the left.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 30 years.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. In addition, the general trend along the coast from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase may require port modifications, leading to local impacts. Future channel deepening activities will likely be undertaken. Existing ports have already affected finfish, invertebrates, and EFH, and future port projects would implement BMPs to minimize impacts. Although the degree of impacts on EFH would likely be undetectable outside the immediate vicinity of the ports, adverse impacts on EFH for certain species and/or life stages may lead to impacts on finfish and invertebrates beyond the vicinity of the port.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures: Hydrodynamic disturbance	Manmade structures, especially tall vertical structures such as foundations for towers of various purposes, continuously alter local water flow at a fine scale. Water flow typically returns to background levels within a relatively short distance from the structure. Therefore, impacts on finfish, invertebrates, and EFH are typically undetectable. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood. New structures are periodically added.	Tall vertical structures can increase seabed scour and sediment suspension. Impacts would likely be highly localized and difficult to detect. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. These impacts are local and often permanent. Fish aggregation may be considered adverse, beneficial, or neutral.	New cables, installed incrementally in the geographic analysis area for this resource over the next 20 to 30 years, would likely require hard protection atop portions of the route (see the New cable emplacement/ maintenance IPF). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are local and may be permanent.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structure-oriented species thus benefit on a constant basis; however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	New cable, installed incrementally in the analysis area over the next 20 to 30 years, would likely require hard protection atop portions of the route (see New cable emplacement/ maintenance). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented species would benefit (Claisse et al. 2014, Smith et al. 2016); however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Soft bottom is the dominant habitat type from Cape Hatteras to the Gulf of Maine (over 60 million acres [242,811 km^2]), and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure is (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 30 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded.
Presence of structures: Transmission cable infrastructure	See other sub-IPFs within the Presence of structures IPF. See Table 3.2-1 on Coastal Habitats.	See other sub-IPFs within the Presence of structures IPF. See Table 3.2-1 on Coastal Habitats.
Regulated fishing effort	Regulated fishing effort results in the removal of a substantial amount of the annually produced biomass of commercially regulated finfish and invertebrates and can also influence bycatch of non-regulated species. Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, municipalities, and/or NOAA, depending on jurisdiction, affect finfish, invertebrates, and EFH by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, change in complexity) on finfish, invertebrates, and EFH through this IPF. Dredging is most likely in sand wave areas where typical jet plowing is insufficient to meet target cable burial depth. Sand waves that are dredged would likely be redeposited in like-sediment areas. Any particular sand wave may not recover to the same height and width as pre-disturbance; however, the habitat function would largely recover post-disturbance. Therefore, seabed profile alterations, while locally intense, have little impact on finfish, invertebrates, and EFH on a regional (Cape Hatteras to Gulf of Maine) scale.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have negative impacts on eggs and larvae, particularly demersal eggs such as longfin squid, which are known to have high rates of egg mortality if egg masses are exposed to abrasion or burial. Impacts may vary based on season/time of year.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Ocean acidification	Continuous carbon dioxide emissions causing ocean acidification may contribute to reduced growth or the decline of invertebrates that have calcareous shells over the course of the next 30 years.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ ecology	Climate change, influenced in part by greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 30 years, influencing the distributions of finfish, invertebrates, and EFH. This sub-IPF has been shown to affect the distribution of fish in the northeast United States, with several species shifting their centers of biomass either northward or to deeper waters (Hare et al. 2016).	See above.
Climate change: Warming and sea level rise, altered migration patterns	See above.	See above.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 30 years, influencing the frequencies of various diseases of finfish and invertebrates.	See above.

°C = degrees Celsius; AC = alternating current; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; DC = direct current; EFH = essential fish habitat; EMF = electromagnetic field; EIS = Environmental Impact Statement; ESP = electrical service platform; FCC = Federal Communications Commission; G&G = Geological and Geophysical; GW = gigawatts; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meters; met = meteorological; mg/L = milligrams per liter; NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; O&M = operations and maintenance; OCS = outer continental shelf; OECC = Offshore Export Cable Corridor(s); USACE = United States Army Corps of Engineers; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.5-1: Summary of Activities and the Associated Impact-Producing Factors for Marine Mammals

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table A-8 in Attachment 2/Appendix A for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008, Smith et al. 2017; Sullivan et al. 2019; Takeshida et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects to prey species (Table 3.4-1).	See Table A-8 in Attachment 2/Appendix A for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008, Smith et al. 2017; Sullivan et al. 2019; Takeshida et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects to prey species (Table 3.4-1).
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Worldwide 62 of 123 (50.4%) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Stranding data indicate potential debris induced mortality rates of 0 to 22%. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects to individuals to population level impacts (Browne et al. 2015).	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. Trash and debris may continue to be accidentally released through fisheries use and other offshore and onshore activities. There may also be a long-term risk from exposure to plastics and other debris in the ocean. Worldwide 62 of 123 (50.4%) of marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Mortality has been documented in cases of debris interacts, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014).
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Marine mammals appear to have a detection threshold for magnetic intensity gradients (i.e., changes in magnetic field levels with distance) of 0.1% of the earth's magnetic field or about 0.05 μT (Kirschvink 1990) and are thus likely to be very sensitive to **minor** changes in magnetic fields (Walker et al. 2003). There is a potential for animals to react to local variations of the geomagnetic field caused by power cable EMFs. Depending on the magnitude and persistence of the confounding magnetic field, such an effect could cause a trivial temporary change in swim direction or a longer detour during the animal's migration (Gill et al. 2005). Such an effect on marine mammals is more likely to occur with direct current cables than with AC cables (Normandeau et al. 2011). However, there are numerous transmission cables installed across the seafloor and no impacts on marine mammals have been demonstrated from this source of EMF.	During operation, future new cables would produce EMF. Submarine power cables in the marine mammal geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Marine mammals have the potential to react to submarine cable EMF, however, no effects from the numerous submarine cables have been observed. Further, this IPF would be limited to extremely small portions of the areas used by migrating marine mammals. As such, exposure to this IPF would be low, and as a result impacts on marine mammals would not be expected.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
New cable emplacement/ maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that since some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. Similarly, McConnell et al. (1999) documented movements and foraging of grey seals in the North Sea. One tracked individual was blind in both eyes, but otherwise healthy. Despite being blind, observed movements were typical of the other study individuals, indicating that visual cues are not essential for grey seal foraging and movement (McConnell et al. 1999). If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be temporary and short-term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (Table 3.4-1).	The FCC has two pending submarine telecommunication cable application in the North Atlantic. The impact on water quality from accidental sediment suspension during cable emplacement is temporary and short-term. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative impacts would be temporary and short-term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on some marine mammal prey species (Table 3.4-1).
Noise: Aircraft	Aircraft routinely travel in the marine mammal geographic analysis area. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from marine mammals. If flights are at a sufficiently low altitude, marine mammals may respond with behavioral changes, including short surface durations, abrupt dives, and percussive behaviors (i.e. breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area. Similarly, aircraft have the potential to disturb hauled out seals if aircraft overflights occur within 2,000 feet (610 meters) of a haul out area (Efroymson et al. 2000). However, this disturbance would be temporary, short-term, and result in minimal energy expenditure. These brief responses would be expected to dissipate once the aircraft has left the area.	Future low altitude aircraft activities such as survey activities and navy training operations could result short-term responses of marine mammals to aircraft noise. If flights are at a sufficiently low altitude, marine mammals may respond with a behavior changes, including short surface durations, abrupt dives, and percussive behaviors (i.e. breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area.
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in high intensity, high consequence impacts, including auditory injuries, stress, disturbance, and behavioral responses, if present within the ensonified area (NOAA 2018). Survey protocols and underwater noise mitigation procedures are typically implemented to decrease the potential for any marine mammal to be within the area where sound levels are above relevant harassment thresholds associated with an operating sound source to reduce the potential for behavioral responses and injury (PTS/TTS) close to the sound source. The magnitude of effects, if any, is intrinsically related to many factors, including: acoustic signal characteristics, behavioral state (e.g., migrating), biological condition, distance from the source, duration and level of the sound exposure, as well as environmental and physical conditions that affect acoustic propagation (NOAA 2018).	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Turbines	Marine mammals would be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Facility, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015) and Kraus et al. (2016), sound pressure levels would be expected to be at or below ambient levels at relatively short distances from the WTG foundations.	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high-intensity, low-exposure level, long-term, but localized intermittent risk to marine mammals. Impacts would be localized in nearshore waters. Pile driving activities may negatively affect marine mammals during foraging, orientation, migration, predator detection, social interactions, or other activities (Southall et al. 2007). Noise exposure associated with pile-driving activities can interfere with these functions, and have the potential to cause a range of responses, including insignificant behavioral changes, avoidance of the ensonified area, PTS, harassment, and ear injury, depending on the intensity and duration of the exposure. BOEM assumes that all ongoing and potential future activities will be conducted in accordance with a project-specific IHA to minimize impacts on marine mammals.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Noise: Cable laying/trenching	N/A	Cable laying impacts resulting from future non-offshore wind activities would be identical to those described for future offshore wind projects.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, scientific and academic research vessels, as well as other construction vessels. The frequency range for vessel noise falls within marine mammals' known range of hearing and would be audible. Noise from vessels presents a long-term and widespread impact on marine mammals across in most oceanic regions. While vessel noise may have some effect on marine mammal behavior, it would be expected to be limited to brief startle and temporary stress response. Results from studies on acoustic impacts from vessel noise on odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 feet (50 meters) of the vessel by 26% (Jensen et al. 2009). Pilot whales in a quieter, deep-water habitat could experience a 50% reduction in communication range from a similar size boat and speed (Jensen et al. 2009). Since lower frequencies propagate farther away from the sound source compared to higher frequencies, low frequency cetaceans are at a greater risk of experiencing Level B Harassment produced by vessel traffic.	Any offshore projects that require the use of ocean vessels could potentially result in long term but infrequent impacts on marine mammals, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes. However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of marine mammals and no stock or population level effects would be expected.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel noise may affect marine mammals, but response would be expect to be temporary and short-term (see Vessels: Noise sub-IPF above). The impacts on water quality from sediment suspension during port expansion activities is temporary, short-term, and would be similar to those described under the New cable emplacement/maintenance IPF above.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strike could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	There are more than 130 artificial reefs in the Mid-Atlantic region. This sub-IPF may result in long-term, high intensity impacts, but with low exposure due to localized and geographic spacing of artificial reefs, long-term. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Moore and van der Hoop 2012), if present nearshore where these structures are located. There are very few, if any, areas within the OCS geographic analysis area for marine mammals that would serve to concentrate recreational fishing and increase the likelihood that marine mammals would encounter lost fishing gear.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Presence of structures: Habitat conversion and prey aggregation	There are more than 130 artificial reefs in the Mid-Atlantic region. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the ‘reef’ effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near shore coastal waters have the potential to provide habitat for seals and small odontocetes as well as preferred prey species. This "reef effect" has the potential to result in long term, low-intensity benefits. Bridge foundations will continue to provide foraging opportunities for seals and small odontocetes with measurable benefits to some individuals. Hard-bottom (scour control and rock mattresses used to bury the offshore export cables) and vertical structures (i.e., WTG and ESP foundations) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef effect” (Taormina et al. 2018; Causon and Gill 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for marine mammals compared to the surrounding soft-bottoms.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Avoidance/ displacement	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Traffic: Vessel collisions	Current activities that are contributing to this sub-IPF include port traffic levels, fairways, traffic separation schemes, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Vessel strike is relatively common with cetaceans (Kraus et al. 2005) and one of the primary causes of death to NARWs with as many as 75% of known anthropogenic mortalities of NARWs likely resulting from collisions with large ships along the US and Canadian eastern seaboard (Kite-Powell et al. 2007). Marine mammals are more vulnerable to vessel strike when they are within the draft of the vessel and when they are beneath the surface and not detectable by visual observers. Some conditions that make marine mammals less detectable include weather conditions with poor visibility (e.g., fog, rain, and wave height) or nighttime operations. Vessels operating at speeds exceeding 10 knots have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart 2007). Reported vessel collisions with whales show that serious injury rarely occurs at speeds below 10 knots (Laist et al. 2001). Data show that the probability of a vessel strike increases with the velocity of a vessel (Pace and Silber 2005; Vanderlaan and Taggart 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of marine mammals makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/ frequency	Increased storm frequency could result in increased energetic costs for marine mammals and reduced fitness, particularly for juveniles, calves and pups.	No future activities were identified within the geographic analysis area for marine mammals other than ongoing activities.
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammals as a result of changes in distribution, reduced breeding, and/or foraging habitat availability, and disruptions in migration.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammal habitat use and migratory patterns. For example, the NARW appears to be migrating differently and feeding in different areas in response to changes in prey densities related to climate change (Record et al. 2019; MacLeod 2009; Nunny and Simmonds 2019.)	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of marine mammals, such as Phocine distemper. Climate change is clearly influencing infectious disease dynamics in the marine environment; however, no studies have shown a definitive causal relationship between any components of climate change and increases in infectious disease among marine mammals. This is due in large part to a lack of sufficient data and to the likely indirect nature of climate change's impact on these diseases. Climate change could potentially affect the incidence or prevalence of infection, the frequency or magnitude of epizootics, and/or the severity or presence of clinical disease in infected individuals. There are a number of potential proposed mechanisms by which this might occur (see summary in Burge et al. 2014 Climate Change Influences on Marine Infectious Diseases: Implications for Management and Society).	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Increased storm frequency could result in increased energetic costs for marine mammals, reduced fitness, particularly for juveniles, calves and pups. Erosion could impact seal haul outs reducing their habitat availability, especially as things like sea walls are added, blocking seals access to shore.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

μPa = micropascal; μT = microtesla; AC = alternating current; BA = Biological Assessment; BOEM = Bureau of Ocean Energy Management; BMP = best management practice; BSW = Bay State Wind; CFR = Code of Federal Regulations; COP = Construction and Operations Plan; dB = decibel; dB RMS = decibel root mean square; DP = dynamic positioning; EIS = Environmental Impact Statement; EMF = electromagnetic field; FCC = Federal Communications Commission; G&G = Geological and Geophysical; hazmat = hazardous material; HRG = High Resolution Geophysical; Hz = hertz; IHA = Incidental Harassment Authorization; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meters; met – meteorological; mg/L = milligrams per liter; MW = megawatt; NARW = North Atlantic right whale; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; PAM = passive acoustic monitoring; PSO = protected species observer; PTS = permanent threshold shift; SOV = service operations vessel; TTS = temporary threshold shift; USCG = U.S. Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.6-1: Summary of Activities and the Associated Impact-Producing Factors for Sea Turtles

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Attachment 2/Appendix A Table A-8 for a quantitative analysis of these risks. Ongoing releases are frequent and chronic. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table 3.4-1).	See Attachment 2/Appendix A Table A-8 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka 2010; Wallace et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table 3.4-1).
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, cables, lines, and pipeline laying, as well as debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct ingestion of plastic fragments is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuylar et al. 2014). In addition to plastic debris, ingestion of tar, paper, Styrofoam™, wood, reed, feathers, hooks, lines, and net fragments have also been documented (Thomás et al. 2002). Ingestion can also occur when individuals mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Potential ingestion of marine debris varies among species and life history stages due to differing feeding strategies (Nelms et al. 2016). Ingestion of plastics and other marine debris can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Long-term sublethal effects may include dietary dilution, chemical contamination, depressed immune system function, poor body condition, as well as reduced growth rates, fecundity, and reproductive success. However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct and indirect ingestion of plastic fragments and other marine debris is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Gregory 2009; Hoarau et al. 2014; Nelms et al. 2016; Schuylar et al. 2014;Thomás et al. 2002). Ingestion can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).

Associated IPF: Sub-IPFs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 µT for loggerhead turtles, and 29.3 to 200 µT for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). Juvenile or adult sea turtles foraging on benthic organisms may be able to detect magnetic fields while they are foraging on the bottom near the cables and up to potentially 82 feet (25 meters) in the water column above the cable. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). However, any potential impacts from AC cables on turtle navigation or orientation would likely be undetectable under natural conditions, and thus would be insignificant (Normandeau et al. 2011).	During operations, future new cables would produce EMF. Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. (Section 5.2.7 of BOEM's 2007 Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.) EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Further, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to this IPF would be low, and as a result, impacts on sea turtles would not be expected.
Light: Vessels	Ocean vessels such as ongoing commercial vessel traffic, recreational and fishing activity, scientific and academic research traffic have an array of lights including navigational, deck lights, and interior lights. Such lights have some limited potential to attract sea turtles, although the impacts, if any, are expected to be localized and temporary.	Construction, operations, and decommissioning vessels associated with non-offshore wind activities produce temporary and localized light sources that could result in the attraction or avoidance behavior of sea turtles. These short-term impacts are expected to be of low intensity and occur infrequently.
Light: Structures	Artificial lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles. Artificial lighting on the OCS does not appear to have the same potential for effects. Decades of oil and gas platform operation in the Gulf of Mexico, that can have considerably more lighting than offshore WTGs, has not resulted in any known impacts on sea turtles (BOEM 2019).	Non-offshore wind activities would not be expected to appreciably contribute to this sub-IPF. As such, no impact on sea turtles would be expected.
New cable emplacement/ maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be too small to be detected (NOAA 2020). Sea turtles would be expected to swim away from the sediment plume. Elevated turbidity is most likely to affect sea turtles if a plume causes a barrier to normal behaviors, but no impacts would be expected due to swimming through the plume (NOAA 2020). Turbidity associated with increased sedimentation may result in short-term, temporary impacts on sea turtle prey species (Table 3.4-1).	The FCC has two pending submarine telecommunication cable application in the North Atlantic. The impact on water quality from accidental sediment suspension during cable emplacement is short-term and temporary. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be short-term and temporary. Turbidity associated with increased sedimentation may result in short-term, temporary impacts on some sea turtle prey species (Table 3.4-1).

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for sea turtles. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from sea turtles. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.	Future low altitude aircraft activities such as survey activities and navy training operations could result in short-term responses of sea turtles to aircraft noise. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in some impacts including potential auditory injuries, short-term disturbance, behavioral responses, and short-term displacement of feeding or migrating leatherback sea turtles and possibly loggerheads, if present within the ensonified area (NSF and USGS 2011). The potential for PTS and TTS is considered possible in proximity to G&G surveys, but impacts are unlikely as turtles would be expected to avoid such exposure and survey vessels would pass quickly (NSF and USGS 2011). No significant impacts would be expected at the population level.	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.
Noise: Turbines	Sea turtles would be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Facility, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base (Miller and Potty 2017). Based on the results of Thomsen et al. (2015) and Kraus et al. (2016), sound pressure levels would be expected to be at or below ambient levels at relatively short distances from the WTG foundations. Furthermore, no information suggests that such noise would affect turtles (NMFS 2015).	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high intensity, low exposure levels, and long-term, but localized intermittent risk to sea turtles. Impacts, potentially including behavioral responses, masking, TTS, and PTS, would be localized in nearshore waters. Data regarding threshold levels for impacts on sea turtles from sound exposure during pile driving are very limited, and no regulatory threshold criteria have been established for sea turtles. BOEM and NMFS have adopted the following thresholds based on current literature: Potential mortal injury: 210 dB cumulative SPL or greater than 207 dB peak SPL (Popper et al. 2014) Potential mortal injury: 180 dB re 1 µPa RMS (SPL; NMFS 2016) Behavioral harassment: 166 dB to175 dB referenced to 1 µPa RMS.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Noise: Cable laying/trenching	N/A	Cable laying impacts resulting from future non-offshore wind activities would be identical to those described for future offshore wind projects.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Vessels	The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with sea turtles' known hearing range (less than 1000 Hz with maximum sensitivity between 200 to 700 Hz; Bartol 1994) and would therefore be audible. However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach and/or noise with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (2005) indicated that vessel noise could have an effect on sea turtle behavior, especially their submergence patterns.	See Section 3.4.6. Any offshore projects that require the use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of sea turtles and no stock or population level effects would be expected.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in short-term, temporary impacts, if any, on sea turtles. Vessel noise may affect sea turtles, but response would be expect to be short-term and temporary (see the Vessels: Noise sub-IPF above). The impact on water quality from sediment suspension during port expansion activities is short-term, temporary, and would be similar to those described under the New cable emplacement/maintenance IPF above.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strikes could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	The Mid-Atlantic region has more than 130 artificial reefs. This sub-IPF may result in long-term, high intensity impacts, but with low exposure due to localized and geographic spacing of artificial reefs. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of sea turtles encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014) if present nearshore where these structures are located. There are very few, if any, areas on the OCS geographic analysis area for sea turtles that would serve to concentrate recreational fishing and increase the likelihood that sea turtles would encounter lost fishing gear.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion and prey aggregation	The Mid-Atlantic region has more than 130 artificial reefs. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the reef effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for sea turtles compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near-shore coastal waters has the potential to provide habitat for sea turtles as well as preferred prey species. This reef effect has the potential to result in long-term, low-intensity beneficial impacts. Bridge foundations will continue to provide foraging opportunities for sea turtles with measurable benefits to some individuals.
Presence of structures: Avoidance/ displacement	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Traffic: Vessel collisions	Current activities contributing to this sub-IPF include port traffic levels, fairways, traffic separation schemes, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike is an increasing concern for sea turtles, especially in the southeastern United States, where development along the coasts is likely to result in increased recreational boat traffic. In the United States, the percentage of strandings of loggerhead sea turtles that were attributed to vessel strikes increased from approximately 10% in the 1980s to a record high of 20.5% in 2004 (NMFS and USFWS 2007). Sea turtles are most susceptible to vessel collisions in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and those vessels travelling at greater than 10 knots would pose the greatest threat to sea turtles.	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of sea turtles makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency could lead to long-term, high-consequence impacts on sea turtle onshore beach nesting habitat, including changes to nesting periods, changes in sex ratios of nestlings, drowned nests, as well as loss or degradation of nesting beaches. Offshore impacts, including sedimentation of near-shore hard bottom habitats have the potential to result in long-term, high consequence changes to foraging habitat availability for green turtles.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtles by influencing distributions of sea turtles and/or prey resources. This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle breeding, foraging, and sheltering habitat use.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle habitat use and migratory patterns.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by greenhouse gas emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of sea turtles such as fibropapillomatosis.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence impacts on sea turtle nesting by eliminating or precluding access to potentially suitable nesting habitat or access to potentially suitable habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, storm severity, frequency, sediment erosion, deposition	Sediment erosion and/or deposition in coastal waters have the potential to result in long-term, high-consequence impacts on green sea turtle foraging habitat. Additionally, sediment erosion has the potential to result in the degradation or loss of potentially suitable nesting habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

μPa = micropascal; μT = microtesla; AC = alternating current; ADLS = Aircraft Detection Light System; AIS = Automatic Identification System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; BSW = Bay State Wind; CFR = Code of Federal Regulations; COP = Construction and Operations Plan; dB = decibel; dB re 1 μPa = decibels relative to one micropascal; dB RMS = decibel root mean square; DC = direct current; DP = dynamic positioning; DPS = distinct population segment; EMF = electromagnetic field; ESP = electrical service platform; FAA = Federal Aviation Administration; FCC = Federal Communications Commission; G&G = Geological and Geophysical; HRG = high resolution geophysical; Hz = hertz; IHA = Incidental Harassment Authorization; IPF = impact-producing factors; km^2 = square kilometers; m^2 = square meters; MCT = Marine Commerce Terminal; met = meteorological; mg/L = milligrams per liter; NARW = North Atlantic right whale; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NRA = Navigational Risk Assessment; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; PAM = passive acoustic monitoring; PSO = protected species observer; PTS = permanent threshold shift; RMS = root mean square; SEIS = Supplemental EIS; SOV = service operations vessel; SPL = sound pressure level; TTS = temporary threshold shift; USACE = U.S. Army Corps of Engineers; USCG = US Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.7-1: Summary of Activities and the Associated Impact-Producing Factors for Demographics, Employment, and Economics

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Energy generation/ security	In 2017, Massachusetts energy production totaled 125.2 trillion Btu, of which 72.4 trillion Btu was from renewable sources, including geothermal, hydroelectric, wind, solar, and biomass (U.S. Energy Information Administration 2018).	Ongoing development of onshore solar and wind energy would provide diversified, small-scale energy generation. State and regional energy markets would require additional peaker plants and energy storage to meet the electricity needs when utility scale renewables are not producing.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors. In the geographic analysis area for demographics, employment, and economics there are six existing power cables. See Attachment 2/Appendix A, Table A-5 for details.	The FCC has two pending submarine telecommunication cable applications in the North Atlantic. Future new cables would disturb the seafloor and cause temporary increases in suspended sediment resulting in infrequent, localized, short-term impacts over the next 30 years.
Noise: O&M	Limited to South Fork Wind Project	Not applicable
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the geographic analysis area for demographics, employment, and economics other than ongoing activities.
Noise: Cable laying/trenching	Infrequent trenching for pipeline and cable laying activities emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 30 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The Marine Commerce Terminal at the Port of New Bedford was upgraded by the port specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. As ports expand, maintenance dredging of shipping channels is expected to increase.	Ports would need to perform maintenance and upgrades over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners, and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations, which may be known as fish aggregating devices (FADs). Recreational and commercial fishing can occur near the FADs, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on FADs.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	No existing offshore structures are within the viewshed of the WDA except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Additional communication cables run between the U.S. East Coast and European countries along the eastern Atlantic.	See Table 3.1.18-1, Other Uses: No known proposed structures not associated with offshore wind development are reasonably foreseeable.
Traffic: Vessels	Study area ports and marine traffic related to shipping, fishing, and recreation are important to the region’s economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the study area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the study area economy.
Traffic: Vessel collisions	The region’s substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	No substantial changes anticipated.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore construction	Onshore development activities support local population growth, employment, and economies. Disturbances can cause temporary, localized traffic delays and restricted access to adjacent properties. The rate of onshore land disturbance is expected to continue at or near current rates.	Onshore development projects would be ongoing in accordance with local government land use plans and regulations.
Climate change: Warming and sea level rise, storm severity/ frequency, property and infrastructure damage	Climate models predict climate change if current trends continue. Climate change has adverse implications for demographics and economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries and other natural resources, increased disease frequency, and sedimentation, among other factors.	Onshore projects that reduce air emissions could contribute to the effort to limit climate change. Onshore solar and wind energy projects, although producing less energy than potential offshore wind developments, would also provide incremental reductions.
Climate change: Ocean acidification		
Climate change: Warming and sea level rise, altered habitat/ecology		
Climate change: Warming and sea level rise, altered migration patterns		
Climate change: Warming and sea level rise, increased disease frequency		
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)		
Climate change: Warming and sea level rise, storm severity, frequency, sediment erosion, deposition		

ADLS = Aircraft Detection Light System; BOEM = Bureau of Ocean Energy Management; Btu = British thermal unit; EIS = Environmental Impact Statement; ESP = electrical service platform; FADs = fish aggregating devices; FCC = Federal Communications Commission; G&G = Geological and Geophysical; GW = gigawatts; IPF = impact-producing factors; km^2 = square kilometers; MA = Massachusetts; NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; O&M = operations and maintenance; OECC = Offshore Export Cable Corridor(s); RI = Rhode Island; SAR = search and rescue; SEIS = Supplemental Environmental Impact Statement; USCG = United States Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.8-1: Summary of Activities and the Associated Impact-Producing Factors for Environmental Justice

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Air emissions: Construction/ decommissioning	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses, and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.
Air emissions: Operations and maintenance	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses, and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	The FCC has two pending submarine telecommunication cable applications in the North Atlantic. Future new cables would disturb the seafloor and cause temporary increases in suspended sediment, resulting in infrequent, localized, short-term impacts over the next 30 years.
Noise: Operations and maintenance	Offshore operations and maintenance of existing wind energy projects generates negligible amounts of noise.	There are no reasonably foreseeable offshore facilities that would generate noise from operations/maintenance.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Trenching	Infrequent trenching for pipeline and cable laying activities emits noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 30 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT at the Port of New Bedford is a completed facility developed by the port specifically to support the construction of offshore wind facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Entanglement, gear loss/ damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners, and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure, and each other.	Vessel traffic is generally not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	There are no existing offshore structures within the viewshed of the WDA except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Existing cable operation and maintenance activities would continue within the analysis area.
Traffic: Vessels	Study area ports and marine traffic related to shipping, fishing and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the study area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the study area employment.
Land disturbance: Erosion and sedimentation	Potential erosion and sedimentation from development and construction is controlled by local and state development regulations.	New development activities would be subject to erosion and sedimentation regulations.
Land disturbance: Onshore construction	Onshore development supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	Onshore development would result in changes in land use in accordance with local government land use plans and regulations.	Development of onshore solar and wind energy would provide diversified, small-scale energy generation.

ADLS = Aircraft Detection Light System; ESP = electrical service platform; FCC = Federal Communications Commission; G&G = Geological and Geophysical; HMS = Highly Migratory Species; IPF = impact-producing factors; MA/RI = Massachusetts/Rhode Island; MCT = New Bedford Marine Commerce Terminal; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); OECR = Onshore Export Cable Route; RI and MA Lease Areas = Rhode Island and Massachusetts Lease Areas; USEPA = U.S. Environmental Protection Agency; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.9-1: Summary of Activities and the Associated Impact-Producing Factors for Cultural Resources

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table A-8 for Water Quality for a quantitative analysis of these risks. Accidental releases of fuel/fluids/hazmat occur during vessel use for recreational, fisheries, marine transportation, or military purposes, and other ongoing activities. Both released fluids and cleanup activities that require the removal of contaminated soils and/or seafloor sediments can cause impacts on cultural resources because resources are impacted during by the released chemicals as well as the ensuing cleanup activities.	Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases within the geographic analysis area for cultural resources, increasing the frequency of small releases. Although the majority of anticipated accidental releases would be small, resulting in small-scale impacts on cultural resources, a single, large-scale accidental release such as an oil spill, could have significant impacts on marine and coastal cultural resources. A large-scale release would require extensive cleanup activities to remove contaminated materials resulting in damage to or the complete removal of terrestrial and marine cultural resources. In addition, the accidentally released materials in deep water settings could settle on seafloor cultural resources such as wreck sites, accelerating their decomposition and/or covering them and making them inaccessible/unrecognizable to researchers, resulting in a significant loss of historic information. As a result, although considered unlikely, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale impacts on cultural resources.
Accidental releases: Trash and debris	Accidental releases of trash and debris occur during vessel use for recreational, fisheries, marine transportation, or military purposes and other ongoing activities. While the released trash and debris can directly affect cultural resources, the majority of impacts associated with accidental releases occur during cleanup activities, especially if soil or sediment removed during cleanup affect known and undiscovered archaeological resources. In addition, the presence of large amounts of trash on shorelines or the ocean surface can impact the cultural value of TCPs for stakeholders. State and federal laws prohibiting large releases of trash would limit the size of any individual release and ongoing local, state, and federal efforts to clean up trash on beaches and waterways would continue to mitigate the effects of small-scale accidental releases of trash.	Future activities with the potential to result in accidental releases include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications). Accidental releases would continue at current rates along the northeast Atlantic coast.
Anchoring	The use of vessel anchoring and gear (i.e., wire ropes, cables, chain, sweep on the seafloor) that disturbs the seafloor, such as bottom trawls and anchors, by military, recreational, industrial, and commercial vessels can impact cultural resources by physically damaging maritime archaeological resources such as shipwrecks and debris fields.	Future activities with the potential to result in anchoring/gear utilization include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); military use; marine transportation; fisheries use and management; and oil and gas activities. These activities are likely to continue to occur at current rates along the entire coast of the eastern United States.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Gear utilization: Dredging	Activities associated with dredge operations and activities could damage marine archaeological resources. Ongoing activities identified by BOEM with the potential to result in dredging impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities.	Dredging activities would gradually increase through time as new offshore infrastructure is built, such as gas pipelines and electrical lines, and as ports and harbors are expanded or maintained.
Light: Vessels	Light associated with military, commercial, or construction vessel traffic can temporarily affect coastal historic structures and TCP resources when the addition of intrusive, modern lighting changes the physical environment ("setting") of cultural resources. The impacts of construction and operations lighting would be limited to cultural resources on the shoreline for which a nighttime sky is a contributing element to historic integrity. This excludes resources that are closed at night, such as historic buildings, lighthouses, and battlefields, and resources that generate their own nighttime light, such as historic districts. Offshore construction activities that require increased vessel traffic, construction vessels stationed offshore, and construction area lighting for prolonged periods can cause more sustained and significant visual impacts on coastal historic structure and TCP resources.	Future activities with the potential to result in vessel lighting impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Light pollution from vessel traffic would continue at the current intensity along the northeast coast, with a slight increase due to population increase and development over time.
Light: Structures	The construction of new structures that introduce new light sources into the setting of historic architectural properties or TCPs can result in impacts, particularly if the historic and/or cultural significance of the resource is associated with uninterrupted nighttime skies or periods of darkness. Any tall structure (commercial building, radio antenna, large satellite dishes, etc.) requiring nighttime hazard lighting to prevent aircraft collision can cause these types of impacts.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Port utilization: Expansion	Major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT was upgraded by the Port of New Bedford specifically to support the construction of offshore wind facilities. Expansion of port facilities can introduce large, modern port infrastructure into the viewsheds of nearby historic properties, impacting their setting and historic significance.	Future activities with the potential to result in port expansion impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Port expansion would continue at current levels, which reflect efforts to capture business associated with the offshore wind industry (irrespective of specific projects).
Presence of structures	The only existing offshore structures within the viewshed of the geographic analysis area are minor features such as buoys.	Non-offshore wind structures that could be viewed would be limited to meteorological towers. Marine activity would also occur within the marine viewshed of the geographic analysis area.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
New cable emplacement/ maintenance	Current offshore construction activity is limited to subsea fiber optic and electrical transmission cables, including six existing power cables in the geographic analysis area.	Future activities with the potential to result in seafloor disturbances similar to offshore impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; and oil and gas activities. Such activities could cause impacts on submerged archaeological resources including shipwrecks and formerly subaerially exposed pre-contact Native American archaeological sites.
Land disturbance: Onshore construction	Onshore construction activities can impact archaeological resources by damaging and/or removing resources.	Future activities that could result in terrestrial land disturbance impacts include onshore residential, commercial, industrial, and military development activities in central Cape Cod, particularly those proximate to OECRs and interconnection facilities. Onshore construction would continue at current rates.
Climate change: Warming and sea level rise, storm severity/frequency	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would also result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources, while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.
Climate change: Warming and sea level rise, altered habitat/ecology	Altered habitat/ecology related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to habitats/ecology would increase as a result of climate change.
Climate change: Warming and sea level rise, altered migration patterns	Altered migration patterns related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to migratory animal patterns would increase as a result of climate change.
Climate change: Warming and sea level rise, property/ infrastructure damage	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	The rate of property and infrastructure damage would increase as a result of climate change.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The installation of protective measures such as barriers and sea walls would impact archaeological resources during associated ground-disturbing activities. Construction of these modern protective structures would alter the viewsheds from historic properties and/or TCPs, resulting in impacts on the historic and/or cultural significance of resources.	The installation of coastal protective measures would increase as a result of climate change.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.

ADLS = Aircraft Detection Light System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; hazmat = hazardous materials; ESP = electrical service platform; IFP = impact-producing factors; km^2 = square kilometers; m^2 = square meters; MCT = New Bedford Marine Commerce Terminal; mg/L = milligrams per liter; MHC = Massachusetts Historical Commission; NEPA = National Environmental Policy Act; NHL = National Historic Landmark; NHPA = National Historic Preservation Act; NRHP = National Register of Historic Places; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; OECR = Onshore Export Cable Route; RI and MA Lease Areas = Rhode Island and Massachusetts Lease Areas; SHPO = state historic preservation office; TCP = Traditional Cultural Property; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.10-1: Summary of Activities and the Associated Impact-Producing Factors for Recreation and Tourism

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Anchoring occurs due to ongoing military, survey, commercial, and recreational activities.	Impacts from anchoring would continue, and may increase due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Modest growth in vessel traffic could increase the temporary, localized impacts of navigational hazards, increased turbidity levels, and potential for direct contact causing mortality of benthic resources.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
Light: Structures	Offshore buoys and towers emit low-intensity light. Onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Cable maintenance or replacement of existing cables in the geographic analysis area would occur infrequently, and would generate short-term disturbances.
Noise: O&M	Limited to Block Island Wind Farm	Not applicable
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Noise: Cable laying/trenching	Offshore trenching occurs periodically in connection with cable installation or sand and gravel mining.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge routes and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The Marine Commerce Terminal at the Port of New Bedford was upgraded by the port specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	No major ports are within the geographic analysis area. Periodic maintenance is necessary for harbors within the analysis area.	Ongoing maintenance and dredging of harbors within the geographic analysis area will continue as needed. No specific projects are known.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations. Recreational and commercial fishing can occur near these aggregation locations, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on structures.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	The only existing offshore structures within the viewshed of the Project are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components of the Project would be limited to meteorological towers. Marine activity would also occur within the marine viewshed.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessels	Study area ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the study area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the study area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	An increased risk of collisions is not anticipated from future activities.

ADLS = Aircraft Detection Light System; EFH = essential fish habitat; ESP = electrical service platform; FAA = Federal Aviation Administration; IPF = impact-producing factors; MW = megawatts; OECC = Offshore Export Cable Corridor; RI and MA = Rhode Island and Massachusetts; SEIS = Supplemental EIS; USCG = U.S. Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.11-1: Summary of Activities and the Associated Impact-Producing Factors for Commercial Fisheries and For-Hire Recreational Fishing

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Impacts from anchoring occur due to ongoing military, survey, commercial, and recreational activities. The short-term, localized impact to this resource is the presence of a navigational hazard (anchored vessel) to fishing vessels.	Impacts from anchoring may occur on a semi-regular basis over the next 30 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Anchoring could pose a temporary (hours to days), localized (within a few hundred meters of anchored vessel) navigational hazard to fishing vessels.
New cable emplacement/ maintenance	New cable emplacement and infrequent cable maintenance activities disturb the seafloor, increase suspended sediment, and cause temporary displacement of fishing vessels. These disturbances would be local and limited to the emplacement corridor.	Future new cables and cable maintenance would occasionally disturb the seafloor and cause temporary displacement in fishing vessels and increases in suspended sediment resulting in local, short-term impacts. The FCC has two pending submarine tele-communication cable applications in the North Atlantic. If the cable routes enter the geographic analysis area for this resource, short-term disruption of fishing activities would be expected.
Noise: Construction, trenching, operations and maintenance	Noise from construction occurs frequently in coastal habitats in populated areas in New England and the Mid-Atlantic, but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. Infrequent offshore trenching could occur in connection with cable installation. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Low levels of elevated noise from operational WTGs likely have low to no impacts on fish and no impacts at a fishery level. Noise is also created by operations and maintenance of marine minerals extraction, which has small, local impacts on fish, but likely no impacts at a fishery level.	Noise from construction near shore is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource. Noise from dredging and sand and gravel mining could occur. New or expanded marine minerals extraction may increase noise during their operations and maintenance over the next 30 years. Impacts from construction, operations, and maintenance would likely be small and local on fish, and not seen at a fishery level. Periodic trenching would be needed for repair or new installation of underground infrastructure. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on commercial fish species are typically less prominent than the impacts of the physical disturbance and sediment suspension. Therefore, fishery-level impacts are unlikely.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb fish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when ports or marinas, piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile, and can cause short-term stress and behavioral changes to individuals over a greater area, leading to temporary local impacts on commercial fisheries and for-hire recreational fishing. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Vessels	Vessel noise is anticipated to continue at levels similar to current levels. While vessel noise may have some impact on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 30 years.	Ports would need to perform maintenance and upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Port utilization is expected to increase over the next 30 years, with increased activity during construction. The ability of ports to receive the increase in vessel traffic may require port modifications, such as channel deepening, leading to local impacts on fish populations. Port expansions could also increase vessel traffic and competition for dockside services, which could affect fishing vessels.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazard and allisions	Structures within and near the cumulative lease areas that pose potential navigation hazards include the Block Island Wind Farm WTGs, buoys, and shoreline developments such as docks and ports. An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. Two types of allisions occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements, or is distracted.	No known reasonably foreseeable structures are proposed to be located in the geographic analysis area that could affect commercial fisheries. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts on fish, but likely no impacts at a fishery level.	No future activities were identified within the analysis area other than ongoing activities.
Presence of structures: Habitat conversion and fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat. Structure-oriented fishes are attracted to these locations. These impacts are local and can be short-term to permanent. Fish aggregation may be considered adverse, beneficial, or neither. Commercial and for-hire recreational fishing can occur near these structures. For-hire recreational fishing is more popular, as commercial mobile fishing gear risk snagging on the structures.	New cables, installed incrementally in the analysis area over the next 20 to 30 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance IPF above). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented species could be attracted to these locations. Structure-oriented species would benefit (Claisse et al. 2014, Smith et al. 2016). This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on the communities, as well as increased private and for-hire recreational fishing opportunities. Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). These impacts are expected to be local and may be long-term.
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, buoys, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow species migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure (Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 30 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded. Therefore, fishery-level impacts are not anticipated.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	No known reasonably foreseeable structures are proposed for location in the geographic analysis area that could affect commercial fisheries and for-hire recreational fishing.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Seven subsea cable corridors cross cumulative lease areas. Shoreline developments are ongoing and include docks, ports, and other commercial, industrial, and residential structures.	No known proposed structures (other than those associated with offshore wind development) are reasonably foreseeable and proposed to be located in the geographic analysis area for this resource.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessels and vessel collisions	No substantial changes are anticipated to the vessel traffic volumes. The study area would continue to have numerous ports and the extensive marine traffic related to shipping, fishing, and recreation would continue to be important to the region's economy. The region's substantial marine traffic may result in occasional collisions. Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is more complex, as the vessels need to avoid both the structure and each other. The risk for collisions is ongoing but infrequent.	New vessel traffic in the geographic analysis area would consistently be generated by proposed barge routes and dredging demolition sites. Marine commerce and related industries would continue to be important to the regional economy.
Climate change	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the distributions of species that are important for commercial and for-hire recreational fisheries. If the distribution of important fish stocks changes, it could affect where commercial and for-hire recreational fisheries are located, and could potentially increase the cost of fishing if transiting time increases. Continuous CO_2 emissions causing ocean acidification may contribute to reduced growth, or the decline of, invertebrates that have calcareous shells over the course of the next 30 years. Over time, this could potentially directly affect species that are important for commercial and for-hire recreational fisheries or their prey species.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NOAA Fisheries and coastal states, affect how the commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the North Atlantic right whale by 60% (McCreary and Brooks 2019). This will likely have a significant impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. See Baseline Conditions for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = Environmental Impact Statement; FMP = fisheries management plan; G&G = Geological and Geophysical; GHG = greenhouse gas; IPF = impact-producing factors; km^2 = square kilometers; met; meteorological; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; RI and MA Lease Area = Rhode Island and Massachusetts Lease Areas; SAR = search and rescue; VMS = vessel monitoring system; WDA = Wind Development Area; WTG = wind turbine generator

Table 3.12-1: Summary of Activities and the Associated Impact-Producing Factors for Land Use and Coastal Infrastructure

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	Various ongoing onshore and coastal construction projects include the use of vehicles and equipment that contain fuel, fluids, and hazardous materials that could be released.	Ongoing onshore construction projects involve vehicles and equipment that use fuel, fluids, or hazardous materials could result in an accidental release. Intensity and extent would vary, depending on the size, location, and materials involved in the release.
Light: Structures	Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would use nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary, depending on the location, type, direction, and duration of nighttime lighting.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT at the Port of New Bedford is a completed facility developed by the port specifically to support the construction of offshore wind facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep draft vessels as they continue to increase in size.
Presence of structures: Viewshed	The only existing offshore structures within the offshore viewshed of the Project are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components would be limited to met towers. Marine activity would also occur within the marine viewshed.
Presence of structures: Transmission cable infrastructure	Onshore buried transmission cables are present in the area near the Project onshore and offshore improvements. Onshore activities would only occur where permitted by local land use authorities, which would avoid long-term land use conflicts.	No known proposed structures are reasonably foreseeable and proposed to be located in the geographic analysis area for land use and coastal infrastructure.
Land disturbance: Onshore construction	Onshore construction supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	New development or redevelopment would result in changes in land use in accordance with local government land use plans and regulations.	Ongoing and future development and redevelopment is anticipated to reinforce existing land use patterns, based on local government planning documents.

ADLS = Aircraft Detection Light System; IPF = impact-producing factors; MCT = New Bedford Marine Commerce Terminal; met = meteorological; NOAA = National Oceanic and Atmospheric Administration; ROW = right-of-way; USACE = U.S. Army Corps of Engineers; WTG = wind turbine generator

Table 3.13-1: Summary of Activities and the Associated Impact-Producing Factors for Navigation and Vessel Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Larger commercial vessels (specifically tankers) sometimes anchor outside of major ports to transfer their cargo to smaller vessels for transport into port, an operation known as lightering. These anchors have deeper ground penetration and are under higher stresses. Smaller vessels (commercial fishing or recreational vessels) would anchor for fishing and other recreational activities. These activities cause temporary to short-term impacts on navigation in the immediate anchorage area. All vessels may anchor in an emergency scenario (such as power loss) if they lose power to prevent them from drifting and creating navigational hazards for other vessels or drifting into structures.	Lightering and anchoring operations are expected to continue at or near current levels, with the expectation of moderate increase commensurate with any increase in tankers visiting ports. Deep draft visits to major port visits are expected to increase as well, increasing the potential for an emergency need to anchor, creating navigational hazards for other vessels. Recreational activity and commercial fishing activity would likely stay largely the same related to this IPF.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Impacts from these activities would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.	Ports would need to perform maintenance and perform upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep draft vessels as they continue to increase in size. Impacts would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. There are two types of allisions that occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements, or is distracted.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 30 years. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Fish aggregation	Items in the water, such as ghost fishing gear, buoys, and energy platform foundations can create an artificial reef effect, aggregating fish. Recreational and commercial fishing can occur near the artificial reefs. Recreational fishing is more popular than commercial near artificial reefs as commercial mobile fishing gear can risk snagging on the artificial reef structure.	Fishing near artificial reefs is not expected to change meaningfully over the next 30 years.
Presence of structures: Habitat conversion	Equipment in the ocean can create a substrate for mollusks to attach to, and fish eggs to settle near. This can create a reef-like habitat and benefit structure-oriented species on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Migration disturbances	Noise-producing activities, such as pile driving and vessel traffic, may interfere and adversely affect marine mammals during foraging, orientation, migration, response to predators, social interactions, or other activities. Marine mammals may also be sensitive to changes in magnetic field levels. The presence of structures and operation noise could cause mammals to avoid areas.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is made more complex, as the vessels need to avoid both the structure and each other.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 30 years. Even with increased port visits by deep draft vessels, this is still a relatively small adjustment when considering the whole of New England vessel traffic. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Currently, the offshore area is occupied by marine trade, stationary and mobile fishing, and survey activities.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	See IPF for Anchoring.	See IPF for Anchoring.
New cable emplacement/ maintenance	Within the geographic analysis area for navigation and vessel traffic, existing cables may require access for maintenance activities. Infrequent cable maintenance activities may cause temporary increases in vessel traffic and navigational complexity.	The FCC has two pending submarine tele-communication cable applications in the North Atlantic. Future new cables would cause temporary increases in vessel traffic during installation or maintenance, resulting in infrequent, localized, short-term impacts over the next 30 years. Care would need to be taken by vessels that are crossing the cable routes during these activities.
Traffic: Aircraft	USCG search and rescue (SAR) helicopters are the main aircraft that may be flying at low enough heights to risk interaction with WTGs. USCG SAR aircraft need to fly low enough that they can spot objects in the water.	SAR operations could be expected to increase with any increase in vessel traffic. However, as vessel traffic volume is not expected to increase appreciably, neither should SAR operations. DEIS Section 3.5.6 provides a discussion of navigation impacts on fishing vessel traffic.
Traffic: Vessels	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.
Traffic: Vessels, collisions	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.

AIS = Automatic Identification System; BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; ESP = electrical service platform; FCC = Federal Communications Commission; IPF = impact-producing factors; km^2 = square kilometers; MA = Massachusetts; MARIPARS = Massachusetts and Rhode Island Port Access Route Study; MCT = Marine Commerce Terminal; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); RI = Rhode Island; SAR = search and rescue; TSS = traffic separation scheme; USCG = U.S. Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator.

Table 3.14-1: Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Military and National Security Uses

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions	Existing stationary facilities that present allision risks include the five offshore wind turbines associated with Block Island Wind Farm, dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No additional non-offshore wind stationary structures were identified within the geographic analysis area. Stationary structures such as private or commercial docks may be added close to the shoreline.
Presence of structures: Fish aggregation	Existing stationary facilities that act as FADs include offshore wind turbines associated with Block Island Wind Farm.	No future non-offshore wind additional stationary structures that would act as FADs were identified within the geographic analysis area.
Presence of structures: Navigation hazard	Existing stationary facilities within the geographic analysis area that present navigational hazards include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: Space use conflicts	Existing stationary facilities within the geographic analysis area that present a navigational hazard include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: Transmission cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Submarine cables would remain in current locations with infrequent maintenance continuing along those cable routes for the foreseeable future.
Traffic: Vessels	Current vessel traffic in the region is described in Draft EIS Section 3.5.6. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region, as described in Draft EIS Section 3.5.6.
Traffic: Vessels, collisions	Current vessel traffic in the region is described in Draft EIS Section 3.5.6. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region is described in Draft EIS Section 3.5.6.

Table 3.15-1: Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Aviation and Air Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazard	Existing aboveground stationary facilities within the geographic analysis area that present navigational hazards include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore development activities are anticipated to continue with additional proposed communications towers.
Presence of structures: Space use conflicts	Existing aboveground stationary facilities within the geographic analysis area that could cause space use conflicts for aircraft include the five WTGs associated with Block Island Wind Farm, onshore wind turbines, communication towers, and other onshore and offshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers.

Table 3.16-1: Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Cables and Pipelines

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions and navigation hazards	Structures within and near the geographic analysis area that pose potential allision hazards include the five Block Island Wind Farm WTGs, meteorological buoys associated with offshore wind lease areas, and shoreline developments such as docks, ports, and other commercial, industrial, and residential structures.	Reasonably foreseeable non-offshore wind structures that could affect submarine cables have not been identified in the geographic analysis area.
Presence of structures: Space use conflicts	Two submarine cables cross the far western portion of OCS-A 0487. These cables are associated with a larger network of submarine cables that make landfall near Charlestown, Massachusetts.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.
Presence of structures: Transmission cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.

Table 3.17-1: Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Radar Systems

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazards	Wind developments in the direct line-of-sight with, or extremely close to, radar systems can cause clutter and interference. Existing wind developments in the area include scattered onshore wind turbines, and five WTGs in the Block Island Wind Farm.	Reasonably foreseeable non-offshore wind structures proposed for construction in the lease areas that could affect radar systems have not been identified.

Table 3.18-1: Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Scientific Research and Surveys

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazards	Stationary structures are limited in the open ocean environment of the geographic analysis area, and include met buoys associated with site assessment activities, the five Block Island Wind Farm WTGs, and the two CVOW WTGs. Other lease areas within the geographic analysis area are not yet developed, and are in various stages of permitting.	Reasonably foreseeable non-offshore wind activities would not implement stationary structures within the open ocean environment that would pose navigational hazards and raise the risk of allisions for survey vessels and collisions for survey aircraft.

AMSL = above mean sea level; BOEM = Bureau of Ocean Energy Management; CVOW = Coastal Virginia Offshore Wind; ESP = electrical service platform; FAA = Federal Aviation Administration; FAD = Fish Attracting Device; IPF = impact-producing factor; MA = Massachusetts; met = meteorological; NEXRAD = Next Generation Weather Radar; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; OECC = Offshore Export Cable Corridor(s); OCS = outer continental shelf; RI = Rhode Island; SAR = search and rescue; USACE = United States Army Corps of Engineer; USCG = United States Coast Guard; WDA = Wind Development Area; WTG = wind turbine generator

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ATTACHMENT 4

Maximum-Case Scenario Estimates for Offshore Wind Projects

The following tables provide maximum-case scenario estimates of potential offshore wind project impacts assuming full build out, using SFWF EIS geographic analysis areas and COP-designated numbers for the SFWF and SFEC. BOEM developed these estimates based on offshore wind demand, as discussed in 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). Estimates disclosed in this EIS's Chapter 3, No Action analyses were developed by summing acreage or number calculations across all lease areas noted as occurring within, or overlapping, a given geographic analysis area. This likely over-estimates some impacts in cases where lease areas only partially overlap analysis areas. However, this approach was used to provide the most conservative estimate of future offshore wind development.

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Table A-4: Offshore Wind Leasing Activities in the U.S. East Coast: Projects and Assumptions (part 1)

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Estimated Construction Schedule[4]	Expected Turbine Size[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[9]	Total Height of Turbine (feet)[10]
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism									
NE	Aquaventis (state waters)	State Project				X			2022	6 MW							
NE	Block Island (state waters)	Built				X			Built	6 MW		28	5	2	328	541	659
	Total State Waters											28	5	2			
MA/RI	Vineyard Wind 1 part of OCS-A 0501	COP, PPA	X			X	X	X	2021–2022	up 14 MW	800	98	6.5	177	473	729	837
MA/RI	South Fork (Proposed Action), OCS-A 0517	COP, PPA	X	X	X	X	X	X	2021–2022	6 to 12 MW	130	65.5	8.2	21.4	472	735	840
MA/RI	Sunrise, parts of OCS-A 0500 and OCS-A 0487	PPA	X		X	X	X	X	2022–2023	8 or 12 MW	880	115	6.5	169	492	722	853
MA/RI	Revolution, part of OCS-A 0486	COP, PPA	X	X	X	X	X	X	2022–2023	8 or 12 MW	700	40	6.5	136	492	722	853
MA/RI	Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	PPA	X			X	X	X	2023–2024	8 or 12 MW	804	138	6.5	155	492	722	853
MA/RI	Mayflower (North), part of OCS-A 0521	PPA				X	X		2023–2024	8 or 12 MW	804	60	6.5	155	492	722	853
MA/RI	Bay State Wind Project, part of OCS-A 0500	COP (unpublished), the MW is included in the description below in the 7,304 MW.	X		X	X	X	X	By 2030, spread over 2024–2030	12 MW	7,304				492	722	853
MA/RI	OCS-A 0500 and OCS-A 0487 remainder	This group may collectively support up to 5,296 MW of development—for MA (1,600 MW remaining), CT (1,196 MW remaining), and NY (up to 2,500 MW remaining). This would result in a total of 441 turbines based on the assumed 12 MW turbine. Collectively the technical capacity is 7,304 MW.	X		X	X	X	X		12 MW					492	722	853
MA/RI	OCS-A 0520 (Equinor MA)					X	X	X		12 MW					492	722	853
MA/RI	OCS-A 0521 remainder					X	X			12 MW					492	722	853
MA/RI	Liberty Wind, part of OCS-A 0522					X	X			12 MW					492	722	853
MA/RI	OCS-A 0522 remainder					X	X			12 MW					492	722	853
	Remaining MA/RI Lease Area Total[2]	73%				X	X				5,296	720	6.5	659			
	Total MA/RI Leases[2]									**-**	**9,414**	**1,237**		**1,472**			
NY/NJ	Ocean Wind, part of OCS-A 0498	COP, PPA				X			2022–2023	12 MW	1,100	142	5	142	492	722	853
NY/NJ	Empire Wind, part of OCS-A 0512	COP, PPA				X			2023–2024	12 MW	816	64	5	107	492	722	853

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Estimated Construction Schedule[4]	Expected Turbine Size[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[9]	Total Height of Turbine (feet)[10]
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism									
NY/NJ	Empire Wind Phase 2 and 3, part of OCS-A 0512	This group may collectively support up to 3,996 MW of development (333 turbines) from NJ and NY. Part of the NY demand is also represented under the MA/RI group as well. Collectively the technical capacity is 3,996 MW. NJ has State goals of nearly 4,000 MW that cannot be fulfilled by existing lease areas.				X			By 2030, spread over 2024–2030	12 MW	3,996			A	492	722	853
NY/NJ	Atlantic Shores OCS-A 0499					X				12 MW					492	722	853
NY/NJ	OCS-A 0498 remainder					X				12 MW					492	722	853
	Remaining NY/NJ Lease Area Total					X					3,996	480	5	499			
	Total NY/NJ Leases										**5,912**	**686**		**748**			
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA				X			2022–2023	12 MW	120	40	10	21	492	722	853
DE/MD	US Wind, part of OCS-A 0490	PPA				X			2022–2023	12 MW	270	80	5	40	492	722	853
DE/MD	GSOE I, OCS-A 0482	This group may collectively support up to 1,200 MW of development from MD. NJ has almost 4,000 MW in outstanding State goals. Collectively the technical capacity of this is group is 1,908 MW (159 turbines). The remaining capacity may be utilized by demand from NJ (60 turbines).				X			By 2030, spread over 2023–2030	12 MW	1,908				492	722	853
	OCS-A 0519 remainder					X				12 MW		360			492	722	853
DE/MD	OCS-A 0490 remainder					X				12 MW					492	722	853
	Remaining DE/MD Lease Area Total					X					1,908	360	5	242			
	Total DE/MD Leases										**2,298**	**480**		**303**			
VA/NC	CVOW, OCS-A 0497	Approved RAP, FDR/FIR complete				X			2020	6 MW	12	27	3.3	9	364	506	620
VA/NC	Dominion Commercial lease, OCS-A 0483	Announced				X			2023–2026	12 MW	2,640	200	5	332	492	722	853
VA/NC	Avangrid Renewables, OCS-A 0508	No announcement as of yet for this project. Technical capacity is 1,824 MW with 12 MW turbines and 1 x 1–nm spacing.				X			2030	12 MW	1,824	110	5	231	492	722	853
	Total VA/NC Leases										**4,476**	**337**		**572**			
	OCS Total[21,22]										**22,100**	**2,768**		**3,096**			

Table A-4: Offshore Wind Leasing Activities in the U.S. East Coast: Projects and Assumptions (part 2)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Turbine Number[11]	Estimated Foundation Number[12]	Foundation Footprint[13] (acres)	Seabed Disturbance Based on Addition of Scour Protection (Foundation + Scour Protection) (acres)[14]	Offshore Export Cable Seabed Disturbance (acres)[15]	Offshore Export Cable Operating Seabed Footprint (acres)	Offshore Export Cable Hard Protection (acres)[16]	Anchoring Disturbance (acres)[17]	Inter-Array Construction Footprint/ Seabed Disruption (acres)[18]	Inter-Array Operating Footprint/ Seabed Disruption (acres)[19]	Inter-Array Cable Hard Protection (acres)[20]
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism											
NE	Aquaventis (state waters)	State Project				X			2	2									
NE	Block Island (state waters)	Built				X			5	5	1	6		17			4	0.1	0.01
	Total State Waters								7	7	1	6		17	0	0	4	0.1	0.01
MA/RI	Vineyard Wind 1 part of OCS- A 0501	COP, PPA	X			X	X	X	100	102	2	53	117	77	35	4	204	146	63
MA/RI	South Fork, part of OCS-A 0517	COP, PPA	X	X	X	X	X	X	15	16	0.64	13.6	573.3	7.4	7.3	820.8	340	2.5	10.2
MA/RI	Sunrise, parts of OCS-A 0500 and OCS-A 0487	PPA	X		X	X	X	X	110	112	4	95	137	91	41	12	264	160	0
MA/RI	Revolution, part of OCS-A 0486	COP, PPA	X	X	X	X	X	X	88	90	4	76	48	32	14	4	211	128	66
MA/RI	Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	PPA	X			X	X	X	101	103	4	87	164	109	49	14	241	147	76
MA/RI	Mayflower (North), part of OCS-A 0521	PPA				X			101	103	4	87	72	47	21	6	241	147	0
MA/RI	Bay State Wind Project, part of OCS-A 0500	COP (unpublished), the MW is included in the description below in the 7,304 MW.	X		X	X	X	X	609	621	25	528	856	567	257	72	1,461	888	0
MA/RI	OCS-A 0500 and OCS-A 0487 remainder	This group may collectively support up to 5,296 MW of development—for MA (1,600 MW remaining), CT (1,196 MW remaining), and NY (up to 2,500 MW remaining). This would result in a total of 441 turbines based on the assumed 12 MW turbine. Collectively the technical capacity is 7,304 MW.	X		X	X	X	X											
MA/RI	OCS-A 0520 (Equinor MA)					X	X	X											
MA/RI	OCS-A 0521 remainder					X	X	X											
MA/RI	Liberty Wind, part of OCS-A 0522					X	X												
MA/RI	OCS-A 0522 remainder					X	X												
	Remaining MA/RI Lease Area Total[2]	73%				X			441	450	18	383	856	567	257	72	1,059	644	0
	Total MA/RI Leases[2]								**955**	**975**	**37**	**795**	**1,967**	**930**	**424**	**933**	**2,560**	**1,375**	**215**
NY/NJ	Ocean Wind, part of OCS-A 0498	COP, PPA				X			92	94	4	80	169	86	51	14	221	134	0
NY/NJ	Empire Wind, part of OCS-A 0512	COP, PPA				X			68	70	3	60	77	39	23	6	163	100	0

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Turbine Number[11]	Estimated Foundation Number[12]	Foundation Footprint[13] (acres)	Seabed Disturbance Based on Addition of Scour Protection (Foundation + Scour Protection) (acres)[14]	Offshore Export Cable Seabed Disturbance (acres)[15]	Offshore Export Cable Operating Seabed Footprint (acres)	Offshore Export Cable Hard Protection (acres)[16]	Anchoring Disturbance (acres)[17]	Inter-Array Construction Footprint/ Seabed Disruption (acres)[18]	Inter-Array Operating Footprint/ Seabed Disruption (acres)[19]	Inter-Array Cable Hard Protection (acres)[20]
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism											
NY/NJ	Empire Wind Phase 2 and 3, part of OCS-A 0512	This group may collectively support up to 3,996 MW of development (333 turbines) from NJ and NY. Part of the NY demand is also represented under the MA/RI group as well. Collectively the technical capacity is 3,996 MW. NJ has State goals of nearly 4,000 MW that cannot be fulfilled by existing lease areas.				X			333	340									
NY/NJ	Atlantic Shores OCS-A 0499					X													
NY/NJ	OCS-A 0498 remainder					X													
	Remaining NY/NJ Lease Area Total					X			333	340	14	289	571	291	171	48	799	486	0
	Total NY/NJ Leases								**493**	**504**	**20**	**428**	**817**	**416**	**245**	**69**	**1,183**	**721**	**0**
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA				X			10	11	0.4	9	48	50	14	4	24	16	0
DE/MD	US Wind, part of OCS-A 0490	PPA				X			23	24	1	20	96	48	29	8	55	34	0
DE/MD	GSOE I, OCS-A 0482	This group may collectively support up to 1,200 MW of development from MD. NJ has almost 4,000 MW in outstanding State goals. Collectively the technical capacity of this is group is 1,908 MW (159 turbines). The remaining capacity may be utilized by demand from NJ (60 turbines).				X													
	OCS-A 0519 remainder					X			159	163									
DE/MD	OCS-A 0490 remainder					X													
	Remaining DE/MD Lease Area Total					X			159	163	7	139	428	218	129	36	382	233	0
	Total DE/MD Leases								**192**	**198**	**8**	**168**	**572**	**317**	**171**	**48**	**461**	**283**	**0**
VA/NC	CVOW, OCS-A 0497	Approved RAP, FDR/FIR complete				X			2	2	0.08	2	33	11	10	3	5	3	0
VA/NC	Dominion Commercial lease, OCS-A 0483	Announced				X			220	225	9	191	238	121	71	20	528	322	0
VA/NC	Avangrid Renewables, OCS-A 0508	No announcement as of yet for this project. Technical capacity is 1,824 MW with 12 MW turbines and 1 x 1–nm spacing.				X			152	155	6	132	131	67	39	11	365	222	0
	Total VA/NC Leases								**374**	**382**	**15**	**325**	**402**	**199**	**120**	**34**	**898**	**546**	**0**
	OCS Total[21,22]								**2,021**	**2,066**	**81**	**1,723**	**3,758**	**1,879**	**960**	**1084**	**5,106**	**2,925**	**215**

Table A-4: Offshore Wind Leasing Activities in the U.S. East Coast: Projects and Assumptions (part 3)

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Total of Coolant Fluids in WTGs (gallons)	Total Coolant Fluids in OSS (gallons)	Total of Oils and Lubricants in WTGs (gallons)	Total Oils and Lubricants in OSS (gallons)	Total Diesel Fuel in WTGs (gallons)	Total Diesel Fuel in OSS (gallons)
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/ Marine Mammals/Sea Turtles/ Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/Recreation-Tourism						
NE	Aquaventis (state waters)	State Project				X								
NE	Block Island (state waters)	Built				X								
	Total State Waters													
MA/RI	Vineyard Wind 1 (Proposed Action) part of OCS- A 0501	COP, PPA	X			X	X	X	42,300	46	383,000	123,559	79,300	5,696
MA/RI	South Fork, part of OCS-A 0517	COP, PPA	X	X	X	X	X	X	6,345	23	57,450	61,780	11,895	2,848
MA/RI	Sunrise, parts of OCS-A 0500 and OCS-A 0487	PPA	X		X	X	X	X	46,530	51	421,300	135,915	87,230	6,266
MA/RI	Revolution, part of OCS-A 0486	COP, PPA	X	X	X	X	X	X	37,224	40	337,040	108,732	69,784	5,012
MA/RI	Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	PPA	X			X	X	X	42,512	46	384,915	124,177	79,697	5,724
MA/RI	Mayflower (North), part of OCS-A 0521	PPA				X			42,512	46	384,915	124,177	79,697	5,724
MA/RI	Bay State Wind Project, part of OCS-A 0500	COP (unpublished), the MW is included in the description below in the 7,304 MW.	X		X	X	X	X	257,466	284	2,331,193	761,947	482,673	35,125
MA/RI	OCS-A 0500 and OCS-A 0487 remainder	This group may collectively support up to 5,296 MW of development—for MA (1,600 MW remaining), CT (1,196 MW remaining), and NY (up to 2,500 MW remaining). This would result in a total of 441 turbines based on the assumed 12 MW turbine. Collectively the technical capacity is 7,304 MW.	X		X	X	X	X						
MA/RI	OCS-A 0520 (Equinor MA)					X	X	X						
MA/RI	OCS-A 0521 remainder					X	X	X						
MA/RI	Liberty Wind, part of OCS-A 0522					X	X							
MA/RI	OCS-A 0522 remainder					X	X							
	Remaining MA/RI Lease Area Total[2]	73%				X			186,684	206	1,690,307	552,474	349,977	25,469
	Total MA/RI Leases[2]								**404,106**	**458**	**3,658,927**	**1,230,813**	**757,579**	**56,740**
NY/NJ	Ocean Wind, part of OCS-A 0498	COP, PPA				X			38,916	46	352,360	123,559	72,956	5,696
NY/NJ	Empire Wind, part of OCS-A 0512	COP, PPA				X			28,764	46	260,440	123,559	53,924	5,696
NY/NJ	Empire Wind Phase 2 and 3, part of OCS-A 0512	This group may collectively support up to 3,996 MW of development (333 turbines) from NJ and NY. Part of the NY demand is also represented under the MA/RI group as well. Collectively the technical capacity is 3,996 MW. NJ has State goals of nearly 4,000 MW that cannot be fulfilled by existing lease areas.				X								
NY/NJ	Atlantic Shores OCS-A 0499					X								
NY/NJ	OCS-A 0498 remainder					X								
	Remaining NY/NJ Lease Area Total					X			140,859	161	1,275,390	432,457	264,069	19,936
	Total NY/NJ Leases								**208,539**	**253**	**1,888,190**	**679,575**	**390,949**	**31,328**
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA				X			4,230	46	38,300	61,780	7,930	2,848
DE/MD	US Wind, part of OCS-A 0490	PPA				X			9,729	46	88,090	61,780	18,239	2,848

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Total of Coolant Fluids in WTGs (gallons)	Total Coolant Fluids in OSS (gallons)	Total of Oils and Lubricants in WTGs (gallons)	Total Oils and Lubricants in OSS (gallons)	Total Diesel Fuel in WTGs (gallons)	Total Diesel Fuel in OSS (gallons)
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/ Marine Mammals/Sea Turtles/ Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/Recreation-Tourism						
DE/MD	GSOE I, OCS-A 0482	This group may collectively support up to 1,200 MW of development from MD. NJ has almost 4,000 MW in outstanding State goals. Collectively the technical capacity of this is group is 1,908 MW (159 turbines). The remaining capacity may be utilized by demand from NJ (60 turbines).				X								
	OCS-A 0519 remainder					X								
DE/MD	OCS-A 0490 remainder					X								
	Remaining DE/MD Lease Area Total					X			67,257	92	608,970	247,118	126,087	11,392
	Total DE/MD Leases								**81,216**	**184**	**735,360**	**370,677**	**152,256**	**17,088**
VA/NC	CVOW, OCS-A 0497	Approved RAP, FDR/FIR complete				X			846	0	7,660	0	1,586	0
VA/NC	Dominion Commercial lease, OCS-A 0483	Announced				X			93,060	115	842,600	308,898	174,460	14,240
VA/NC	Avangrid Renewables, OCS-A 0508	No announcement as of yet for this project. Technical capacity is 1,824 MW with 12 MW turbines and 1 x 1–nm spacing.				X			64,296	69	582,160	185,339	120,536	8,544
	Total VA/NC Leases								**158,202**	**184**	**1,432,420**	**494,236**	**296,582**	**22,784**
	OCS Total[21,22]								**852,063**	**1,079**	**7,714,897**	**2,775,301**	**1,597,366**	**127,940**

Table A-4: Offshore Wind Leasing Activities in the U.S. East Coast: Projects and Assumptions

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Construction Emissions NOx (tons)	Construction Emissions VOC (tons)	Construction Emissions CO (tons)	Construction Emissions PM10 (tons)	Construction Emissions PM2.5 (tons)	Construction Emissions SO2 (tons)	Construction Emissions CO2 (tons)	Operation Emissions NOx (tpy)	Operation Emissions VOC (tpy)	Operation Emissions CO (tpy)	Operation Emissions PM10 (tpy)	Operation Emissions PM2.5 (tpy)	Operation Emissions SO2 (tpy)	Operation Emissions CO2 (tpy)
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/ Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism														
NE	Aquaventis (state waters)	State Project				X																
NE	Block Island (state waters)	Built				X																
	Total State Waters																					
MA/RI	Vineyard Wind 1 (Proposed Action) part of OCS-A 0501	COP, PPA	X			X	X	X	4,961	122	1,116	172	166	38	318,660	71	2	18	2	2	0.3	5,487
MA/RI	South Fork, part of OCS-A 0517	COP, PPA	X	X	X	X	X	X														
MA/RI	Sunrise, parts of OCS-A 0500 and OCS-A 0487	PPA	X		X	X	X	X	2,510	61	565	87	84	19	161,242	36	1	9	1	1	0	2,776
MA/RI	Revolution, part of OCS-A 0486	COP, PPA	X	X	X	X	X	X	347	9	78	12	12	3	22,306	5	0	1	0	0	0	384
MA/RI	Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	PPA	X			X	X	X	4,986	122	1,121	173	167	38	320,253	71	2	18	2	2	0	5,514
MA/RI	Mayflower (North), part of OCS-A 0521	PPA				X			4,986	122	1,121	173	167	38	320,253	71	2	18	2	2	0	5,514

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Construction Emissions NOx (tons)	Construction Emissions VOC (tons)	Construction Emissions CO (tons)	Construction Emissions PM10 (tons)	Construction Emissions PM2.5 (tons)	Construction Emissions SO2 (tons)	Construction Emissions CO2 (tons)	Operation Emissions NOx (tpy)	Operation Emissions VOC (tpy)	Operation Emissions CO (tpy)	Operation Emissions PM10 (tpy)	Operation Emissions PM2.5 (tpy)	Operation Emissions SO2 (tpy)	Operation Emissions CO2 (tpy)
			Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/ Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism														
MA/RI	Bay State Wind Project, part of OCS-A 0500	COP (unpublished), the MW is included in the description below in the 7,304 MW.	X		X	X	X	X														
MA/RI	OCS-A 0500 and OCS-A 0487 remainder	This group may collectively support up to 5,296 MW of development--for MA (1,600 MW remaining), CT (1,196 MW remaining), and NY (up to 2,500 MW remaining). This would result in a total of 441 turbines based on the assumed 12 MW turbine. Collectively the technical capacity is 7,304 MW.	X		X	X	X	X														
MA/RI	OCS-A 0520 (Equinor MA)					X	X	X														
MA/RI	OCS-A 0521 remainder					X	X	X														
MA/RI	Liberty Wind, part of OCS-A 0522					X	X															
MA/RI	OCS-A 0522 remainder					X	X															
	Remaining MA/RI Lease Area Total[2]	73%				X			16,011	392	3,601	556	535	124	1,028,420	228	6	58	8	7	1	17,708
	Total MA/RI Leases[2]								**33,801**	**828**	**7,602**	**1,175**	**1,129**	**261**	**2,171,135**	**482**	**14**	**123**	**16**	**16**	**2**	**37,385**
NY/NJ	Ocean Wind, part of OCS-A 0498	COP, PPA				X																
NY/NJ	Empire Wind, part of OCS-A 0512	COP, PPA				X																
NY/NJ	Empire Wind Phase 2 and 3, part of OCS-A 0512	This group may collectively support up to 3,996 MW of development (333 turbines) from NJ and NY. Part of the NY demand is also represented under the MA/RI group as well. Collectively the technical capacity is 3,996 MW. NJ has State goals of nearly 4,000 MW that cannot be fulfilled by existing lease areas.				X																
NY/NJ	Atlantic Shores OCS-A 0499					X																
NY/NJ	OCS-A 0498 remainder					X																
	Remaining NY/NJ Lease Area Total					X																
	Total NY/NJ Leases																					
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA				X																

Region	Lease/Project/ Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3] Air	Benthic/Cultural Resources (marine)	Water	Birds/Bats/Finfish-Invertebrates-EFH/Marine Mammals/Sea Turtles/ Commercial Fisheries	Other Marine Uses (excluding research and surveys)/Navigation	Visual Resources/ Recreation-Tourism	Construction Emissions NOx (tons)	Construction Emissions VOC (tons)	Construction Emissions CO (tons)	Construction Emissions PM10 (tons)	Construction Emissions PM2.5 (tons)	Construction Emissions SO2 (tons)	Construction Emissions CO2 (tons)	Operation Emissions NOx (tpy)	Operation Emissions VOC (tpy)	Operation Emissions CO (tpy)	Operation Emissions PM10 (tpy)	Operation Emissions PM2.5 (tpy)	Operation Emissions SO2 (tpy)	Operation Emissions CO2 (tpy)
DE/MD	US Wind, part of OCS-A 0490	PPA				X																
DE/MD	GSOE I, OCS-A 0482	This group may collectively support up to 1,200 MW of development from MD. NJ has almost 4,000 MW in outstanding State goals. Collectively the technical capacity of this is group is 1,908 MW (159 turbines). The remaining capacity may be utilized by demand from NJ (60 turbines).				X																
	OCS-A 0519 remainder					X																
DE/MD	OCS-A 0490 remainder					X																
	Remaining DE/MD Lease Area Total					X																
	Total DE/MD Leases																					
VA/NC	CVOW, OCS-A 0497	Approved RAP, FDR/FIR complete				X																
VA/NC	Dominion Commercial lease, OCS-A 0483	Announced				X																
VA/NC	Avangrid Renewables, OCS-A 0508	No announcement as of yet for this project. Technical capacity is 1,824 MW with 12 MW turbines and 1 x 1–nm spacing.				X																
	Total VA/NC Leases																					
	OCS Total[21,22]								**33,801**	**828**	**7,602**	**1,175**	**1,129**	**261**	**2,171,135**	**482**	**14**	**123**	**16**	**16**	**2**	**37,385**

Notes: COP = Construction and Operations Plan, CT = Connecticut, DE = Delaware, EFH =essential fish habitat, FDR = Facility Design Report, FIR = Fabrication and Installation Report, km^2 = square kilometers, m^2 = square meters, MA = Massachusetts, MD = Maryland, MW = megawatt, NE = New England, NJ = New Jersey, nm = nautical mile, NY = New York, OSS = offshore substation, PPA = Power Purchase Agreement, RAP = Research Activities Plan, RI = Rhode Island, tpy = tons per year, WTG = wind turbine generator

1. The spacing/layout for projects/regions are as follows: NE State water projects include a single strand of WTGs and no OSSs; for projects in the RI and MA Lease Areas, a 1 × 1–nm grid spacing is assumed; for the projects in the New Jersey/New York and the Delaware/Maryland lease areas, BOEM assumes that a 1 × 1–nm grid spacing also would be utilized; for the Coastal Virginia Offshore Wind Project, the spacing is 0.7 nm; and the Dominion commercial lease area off the coast of Virginia would utilize 0.5 nm average spacing, which is less than the 1 × 1–nm spacing due to the need to attain the state's goals.
2. Because development could occur anywhere within the RI and MA Lease Areas and assumes a continuous 1 x 1–nm grid, the actual development for these projects is expected to be approximately 73% of the collective technical capacity. Under the cumulative scenario described in in this appendix (Appendix E), the total area in the RI and MA Lease Areas is greater than the area needed to meet state demand. Therefore, if a project is not constructed, BOEM assumes that another future project would be constructed to fulfill the unmet demand.
3. This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.
4. The estimated construction schedule is based on information known at the time of this analysis and could be different when an applicant submits a COP. Furthermore, for this cumulative analysis BOEM assumes that construction of all the foundations would be installed during year 1 of construction and the balance of the work would be completed in year 2.
5. It is difficult to accurately predict future technology for planned but currently unscheduled offshore wind awards, including turbine spacing and capacity. For those projects with announced WTG sizes, BOEM used the assumption of an 8- or 12-MW WTG based on maximum-impact case for the resource. BOEM understands that it is feasible that in the future, turbine capacity could be greater than 12 MW. For future procurements and projects under this cumulative analysis, BOEM assumes the largest turbine that is presently commercially available, a 12-MW WTG, to evaluate potential impacts.
6. BOEM assumes that each offshore wind development would have its own cable (both onshore and offshore) and that future projects would not utilize a regional transmission line. The length of offshore export cable for those lease areas without a known project size has been assumed to include two offshore cables totaling 120 miles (193 kilometers). The offshore export cable would be buried a minimum of 4 feet (1.8 meters) but not more than 10 feet (3.1 meters).
7. The length of inter-array cabling has been assumed for all lease areas, except SFWF and Vineyard Wind 1 which have been calculated by the applicant, to be the average amount per foundation based on the COPs submitted to date, which is 1.48 miles (2.4 kilometers). In addition, for those lease areas that require more than one OSS, it has been assumed that an additional 6.2 miles (9.9 kilometers) of inter-link cable would be required to link the two OSSs. Inter-array cable is assumed to be buried between 4 and 6 feet.
8. The hub height for lease areas is based on worst-case scenario for the resource area.
9. The rotor diameter for lease areas is based on worst-case scenario for the resource area.
10. The total height of the turbine for lease areas is based on worst-case scenario for the resource area.

11. The number of turbines for those lease areas without a known project size has been calculated based on the generating capacity and a 12-MW turbine.
12. The estimated number of foundations is the total number of turbines plus OSSs, and it has been assumed that for every 50 turbines there would be 1 OSS installed. There are some exceptions to this assumption where additional relevant information is available in publicly available COPs for future projects.
13. The foundation footprint has been assumed to be 0.04 acre (161 m^2), which is based on the largest monopile reported (12 MW) for all lease areas other than SFWF and Vineyard Wind 1, which have been calculated by the applicant.
14. The seabed disturbance with the addition of scour protection was calculated based on scour protection expected in submitted COPs. It is assumed that for all lease areas that a 12-MW foundation with addition of scour protection would be 0.85 acres (3,440 m^2) per foundation other than SFWF and Vineyard Wind 1, which have been calculated by the applicant.
15. Offshore export cable seabed bottom disturbance is assumed to be due to installation of the export cable, the use of jack-up vessels, and the need to perform dredging.
16. For projects other than SFWF, the offshore export cable hard protection is assumed to be similar to Vineyard Wind 1 Project, which is 0.357 acres (1,445 m^2) per mile of offshore export cable.
17. Anchoring disturbance for the SFWF has been calculated by the applicant. Anchoring disturbance for other lease areas has been assumed to be a rate equal to 0.10 acres (405 m^2) per mile of offshore export cable, with the exception of Vineyard Wind 1 Project, which is 0.044 acres per mile of offshore export cable.
18. Inter-array construction seabed disturbance for the SFWF has been calculated by the applicant. Inter-array construction seabed disturbance for other lease areas has been assumed to be a rate equal to the average area per foundation, 2.4 acres (9,712 m^2) per foundation, with the exception of Vineyard Wind 1 Project, which is 2.04 acres (8,256 m^2) per foundation.
19. The inter-array operating footprint for the SFWF has been calculated by the applicant. The inter-array operating footprint for other lease areas is assumed to be a rate equal to the average amount per foundation of 1.43 acres (5,787 m^2) per foundation for all other lease areas.
20. Inter-array cable hard protection for the SFWF has been calculated by the applicant. The inter-array cable hard protection for other lease areas is assumed to be zero for all other lease areas with the exception of Vineyard Wind 1 Project, Vineyard Wind South OCS-A-5001, and Revolution Wind.
21. BOEM recognizes that the estimates presented within this cumulative analysis are likely high, conservative estimates; however, BOEM believes that this analysis is appropriately capturing the potential cumulative impacts and errs on the side of maximum impacts. Totals by lease area and by OCS may not fully sum due to rounding errors.
22. New York's demand is not double-counted, this total comes from looking at New York's state demand, not adding up the potential of the areas because that would double-count New York.

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APPENDIX F

Supplemental Information

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INTRODUCTION

This appendix provides information by resource, as applicable, that supplements the information provided in the *South Fork Wind Farm and South Fork Export Cable Project Environmental Impact Statement* (EIS).

COMMERCIAL FISHERIES AND FOR-HIRE RECREATIONAL FISHING

Information in this section provides an overview of the commercial fisheries data used in EIS Section 3.5.1 Commercial Fisheries and For-Hire Recreational Fishing.

Overview of Commercial Fisheries Data Used in EIS Section 3.5.1

The primary source of commercial fisheries data was provided by National Marine Fisheries Service (NMFS) Greater Atlantic Regional Fisheries Office (GARFO) upon request in December 2020 (NMFS 2020a). Included were three sets of annual data (2008–2018) for specific geographic areas relevant to the South Fork Wind Farm (SFWF) showing nominal revenues, trips, and unique vessels for each fishery management plan (FMP), gear, and port.

A second source of commercial fisheries data used in EIS Section 3.5.1 has been published online by NMFS and is specific to each proposed offshore wind energy project (NMFS 2020b). These data were downloaded and used to summarize revenues at risk across all proposed offshore wind projects under the No Action alternative.

A third source of commercial fisheries revenue data is the geographic information system (GIS) data available at Bureau of Ocean Energy Management's (BOEM's) Renewable Energy GIS data website (BOEM 2020) under the section *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fishing in the U.S. Atlantic.* These GIS data were used to develop the revenue intensity figures provided in EIS Appendix C. These GIS-based data were also used for comparisons of alternative South Fork Export Cable (SFEC) landfall sites, and for the assessment of impacts of the Vessel Transit Lane Alternative. These data provided revenue for each of the federal FMPs in the form of raster files[1] for 2007–2018, with a separate file for each year.

The remainder of this section describes data that NMFS-GARFO provided upon request from the SWFW analytical team. As indicated above, annual data were provide for seven specific geographic areas relevant to the Project as shown in Table F-1. Tables F-2, F-3, and F-4 show the FMPs, gears, and ports for which NMFS-GARFO provide annual data if they could be disclosed.[2]

[1] A raster file is a matrix of cell organized into rows and column where each cell contains a value representing information about the cell. The raster files in the BOEM GIS data sets are 500 meters on each side and show the revenue that was estimated to have been generated from that cell. A raster file for a widely utilized FMP on the U.S. East Coast could contain 4 million or more cells, each representing the revenue generated in a 500 × 500–meter cell.

[2] In general NMFS and GARFO require that a no less than three vessels and three dealers are included in any data point released to the public. FMPs, gears, or ports that did not meet the disclosure requirements were combined into an "Non-Disclosed" bin.

Table F-1. Specific Geographic Areas for which NMFS-GARFO Provided Data

South Fork Wind Energy Area (OCS-A 0517)	South Fork Maximum Work Area	South Fork Offshore Export Cable to Beach Lane	Revolution Wind Energy Area (in OCS-A 0486)
Sunrise Wind Energy Area (in OCS-A 0487)	OCS-A 0486 (Remainder)	OCS-A 0487 (Remainder)	

Table F-2. FMPs for which NMFS-GARFO Provided Data

American Lobster	Atlantic Herring	Bluefish	Golden and Blueline Tilefish
Highly Migratory Species	Jonah Crab	Mackerel, Squid, and Butterfish	Northeast Multispecies (Large Mesh)
Monkfish	Sea Scallop	Skates	Northeast Multispecies (Small Mesh)
Spiny Dogfish	No Federal FMP	Surfclam, Ocean Quahog	Summer Flounder, Scup, Black Sea Bass
Non-Disclosed FMPs			

Table F-3. Gears for which NMFS-GARFO Provided Data

Dredge-clam	Dredge-scallop	Gillnet-other	Gillnet-sink
Handline	Longline-bottom	Other gears	Pot-other
Trawl-bottom	Trawl-midwater	Non-disclosed gears	

Table F-4. Ports for which NMFS-GARFO Provided Data

New London, CT	Stonington, CT	Barnstable, MA	Boston, MA	Chatham, MA	Chilmark, MA
Fairhaven, MA	Fall River, MA	Falmouth, MA	Gloucester, MA	Harwichport, MA	Menemsha, MA
Nantucket, MA	New Bedford, MA	Sandwich, MA	Westport, MA	Vineyard Haven, MA	Woods Hole, MA
Beaufort, NC	Wanchese, NC	Atlantic City, NJ	Belford, NJ	Cape May, NJ	Point Pleasant, NJ
Freeport, NY	Greenport, NY	Hampton Bays, NY	Montauk, NY	Other Ny, NY	Shinnecock, NY
Bristol, RI	Davisville, RI	Little Compton, RI	Newport, RI	New Shoreham, RI	North Kingstown, RI
Point Judith, RI	Tiverton, RI	Chincoteague, VA	Hampton, VA	Newport News, VA	Non-disclosed ports

Average Annual Revenues and Non-Disclosure Issues

In general, EIS Section 3.5.1 provides information on the average annual revenue over the 2008–2018 period. However annual data were provided only for the years for which data could be disclosed. If an annual data-point for a given FMP, gear, or port within a given geographic area could not be disclosed because there were insufficient number of vessels or dealers, then NMFS-GARFO added the data-point to a “non-disclosed” category. By combining all the data-points that could not disclosed, NMFS-GARFO was able to report to the annual total revenue for every year. Unfortunately, this methodology for reporting non-disclosed data-points creates issue when attempting to accurately estimate average annual revenue because there will often be non-disclosed data for one or more years, particularly if the geographic area is small, or if there are relatively low-levels of participation.

Table F-5 shows the annual data for gears as provided by NMFS-GARFO for the Offshore Export Cable for SFWF. Note that for three gear types (Gillnet-Other, Longline-Bottom, and Other Gears) 3 or fewer years of data are provided. Also note that for Dredge-Clam only 8 years of data are available and for Trawl-Midwater only 10 years of data are available. In the face of these non-disclosure issues, the analytical team determined that unless six or more data-points of the 11-year period from 2008–2018 were available, the data for that row would not be reported. Further, the analytical team determined that the average for rows that had 6 or more years of data that the "annual average" revenue would be calculated as the total reported revenue for the period ÷ the number of reported years. Thus, the annual average revenue for Dredge-Clam gear is estimated to be $82,200 (i.e., $657,200 ÷ 8 = 82,200) rather than $59,700 (i.e., $657,200 ÷ 11 = 59,700). This methodology for calculating annual average revenue when there are non-disclosed data points has been judged by the analytical teams as a reasonable, given the alternative of only reporting data if all years are available. In the tables within Section 3.5.1 rows in which averages are calculated with fewer than 11 years are shown with an italicized font.

Table F-5. NMFS-GARFO Provided Data for the Offshore Export Cable to Beach Lane for SFWF

Gear	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Reported Years
Gillnet-Other	$1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Longline-Bottom	$24.5	$25.7	ND	$30.6	ND	ND	ND	ND	ND	ND	ND	3
Other Gears	$2.1	ND	ND	ND	ND	ND	ND	ND	ND	$4.0	$17.1	3
Dredge-Clam	ND	$277.0	$108.6	$49.7	$85.4	ND	ND	$30.0	$50.6	$32.3	$23.6	8
Dredge-Scallop	$157.6	$68.2	$401.3	$422.5	$182.1	$486.5	$860.7	$398.3	$514.8	$295.1	$186.0	11
Gillnet-Sink	$163.4	$131.1	$157.4	$228.0	$255.2	$181.9	$228.8	$165.4	$184.0	$172.7	$188.3	11
Handline	$21.3	$21.6	$18.9	$20.4	$16.7	$13.2	$11.3	$8.8	$14.0	$15.8	$15.3	11
Pot-Other	$85.8	$58.0	$55.8	$57.0	$63.2	$57.3	$58.4	$49.0	$61.6	$45.5	$43.5	11
Trawl-Bottom	$505.5	$429.6	$281.3	$454.7	$568.9	$702.2	$476.8	$501.4	$734.5	$397.2	$332.2	11
Trawl-Midwater	$21.1	$103.6	$5.5	$36.8	$15.2	$17.9	$27.0	$12.2	$26.1	$5.4	ND	10
Non-Disclosed	$68.8	$1.1	$70.7	$73.4	$5.1	$247.7	$103.0	$7.8	$18.0	$9.0	$3.4	11

Source: NMFS (2020a).
Notes: Revenue is adjusted for inflation to 2019 dollars. ND = Not Disclosed.

Caveats on the Use and Applicability of Commercial Fisheries Revenue Intensity Figures in EIS Appendix C

As indicated above, the revenue intensity figures for commercial fisheries shown in EIS Appendix C have been developed to provide a visual representation of harvesting locations across FMPs, gears, and ports. These figures rely on raster files that were originally developed by NMFS specifically for the purpose of assessing the impacts of proposed wind energy projects. These raster files are available to the public at BOEM's Renewable Energy GIS data website (BOEM 2020). The BOEM GIS raster files provide information specific to federal FMPs as well as information for gears, ports, states, and specific species many of which are not included in federal FMPs (e.g., American Lobster and Jonah Crab). Raster files for FMPs are available for 2007–2018; however, raster files for gears, ports, states, and specific species are only available for 2007–2012.

Although the NMFS-GARFO data are deemed the best available data for numerical assessment of the existing conditions in commercial fisheries and for assessing impacts of the alternatives, NMFS has not yet released the corresponding GIS data raster files that enable the visualization of fishing activity associated with particular locations such as the SFWF. GARFO indicates that GIS raster files summarizing these data will be available in early 2021. They also indicate that because NMFS-GARFO data (and eventually the raster files) use improved algorithms for estimation of revenues and improved algorithms for the assignment of harvests to specific geographic locations, they are superior to previously developed raster files available from BOEM (2020).

The SFWF analytical team compared average annual inflation-adjusted revenues for these two data sets across all proposed wind energy projects included in the No Action alternative (summarized in EIS Table 3.5.1-16). Estimated average annual revenues using NMFS-GARFO data were 1.3% higher that estimated average annual revenue revenues using the BOEM GIS raster files. Thus, although the BOEM GIS data may slightly understate revenues within the proposed future wind energy project sites, they are clearly comparable and representative. The SFWF analytical team believes that in the absence of other GIS-based data, the revenue intensity figures provide valuable insights into the fish harvesting locations. The SFWF analytical team notes that a complete set of revenue intensity figures using the raster files that are eventually be developed from NMFS-GARFO data will be included in future iterations of the SFWF EIS.

It must be re-iterated that revenue intensity figures provided in Appendix C for gears and ports, and for American Lobster and Jonah Crab, summarize harvest locations for the years 2007–2012 rather than for 2007–2018. Although the overall inflation-adjusted average annual revenue for the 2007–2012 period is only 0.1% less than inflation-adjusted average annual revenue for the 2008–2018 period, it is possible that harvesting locations may have systemically shifted in later years.

Finally, it is noted that because of the very limited time between the provision of the NMFS-GARFO data in early December 2020, and the publication of the SFWF DEIS in early January 2021, coupled with the imminent availability of raster files from NFMS-GARFO data (planned for release in early 2021), revenue intensity figures for several of the FMPs and ports that are shown in the tables in EIS Section 3.5.1 have not been developed. Also please note that revenue intensity figures for gears have been aggregated into two broad gear types—Mobile Gear and Fixed Gear.

Literature Cited

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DEMOGRAPHICS, EMPLOYMENT, AND ECONOMICS

Project capital expenditures (CapEx) during development and construction of the Project coupled with annual operating expenditures once the Project is up and running would be the key drivers of economic activity in the analysis area. This appendix section summarizes the development of estimates of CapEx and operational expenditures (OpEx) for the SFWF. The intent of this section is to provide a basis for quantitative estimates of economic impacts of the SFWF in terms of local spending for materials, supplies, and services, and for estimates of direct, indirect, and induced employment and earnings generated in each phase of the Project: 1) the development and construction phase, 2) the operation and maintenance phase, and 3) the conceptual decommissioning phase.

Also included in this section are details of estimates of local employment from future wind farm projects.

Estimates of South Fork Wind Farm Capital and Operating Expenditures

Estimates of CapEx or OpEx for the Project were developed using the *Jobs and Economic Development Impacts Offshore Wind Model* (JEDI-OWM)—an interactive spreadsheet model developed and maintained by the National Renewable Energy Laboratory (NREL). JEDI-OWM is available to the public (NREL 2017).

JEDI-OWM generates estimates of CapEx and OpEx for user-specified wind farms. Key user inputs to the JEDI-OWM include 1) the project state, 2) total farm capacity, 3) wind turbine generator (WTG) capacity, 4) water depth, 5) distance to primary port, 6) length of the export cable, and 7) length of the onshore interconnection cable(s).

A critical set of inputs into the JEDI-OWM are the assumptions with respect to the wind turbine itself. Table 3.1-3 of the construction and operations plan (COP) (Jacobs Engineering Group Inc. [Jacobs] 2020)[3] was used for these key inputs, including parameters for turbine blade lengths and the height of the hub. Estimates of the total cost of each 6-megawatt (MW) turbine assembly were based on information documented in the *2017 Cost of Wind Energy Review* (Stehly et al. 2018). Stehly et al. (2018) report that a 5.64-MW turbine is expected to cost $1,557 per kilowatt (kW). This cost per kW was assumed for the Project's 6-MW turbines resulting in a total of $9.34 million per 6-kW turbine. Beiter et al. (2018), in the 2017 *Offshore Wind Technologies Market Update,* reports that in the future, CapEx savings are likely to be significant if using a 12-MW turbine rather than a 6-MW turbine because fewer turbines, towers, and interconnections would need to be purchased and installed. Although the cost per turbine for a 12-MW turbine would exceed the cost of a 6-MW turbine, the total Project CapEx would be much lower. Based on information in these reports, it is assumed that the cost per kW of a 12-MW turbine would be almost equal to $1,092 per kW or 13.1 million per 12-MW turbine.

JEDI-OWM was used to generate estimates of CapEx and OpEx for a range of assumptions including four of the potential primary ports (New Bedford, Massachusetts; Providence, Rhode Island; New London, Connecticut; and Norfolk, Virginia), two landing sites (Beach Lane and Hither Hills, Long Island, New York), and two levels of overall capacity each using 15 WTGs (90 MW total with 6 MW per WTG or 180 MW total with 12 MW per WTG). Water depth—the other key input for JEDI-OWM calculations—was set at 35.1 meters for all options. As reported in the COP, the onshore cable from the Hither Hills landing site to the new interconnection facility adjacent to the existing East Hampton substation would be 11.9 miles, whereas the length of the cable from the Beach Lane landing site to the interconnection facility would be 4.1 miles (Jacobs 2020). Table F-6 shows assumed distances from the WTG work area (WTG-WA) to each landing site and primary port.

Table F-6. Distances from the Wind Turbine Generator Work Area to Landing Sites and Selected Primary Ports

Port/Landing Site	Beach Lane, NY	Hither Hills, NY	New Bedford, MA	Providence, RI	New London, CT	Norfolk, VA	Paulsboro NJ
Distance from WTG-WA (kilometers)	98.80	79.80	60.51	65.24	93.73	660.80	878.6

Note: NY – New York, MA = Massachusetts, RI = Rhode Island, CT = Connecticut, VA = Virginia, NJ = New Jersey.

[3] The updated construction and operations plan (COP)—*South Fork Wind Farm and South Fork Export Cable Construction and Operations Plan*— is referred to frequently throughout the EIS, and therefore the author-date citation is provided here at first mention only.

JEDI-OWM results for total CapEx without taxes or financing charges and interest for the options are shown in Table F-7. It is important to note that there is very little variation in these CapEx estimates across the different ports and states, even though there is considerable variation in the distance from the WTG-WA and the primary ports.[4, 5] There are much more noticeable differences when looking at CapEx across landing sites and capacity options. On average, the CapEx difference between using the Beach Lane landing site or the Hither Hills landing site is estimated by JEDI-OWM to range from $39.2 million to $43.8 million depending on SFWF capacity. The average CapEx of building a 180-MW wind farm is ≈ $173 million greater than the CapEx of a 90-MW wind farm. The range of average cost is $4,106 to $4,349 per kW if total capacity is 180 MW, and $6,344 to $6,791 per kW if total capacity is 90 MW.

Table F-7. Estimated Total CapEx before Taxes and Financing Charges for the South Fork Wind Farm Assuming a Range of Primary Ports, Landing Sites, and Capacity

Primary Port and State	Beach Lane @ 90 MW	Hither Hills @ 90 MW	Beach Lane @ 180 MW	Hither Hills @ 180 MW
	Total CapEx Shown in Millions of Current (2019) Dollars			
New Bedford, MA	$610.11	$571.01	$782.91	$739.22
Providence, RI	$611.12	$571.82	$784.29	$740.40
New London, CT	$611.19	$571.90	$784.58	$740.69
Norfolk, VA	$625.11	$580.07	$809.98	$760.35
Paulsboro, NJ	$627.53	$582.48	$816.18	$766.56
Average: All Ports	$617.01	$575.45	$795.59	$749.45

Note: MA = Massachusetts, RI = Rhode Island, CT = Connecticut, VA = Virginia, NJ = New Jersey.

Estimates of annual OpEx (excluding taxes and finance charges) were set equal to $144,000 per installed MW of capacity based on OpEx estimates for the reference project in the *2017 Cost of Wind Energy Review* (Stehly et al. 2018). Total annual OpEx without taxes and finance charges for the SFWF are estimated by JEDI-OWM to be $25.9 million with 180 MW of installed capacity and $12.9 million with 90 MW of installed capacity.

Estimates of Total Conceptual Decommissioning Expenditures

Expenditures and employment for conceptual decommissioning of the offshore infrastructure are estimated to occur 25 years after Project startup. Bureau of Ocean Energy Management (BOEM) guidance indicates that estimates of conceptual decommissioning costs should be approximately 50% of the original installation and construction costs (AECOM 2017). As documented above, the JEDI-OWM model generates estimates of total CapEx. JEDI-OWM provides additional elements for CapEx including 1) materials and other equipment, 2) installation labor, 3) insurance during construction, 4) development costs and third-party contactors, and 5) other miscellaneous costs. It is assumed that conceptual decommissioning costs can therefore be approximated as 50% of the sum of elements 2 through 5. For the SFWF, the sum of these four CapEx elements ranges from $221.8 million to $267.5 million, and therefore conceptual decommissioning costs are expected to range from $110.9 million to $133.7 million. Because these costs are primarily labor and contracting costs, a relatively high percentage of these expenditures would accrue to local economies.

[4] Estimates of CapEx do not include costs of any port upgrades or expansions that may be needed.

[5] Estimates of CapEx using Quonset Point are not meaningfully different than CapEx estimates for Providence and are therefore not reported in Table F-7.

JEDI-OWM ESTIMATES OF LOCAL EXPENDITURES AND JOBS FOR SOUTH FORK WIND FARM

In addition to total CapEx and OpEx, JEDI-OWM also estimates local expenditures and local jobs. It should be noted that JEDI-OWM defines local expenditures as "in-state" or "in the region"—JEDI-OWM does not provide results indicating total United States spending or total spending outside of the United States. Deepwater Wind South Fork, LLC (DWSF) has indicated that during development and construction, it expects hiring and expenditures to occur throughout the four-state region of New York, Connecticut, Rhode Island, and Massachusetts. It is also important to note that DWSF expects that development and construction of the SFWF and South Fork Export Cable (SFEC) could take up to 48 months (as shown in Table 1.5-1 of the COP). For purposes of the EIS, is assumed that local expenditures and employment during development and construction would occur over a 3-year period from 2020 to 2022. DWSF has also indicated (Table 3.0-1 of the COP) that operations and maintenance facilities would be based in either Montauk, New York, or Quonset Point, Rhode Island.

JEDI-OWM estimates of local shares of CapEx for the SFWF over the potential set of configurations range from 25% to 28% of pre-tax CapEx.[6] If sales taxes are added for each of the four states, the range of local shares increases to 28% to 31%. JEDI-OWM also estimates local shares for OpEx (excluding local taxes) to be 48% of total OpEx (excluding taxes and finance charges) or $6.16 million annually for a 90-MW wind farm, and $12.32 million annually if a 180-MW wind farm is built.

Table F-8 summarizes JEDI-OWM estimates of the local share of CapEx and OpEx with percentages depending primarily on capacity of the WTGs and the landing site. Local spending percentages are highest for options with a 90-MW wind farm and the landing site at Hither Hills (i.e., options with lower CapEx) and lowest with a 180-MW wind farm and the landing site at Beach Lane (i.e., options with higher CapEx). Estimates of local CapEx shares are presented before and after estimated sales taxes. The table also includes estimates of annual local OpEx spending.

Table F-8. Estimated Average Local Spending for CapEx and OpEx for South Fork Wind Farm by Landing Sites and Capacity

Local CapEx and Tax Spending Shown in Millions of Current (2019) Dollars with the Percentage of Total CapEx				
	Beach Lane @ 90 MW	**Hither Hills @ 90 MW**	**Beach Lane @ 180 MW**	**Hither Hills @ 180 MW**
Local CapEx before taxes	$157.05 or 26%	$157.59 or 28%	$207.49 or 26%	$207.87 or 28%
Local estimated sales tax	$24.05 or 4%	$22.82 or 4%	$33.79 or 4%	$32.36 or 4%
Local CapEx with taxes	$178.88 or 28%	$178.87 or 30%	$237.54 or 29%	$237.19 or 31%
Local OpEx Spending Shown in Millions of Current (2019) Dollars with the Percentage of Total OpEx				
	Beach Lane @ 180 MW	**Hither Hills @ 180 MW**	**Beach Lane @ 90 MW**	**Hither Hills @ 90 MW**
Average: all ports/states	$6.16 or 48%	$6.16 or 48%	$12.32 or 48%	$12.32 or 48%

[6] Given the uncertainty with respect to hiring locations, primary port bases, and the location of suppliers likely to provide goods and services to DWSF as it develops and builds the SFWF, it is not possible with the information currently available to make a reliable estimate regarding the distribution of local CapEx within the economic region of impact including the states of New York, Connecticut, Rhode Island, and Massachusetts.

Table F-9 summarizes JEDI-OWM estimates of local CapEx and OpEx spending in terms of full-time equivalent (FTE) jobs with the low- and high-generation capacity for the Project assuming the Beach Lane landing site. There are two sections to the table: the upper section shows results assuming a 90-MW wind farm, whereas the lower section shows results assuming a wind farm with 180-MW rated capacity. The table shows three categories of FTE jobs from CapEx: 1) direct jobs in the development, engineering, and construction of the Project; 2) indirect jobs within the supply chain for the project; and 3) induced jobs generated as workers and business owners spend their earnings on goods and services. Total jobs from CapEx in the region of interest (ROI) are expected to range from 1,246 to 1,617 FTE jobs. It is important to note that the total number of jobs does not account for the timing of the work or the duration of the work. In other words, if development and construction occur over a 3-year period (as indicated earlier), then the number of FTE jobs per year would be 1/3 the number shown in the table. The table also indicates that annual FTE jobs related to Project OpEx in the ROI are expected to range from 49 to 98 and are likely to be concentrated in Montauk, New York, and Quonset Point, Rhode Island. The bottom row of Table F-9 shows estimates of local income earned from the jobs discussed above. Total local income across the socioeconomic ROI for the entire development and construction period is estimated to range from $90.43 million to $115.82 million depending on the final capacity of SFWF. Local annual income for OpEx-related jobs are expected to range from $4.07 to $8.14 million.

In February 2019, Orsted North America provided an assessment of economic development of jobs that can be expected from the SFWF and SFEC (Navigant Consulting, Inc. 2019). The reported estimated levels of local jobs and income are similar to those reported in Table F-9. For example, the report estimates that 413 direct, indirect, and induced jobs would be generated in New York as a result of the Project.[7]

Table F-9. Estimated Local Jobs and Income from CapEx and OpEx for South Fork Wind Farm, Average Over all Ports and States

SFWF with 90 MW - Impacts Resulting from CapEx and OpEx Assuming the Beach Lane Landing Site				
Direct: Development/ Construction	**Indirect: Supply Chain**	**Induced**	**Total CapEx Related Jobs and Income**	**OpEx Annual Total: Direct, Indirect, Induced**
Total FTE Jobs for Entire Construction Period				**Annual FTE**
326	**518**	367	**1,211**	48
Total Income for Entire Construction Period Shown in Millions of Current (2019) Dollars				**Annual Income**
$28.17	$36.36	$24.40	**$90.43**	$4.07
SFWF with 180 MW - Impacts Resulting from CapEx and OpEx, Assuming the Beach Lane Landing Site				
Jobs: Development/ Construction	**Indirect: Supply Chain**	**Induced**	**Total CapEx Related Jobs and Income**	**OpEx Annual Total: Direct, Indirect, Induced**
Total FTE Jobs over Entire Construction Period				**Annual FTE**
428	686	473	**1,587**	96
Total Income for Entire Construction Period Shown in Millions of Current (2019) Dollars				**Annual Income**
$31.57	$51.85	$31.64	**$115.82**	$8.14

[7] The Navigant Consulting, Inc. (2019) report does not directly specify the size of the individual turbines that were modelled—thus, it is unclear whether the total size of the modelled windfarm is 90 MW or 180 MW or some variant between the two extremes. Because of this uncertainty, the Navigant Consulting, Inc. (2019) report is used as a secondary resource.

Additional Analysis Assumptions

ASSUMPTIONS REGARDING LOCAL HIRING PRACTICES

Section 4.6.1.2 of the COP provides indicative descriptions of DWSF's expected hiring practices during construction of the SFWF (Jacobs 2020). These are summarized in the bulleted list below:

- The SFWF would be constructed using multiple ports and access locations in different states throughout the analysis area.
- Workers involved in the construction of the offshore portions of the Project would be housed on board vessels at the offshore work sites.
- Non-local construction personnel would typically include mariners, export cable manufacturing personnel, and other specialists.
- The size of the non-local construction workforce could be large relative to the construction workforce hired locally.
- Local workers would be hired to the extent practical for SFWF and SFEC management, fabrication, and construction.
- Because of the short duration of construction activities, it is unlikely that non-local workers would relocate families to the area.

ASSUMPTIONS REGARDING THE ABILITY OF "LOCAL SUPPLIERS" TO MEET PROJECT DEMANDS FOR SPECIALIZED PROJECT COMPONENTS

Several recent studies describe the offshore wind industry in the United States as being in its early developmental stages, and that as it currently exists, a relatively large share of the CapEx and the resulting jobs and income for offshore wind projects are likely to leak out to economies outside both the analysis area and the United States as a whole. In its study for the U.S. Department of Energy, Navigant Consulting, Inc. (2013) states that because of the lack of United States demand for offshore components, "no domestic manufacturing facilities are currently serving the offshore wind market." More recently, AECOM (2017) in its white paper, *Potential Economic Benefits of Offshore Wind*, developed for BOEM, states the following:

> At each phase of offshore wind energy development, there is the potential to generate economic benefits locally, regionally, nationally, and/or internationally, depending on the extent to which these geographic areas can deliver the materials and skills necessary to develop offshore wind energy. Imported materials and services into the particular region being assessed represent lost opportunities for local production and employment. As the offshore wind energy industry advances in the U.S., more opportunities for domestic value can be created along the value chain and for supporting services. Supporting services could include consulting services, financial services, education and training, and research and development. (AECOM 2017)

From a more quantitative perspective, BVG Associates Limited (BVG) (2017) concludes that for offshore projects constructed before 2022, the United States as a whole can expect to realize a minimum of 35% of the total expected jobs needed to meet United States demand—including jobs in the supply chain, development, and construction. In addition, BVG concludes that there is high probability that United States–based jobs could be between 50% and 63% offshore wind-related jobs by 2022.

For the SFWF, estimates of the local share of CapEx and OpEx and the jobs and income that result from those expenditures, were taken from the JEDI-OWM. The estimates of local shares within JEDI-OWM are limited to expenditures within the state with which the Project would be associated. As documented in this appendix, estimates of the local share of CapEx range from 25% to 27% of pre-tax CapEx. If sales taxes are added for each of the four states, the range of local shares increases to 29% to 31%. JEDI-OWM also estimates local shares for OpEx (excluding local taxes) would range from 48% of total OpEx (excluding taxes and finance charges) or $6.16 million annually for a 90-MW wind farm and $12.32 million annually if a 180-MW wind farm is built.

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ENVIRONMENTAL JUSTICE

This appendix section provides additional details on the methodology used to determine whether the minority or low-income percentages in an individual census block group in the analysis area (see EIS Section 3.5.4 for description) are meaningfully greater than the percentages in the reference populations of the county or state.

The section is organized into three parts:

1. Maps indicating the percentage of minority and low-income populations in each census block group in the analysis area
2. A discussion of the methodology used to determine whether a census block group has a meaningfully greater percentage of minority or low-income populations compared to the county or state in which it is located
3. Maps showing census block groups that are areas of potential environmental justice concern

Minority and Low-Income Populations in Census Block Groups

Figure F-1 shows low-income populations by census block groups for ports and landing sites from Eastern Long Island in the lower left to Providence and New Bedford with insets for wind farm ports in New Jersey, Maryland, and Virginia. Figure F-2 shows minority populations for the same areas.

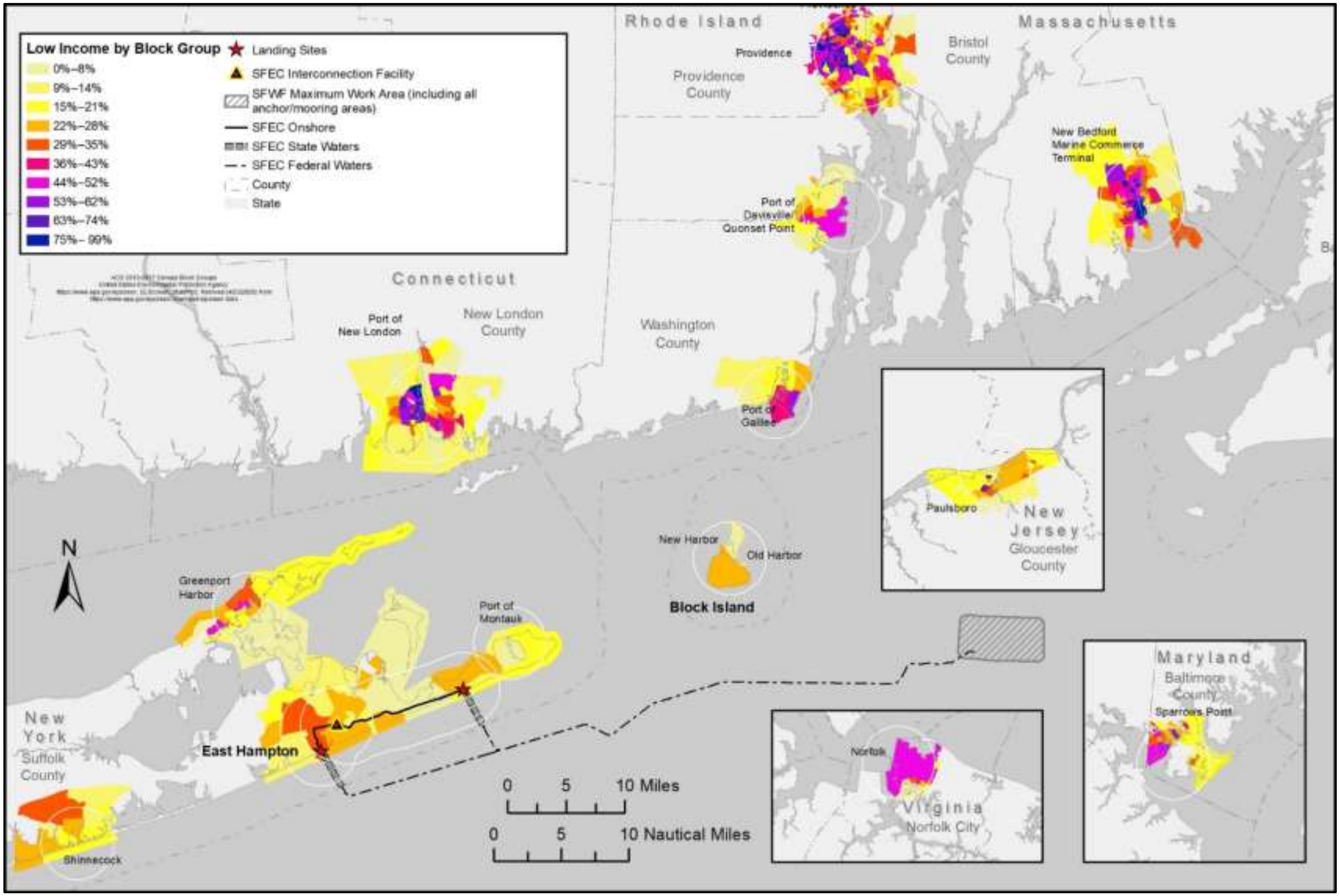

Figure F-1. Low-income populations: Eastern Long Island, Connecticut, Rhode Island, Massachusetts, New Jersey, Maryland, and Virginia.

Source: Developed by Northern Economics based on information from U.S. Environmental Protection Agency (EPA) (2020).

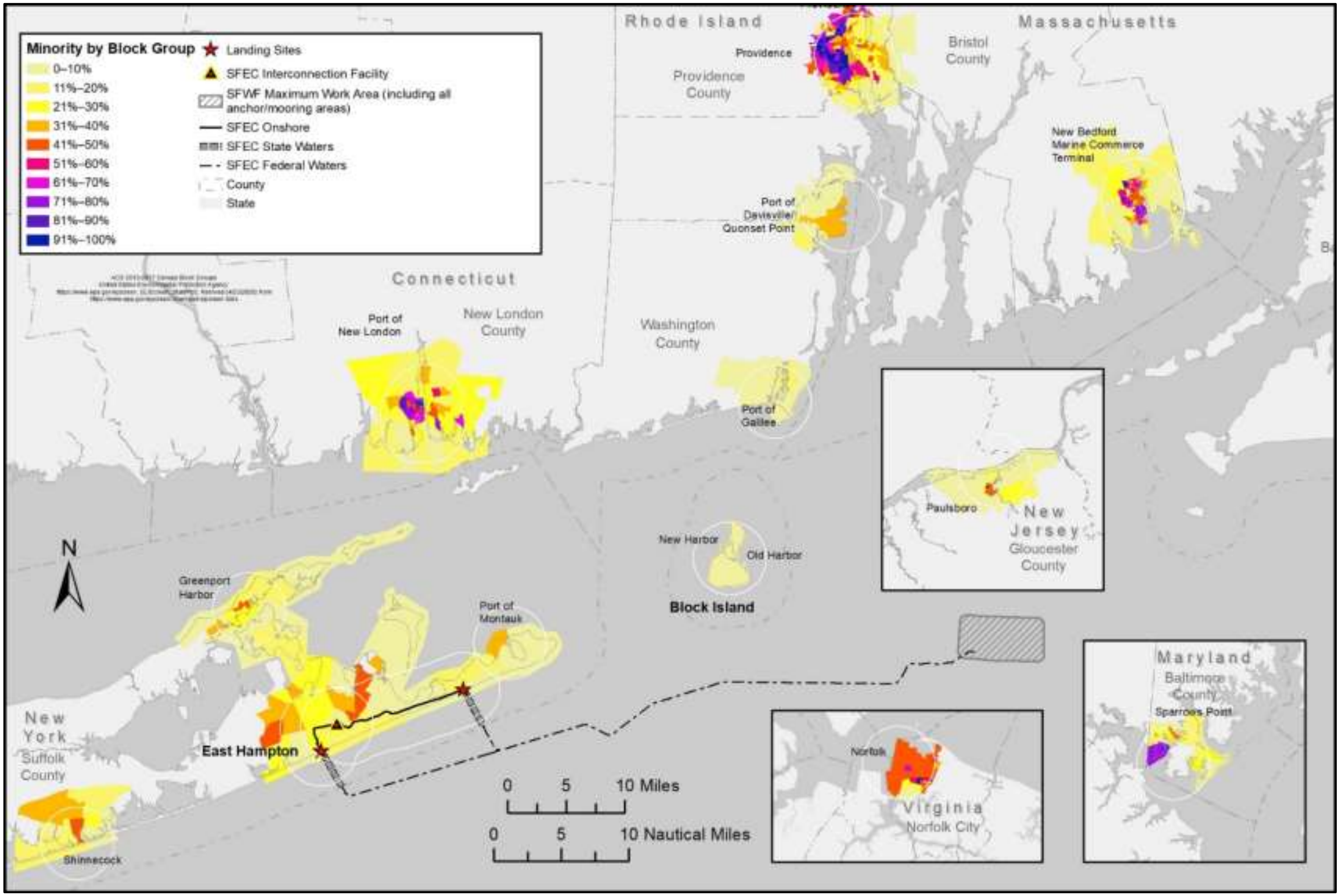

Figure F-2. Minority populations: Eastern Long Island, Connecticut, Rhode Island, Massachusetts, New Jersey, Maryland, and Virginia.
Source: Developed by Northern Economics based on information from EPA (2020).

Methodology

Factors used to estimate criteria for meaningfully greater percentages of minority or low-income populations in each census block group were scaled according to percentage sizes. As shown in Table F-10, for reference populations containing smaller percentages of minorities or low-income individuals, the factors in the middle column are larger. The factors decrease as the percentages within a reference population increase. The minority or low-income percentage of the population of a county or state (whichever is lowest) is multiplied by the factor in Table F-10. If the percent minority or low-income in a given census block population meets or exceed the resulting criterion, that population is considered to have a meaningfully greater percentage than the reference population.

Table F-10. Factors Used to Determine if Census Block Groups in 5-Kilometer Zones Have Meaningfully Greater Percentages of Minority or Low-Income Populations

Range of Percentages for Minority and Low-Income Populations for the County or State	Factor Used to Estimate Criteria for Meaningfully Greater Minority and Low-Income Populations for the Census Block Group	Range of Meaningfully Greater Minority and Low-Income Populations for the Census Block Group to Meet the Criteria
0%–5%	200%	0%–10%
5%–10%	189%	9%–19%
10%–15%	179%	18%–27%
15%–20%	169%	25%–34%
20%–25%	159%	32%–40%
25%–30%	151%	38%–45%
30%–35%	142%	43%–50%
35%–40%	135%	47%–54%
40%–45%	127%	51%–57%
45%–50%	120%	54%–60%
50%–55%	113%	57%–62%

Census Block Groups that are Areas of Potential Environmental Justice Concern

This section provides maps showing the locations of census block groups that have been determined to have meaningfully greater percentages of low-income or minority populations relative to the county or state in which they are located. In all, 563 census block groups were compared to county or state populations, 227 block groups were determined to have meaningfully greater minority populations, and 213 were determined to have meaningfully greater low-income populations. In Figures F-3 though F-6, census block groups shaded yellow have meaningfully greater percentages of low-income populations; census block groups shaded blue have meaningfully greater percentages of minority populations; and census block groups shaded red have meaningfully greater percentages of both minority and low-income populations. Maps are provided for the following groups of communities:

- Eastern Long Island including Montauk, East Hampton, Greenport Harbor, and Shinnecock.
- New London, Old Harbor/New Harbor (Block Island), and the Port of Galilee ((Narragansett/Point Judith)
- Providence, Davisville/Quonset Point and New Bedford
- Norfolk, Sparrows Point, and Paulsboro

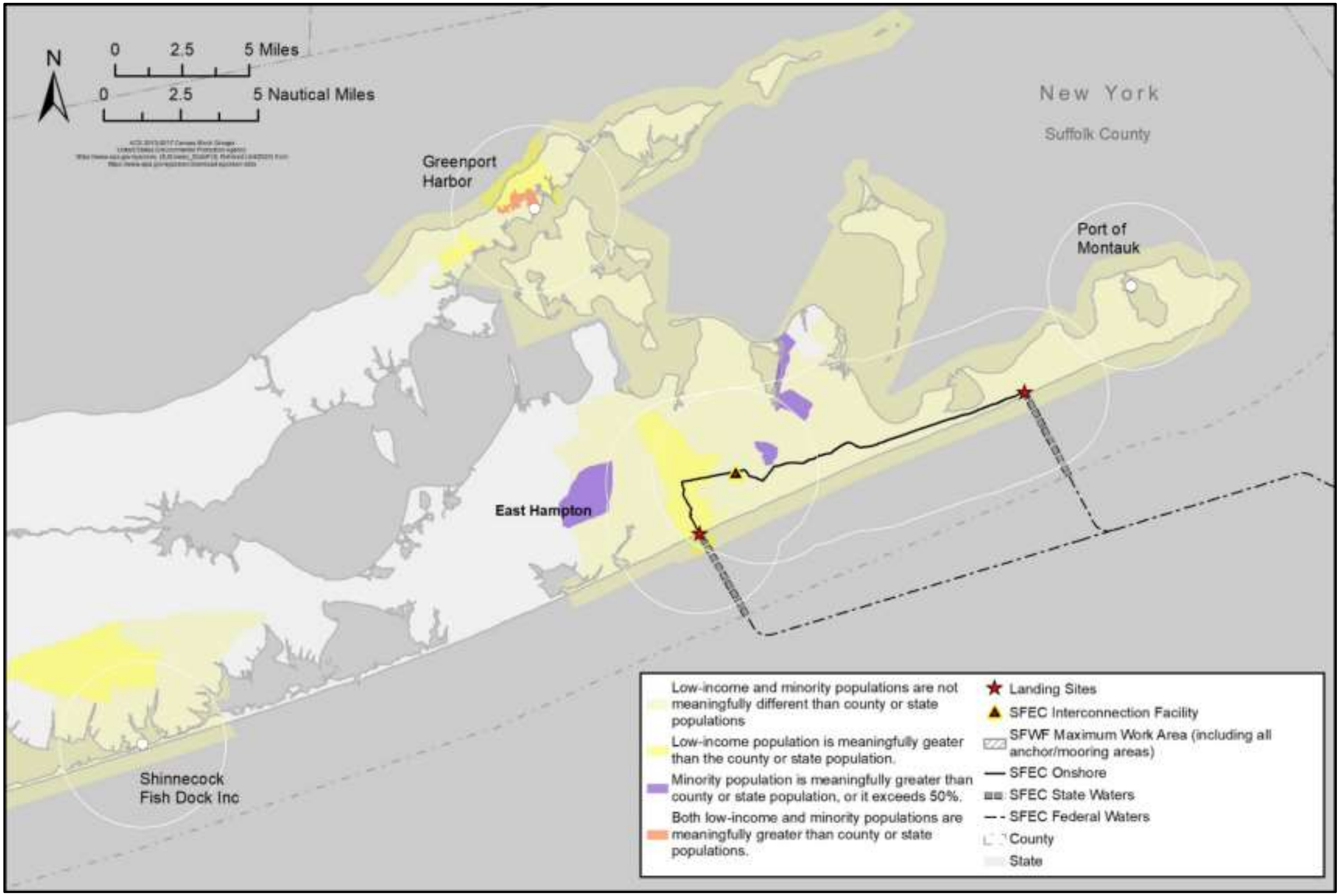

Figure F-3. Census block groups that are areas of potential environmental justice concern: Eastern Long Island.

Source: Developed by Northern Economics based on information from EPA (2020).

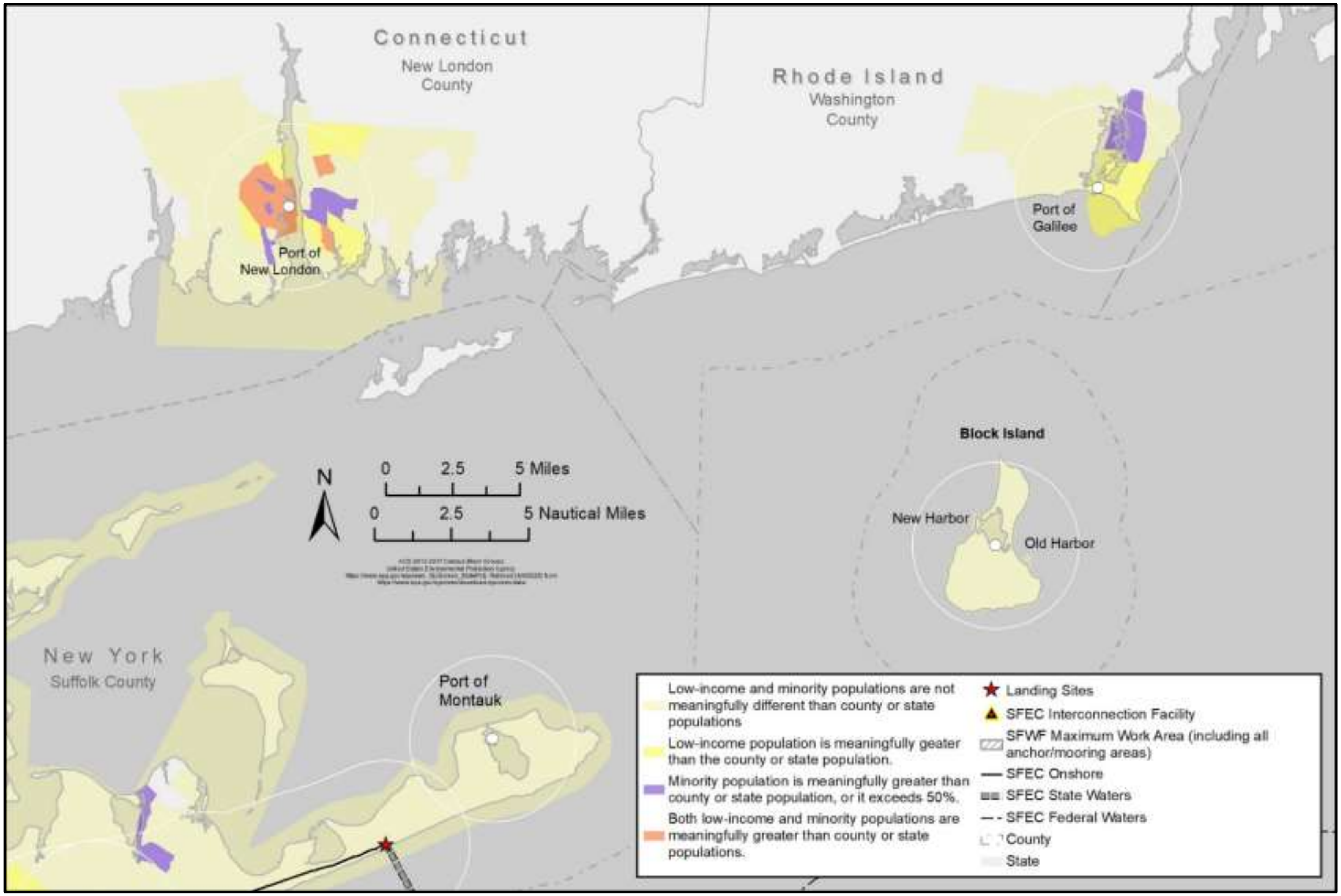

Figure F-4. Census block groups that are areas of potential environmental justice concern: New London, Old Harbor/New Harbor (Block Island), and the Port of Galilee (Narragansett/Point Judith).

Source: Developed by Northern Economics based on information from EPA (2020).

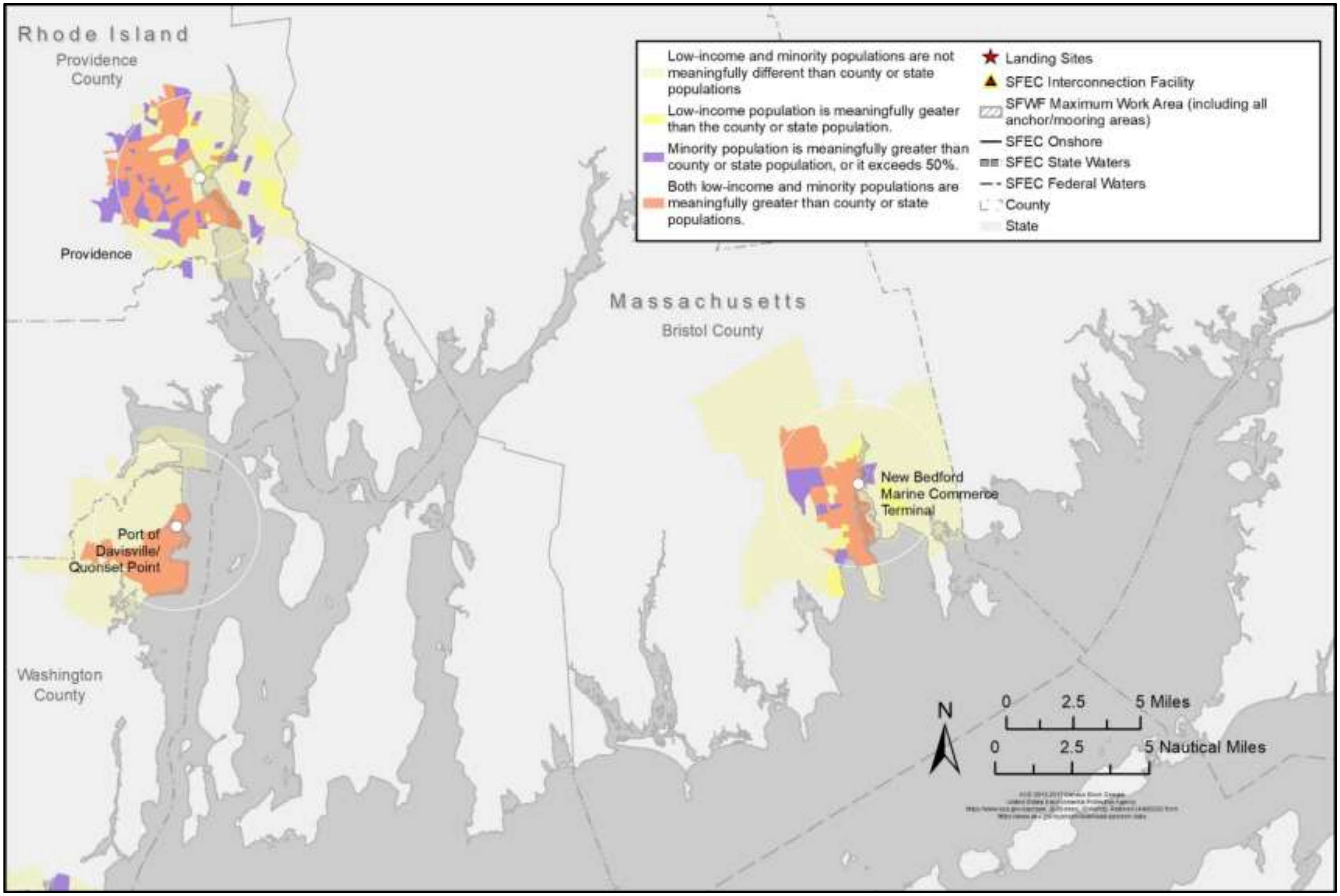

Figure F-5. Census block groups that are areas of potential environmental justice concern: Providence, Davisville/Quonset Point, and New Bedford.
Source: Developed by Northern Economics based on information from EPA (2020).

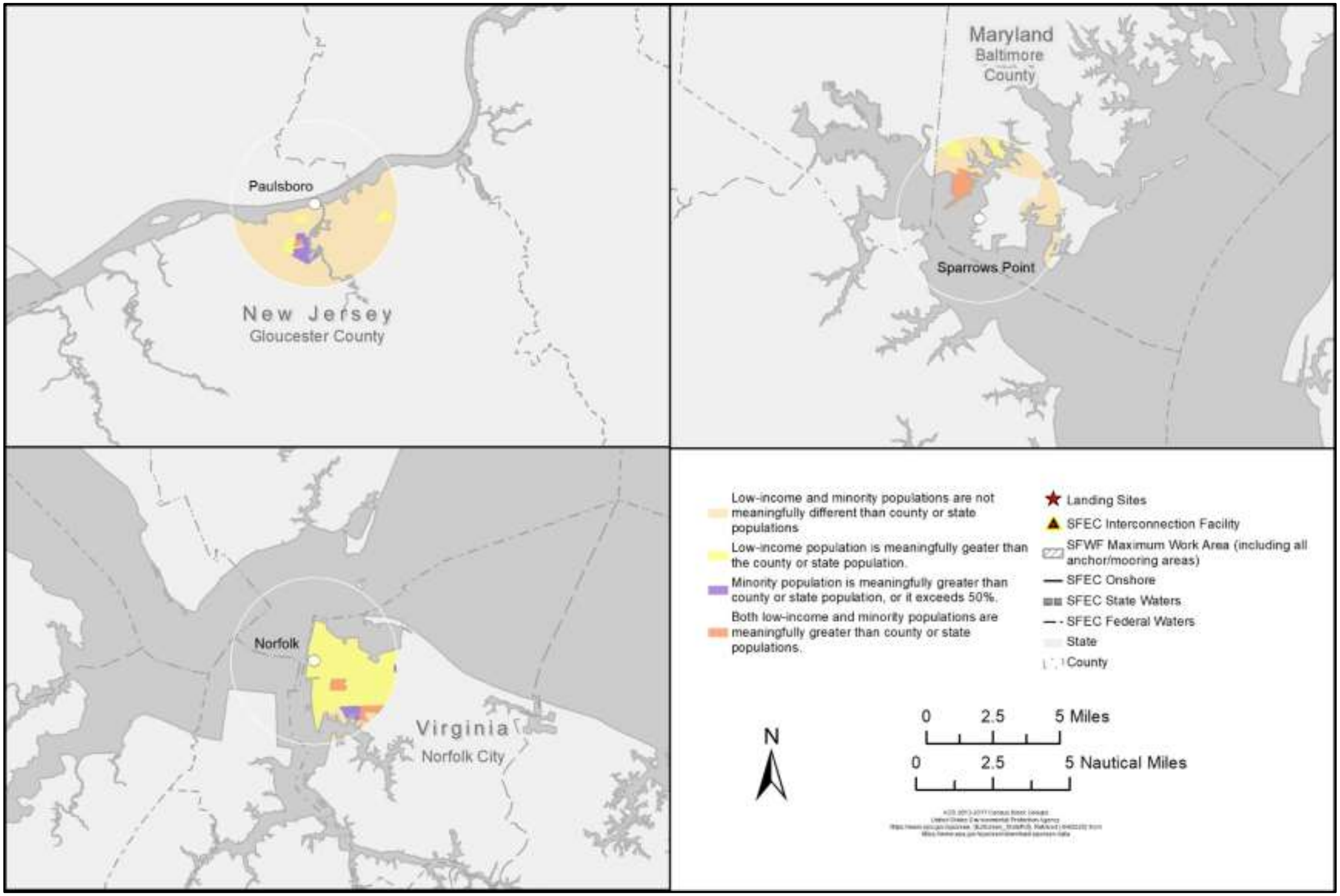

Figure F-6. Census block groups that are areas of potential environmental justice concern: Norfolk, Sparrows Point, and Paulsboro.

Source: Developed by Northern Economics based on information from EPA (2020).

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BENTHIC HABITAT, ESSENTIAL FISH HABITAT, INVERTEBRATES, FINFISH AND MARINE MAMMALS

Environmental factors that influence current conditions for benthic habitat, essential fish habitat, invertebrates, finfish, and marine mammals are listed in Table F-11.

Table F-11. Baseline Marine Conditions for Benthic Habitat, Essential Fish Habitat, Invertebrates, Finfish, and Marine Mammals

Factor	Description	Additional Information
Habitat and spatial factors	Habitat and spatial factors (temperature, salinity, pH, current, etc.) affect the distribution of fish within the oceans.	Major habitat types expected to be found within the analysis area are described in detail in COP Appendix N (Benthic Assessment) (Inspire Environmental 2019) and summarized in EIS Section 3.4.2.2.1 (Benthic Habitat).
Water depth and substrate	Water depths in the analysis area and surrounding area range from 108 to 125 feet below mean lower low water (MLLW) in and around the SFWF, and 30 to 154 feet along the SFEC corridor. Seafloor slopes generally vary from less than 1 to 3 degrees. Sand sheets are the dominant substrate type, with lesser amounts of sand and mobile gravel, and patchy cobble and boulder substrate in and around the SFWF (Fugro 2019a, 2019b; Inspire Environmental 2019). The seabed in the analysis area is periodically disturbed by commercial fishing activity (Jacobs 2020), and benthic community structure in the analysis area is likely influenced by this baseline disturbance leading to increased variation in benthic species diversity (Nilsson and Rosenberg 2003; Rosenberg et al. 2003).	See EIS Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) and Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing).
Baseline water quality conditions	Baseline water quality conditions in the analysis area are typical of those in the broader NW Atlantic outer continental shelf (OCS) region. The EPA (EPA 2012, 2015) recently rated coastal water quality in nearby Block Island Sound as fair to good for all water quality parameters. Total suspended sediment (TSS) is the only water quality parameter likely to be measurably affected by construction of the Project and only during construction. Vinhateiro et al. (2018) estimated ambient TSS levels in the analysis area on the order of 10 milligrams per liter (mg/L) based on nearby observations in Rhode Island Sound. However, baseline TSS levels near the seabed could range as high as 100 mg/L under certain conditions (Inspire Environmental 2019; West and Scott 2016).	For additional details regarding water quality conditions in the analysis area, see EIS Section 3.3.2 (Water Quality).
Ambient airborne and underwater noise	The Project lies within a dynamic ambient noise environment. Wind and wave action, a diverse community of vocalizing cetaceans, commercial shipping traffic, and recreational and commercial fishing vessel traffic all contribute to background underwater noise levels. Anthropogenic noise sources, including commercial shipping traffic in high-use shipping lanes in proximity to the analysis area, contribute substantially to baseline noise levels. Kraus et al. (2016) measured ambient noise in the Rhode Island/Massachusetts Wind Energy Area ranging from 96 decibels (dB) to103 dB in the 70.8-hertz (Hz) to 224-Hz frequency band during 50% of the recording time, with peak ambient noise levels reaching as high as 125 dB in areas close to major shipping lanes. Ambient levels near high vessel traffic areas ranged as high as 125 dB_{RMS} (root mean square decibels). Underwater noise conditions in the remainder of the analysis area are likely to be comparable to those observed by Kraus et al. (2016). Ambient airborne noise from wind and wave action likely ranges from 50 A-weighted decibels (dBA) to 70 dBA based on available literature (Bolin and Åbom 2010; U.S. Army Corps of Engineers 1984, 2005). Large commercial vessels can generate airborne noise ranging from 85 to 115 dBA up to 200 feet from the hull (McKenna et al. 2012; Witte 2010).	Ambient noise conditions are further described in the biological assessment (BOEM 2019, 2020) and are summarized in and summarized in EIS Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) and Section 3.4.4 (Marine Mammals).

Factor	Description	Additional Information
Baseline vessel traffic	Vessel traffic and navigational safety lights on buoys and meteorological towers are the only artificial lighting sources currently present in the open-water portion of analysis area. Land-based artificial light sources become increasingly predominant in the portion of the analysis area approaching the Long Island shoreline. Marine debris from vessels and upland sources is chronic and widespread in the region (National Oceanic and Atmospheric Administration Marine Debris Program 2014a, 2014b).	Baseline vessel traffic in the analysis area and surrounding areas is described in EIS Section 3.5.6 (Navigation and Vessel Traffic).
Ambient electromagnetic field (EMF)	The marine environment continuously generates a variable ambient EMF. The motion of electrically conductive seawater interacting with the Earth's magnetic field induces voltage potential, creating an electrical current. Waves, tides, and coastal ocean currents all create weak induced electrical and magnetic field effects. Their magnitude at a given time and location are dependent on the strength of the ambient magnetic field, site and time-specific ocean conditions, and other external factors like electrical storms and solar events. The intensity of the Earth's natural magnetic field in the analysis area is approximately 512 milligauss (mG) to 517 mG at the seabed (National Oceanic and Atmospheric Administration 2018). Waves and currents interacting with the Earth's natural magnetic field can periodically generate variable electrical fields ranging from zero to 150 microvolts per meter (µV/m) and magnetic field effects of 1 to 10 mG, near the water surface, and a 0to 15 µV/m electrical field and 1 mG magnetic field at the sea bed, respectively (Slater et al. 2010; Vinhateiro et al. 2018). While wave-induced field strength is strongest at the water surface, wave action would likely produce detectable EMF effects on the seabed at depths up to 185 feet (Slater et al. 2010). At least seven submarine power and communications cables cross the aquatic component of the portion of the analysis area surrounding the SFEC (National Oceanic and Atmospheric Administration 2011). Electrical telecommunications cables are likely to induce EMF effects on the order of 1 to 6.3 µV/m at 1 m from a typical cable of this type (Gill et al. 2005). This is within the range of the natural electrical field effects. Fiber-optic cables with optical repeaters do not induce measurable electrical fields.	Ambient EMF conditions are further described in the biological assessment (BOEM 2019) and summarized in EIS Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) and Section 3.4.4 (Marine Mammals).

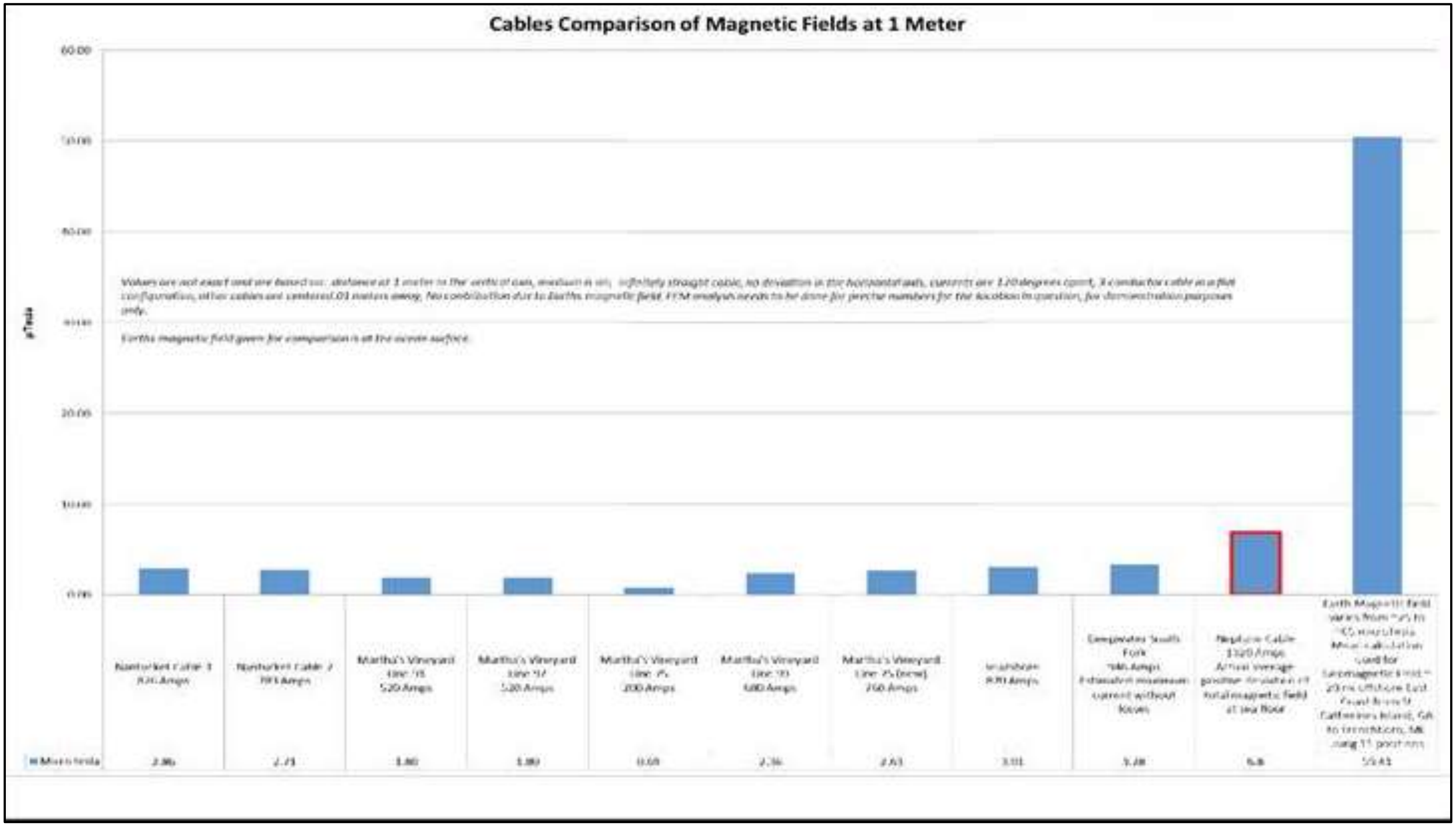

Figure F-7. Comparison of EMF produced by offshore windfarm transmission cables to the earth's background magnetic field.

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APPENDIX G

Environmental Protection Measures, Mitigation, and Monitoring

INTRODUCTION

The *South Fork Wind Farm and South Fork Export Cable Project Draft Environmental Impact Statement* (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of a wind energy project (Project) located in Bureau of Ocean Energy Management's (BOEM's) Renewable Energy Lease Area OCS-A 0517, approximately 18 miles southeast of Block Island, Rhode Island, and 34 miles east of Montauk Point, New York in the Atlantic Ocean. The Project comprises the siting and development of the South Fork Wind Farm (SFWF) and the South Fork Export Cable (SFEC). Deepwater Wind South Fork, LLC (DWSF) is proposing the Project, which is designed to contribute to New York's renewable energy requirements, particularly, the state's goal of 2,400 megawatts of offshore wind energy generation by 2030.

As part of Project, DWSF has committed to self-implement measures to avoid, reduce, mitigate, and/or monitor impacts on the resources discussed in Chapter 3 of the EIS. Said environmental protection measures (EPMs) are summarized in Table G-1 of this appendix. BOEM considers as part of the Proposed Action only those measures that DWSF has committed to in the construction and operations plan (COP) (Jacobs Engineering Group Inc. [Jacobs] 2020). BOEM may select alternatives and/or require additional mitigation or monitoring measures to further protect and monitor these resources. Additional mitigation and monitoring measures may result from reviews under several environmental statutes (Clean Air Act, Endangered Species Act [ESA], Magnuson-Stevens Fisheries Conservation and Management Act, Marine Mammal Protection Act, and National Historic Preservation Act) as discussed in Section 2.1 of the EIS. The mitigation and monitoring measures that DWSF has committed to implement since submission of the February 2020 COP (Jacobs 2020), as well as those that may result from reviews under these statutes, are shown in Table G-2. Please note that not all of these mitigation measures are within BOEM's statutory and regulatory authority but could be adopted and imposed by other governmental entities. Table G-2 provides descriptions of these mitigation or monitoring measures, as well as those that BOEM has identified for analysis in the EIS.

If BOEM decides to approve the COP, its record of decision (ROD) would state which of the mitigation and monitoring measures identified by BOEM in Table G-2 have been adopted, and if not, why they were not. Thus, the ROD would document all terms and conditions of COP approval and would compel compliance with or execution of identified mitigation and monitoring measures (40 Code of Federal Regulations [CFR] 1505.3). DWSF would be required to certify compliance with certain terms and conditions, as required under 30 CFR 585.633(b).

Monitoring measures may be required to evaluate the effectiveness of a mitigation measure or to identify if resources are responding as predicted to impacts from the Proposed Action. Monitoring programs would be developed in coordination between BOEM and agencies with jurisdiction over the resource to be monitored. The information generated by monitoring may be used to 1) adapt how a mitigation measure identified in the COP or ROD is being implemented, 2) develop or modify future mitigation measures for the conceptual decommissioning of the Project or all stages of future projects, and/or 3) contribute to regional efforts intended to gain a better understanding of the impacts and benefits resulting from offshore wind energy projects in the Atlantic (e.g., potential cumulative impact assessment tool). Unless specified, the proposed mitigation and monitoring measures described below would not change the impact ratings on the affected resource, as described in Chapter 3 of the EIS, but would further reduce expected impacts or inform the development of addition mitigation measures if required.

In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (miles used specifically for marine navigation). Statute miles are more commonly used and are referred to simply as *miles*, whereas nautical miles are referred to by name or by their abbreviation *nm*.

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Table G-1. Environmental Protection Measures Proposed by Deepwater Wind South Fork, LLC

Description	Resource Area Mitigated
Vessels providing construction or maintenance services for the SFWF would use low-sulfur fuel where possible.	Air quality
Vessel engines would meet the appropriate U.S. Environmental Protection Agency (EPA) air emission standards for nitrogen oxide emissions when operating within Emission Controls Areas.	Air quality
Equipment and fuel suppliers would provide equipment and fuels that comply with the applicable EPA or equivalent emission standards.	Air quality
Marine engines with a model year of 2007 or later and non-road engines complying with the Tier 3 standards (in 40 Code of Federal Regulations [CFR] 89 or 1039) would be used to satisfy best available control technology.	Air quality
The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.	Air quality
Installation of the SFWF inter-array cable and SFEC offshore would occur using equipment such as a mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method would minimize turbidity and total suspended solids.	Water quality
Vessels would comply with regulatory requirements related to the prevention and control of discharges and accidental spills.	Water quality
Accidental spill or release of oils or other hazardous materials would be managed through the Oil Spill Response Plan (OSRP) (COP Appendix D).	Water quality
At the onshore horizontal directional drilling (HDD) work area for the SFEC, drilling fluids would be managed within a contained system to be collected for reuse as necessary	Water quality
An HDD inadvertent release plan would minimize the potential risks associated with release of drilling fluids or a frac-out.	Water quality
A stormwater pollution prevention plan, including erosion and sedimentation control measures, and a spill prevention, control, and countermeasures plan, would minimize potential impacts to water quality during construction of the SFEC onshore.	Water quality
DWSF has designed the Project to account for site-specific oceanographic and meteorological conditions within the Lease Area; therefore, no additional measures are necessary.	Water quality
Lighting during operations would be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction (or attraction of insect prey) and possibly collision of bats at night.	Bats
SFEC onshore would be located underground in previously disturbed areas, such as roadways and railroad ROW, therefore minimizing potential impacts from clearing.	Bats
A plan for vessels would be developed prior to construction and used to identify no-anchor areas inside the maximum work area (MWA) to protect sensitive habitat or other areas to be avoided.	Benthic habitat, essential fish habitat (EFH), invertebrates, and finfish
The SFWF and SFEC offshore would minimize impacts to complex bottom habitats to the extent practicable.	Benthic habitat, EFH, invertebrates, and finfish
Installation of the SFWF inter-array cable and SFEC offshore would occur using equipment such as a mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method would minimize long-term impacts to the benthic habitat, EFH, invertebrates, and finfish.	Benthic habitat, EFH, invertebrates, and finfish
Use of monopiles with associated scour protection would minimize impacts to benthic habitat compared to other foundation types.	Benthic habitat, EFH, invertebrates, and finfish
The SFWF inter-array cable and SFEC offshore would be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m) to minimize potential impacts from electromagnetic fields.	Benthic habitat, EFH, invertebrates, and finfish
Installation of the offshore sections of the SFEC would use equipment such as a mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method would minimize turbidity and total suspended solids.	Benthic habitat, EFH, invertebrates, and finfish
Use of dynamic positioning vessels for cable installation for the SFWF inter-array cable and SFEC would minimize impacts to benthic habitat, EFH, invertebrates, and finfish as compared to use of a vessel relying on multiple anchors.	Benthic habitat, EFH, invertebrates, and finfish
The SFEC sea-to-shore transition would be installed via HDD to avoid impacts to the dunes, beach, and nearshore zone, including benthic habitat, EFH, invertebrates, and finfish.	Benthic habitat, EFH, invertebrates, and finfish
A plan for vessels would be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.	Benthic habitat, EFH, invertebrates, and finfish
The SFWF and SFEC offshore would minimize impacts to important habitats for finfish species.	Benthic habitat, EFH, invertebrates, and finfish
Site-specific benthic habitat assessments and Atlantic cod spawning surveys informed siting of the SFWF and SFEC offshore.	Benthic habitat, EFH, invertebrates, and finfish
DWSF is committed to collaborative science with commercial and recreational fishing industries; agencies; non-governmental organizations; and marine mammal, sea turtle, and sturgeon scientists to improve and expand the knowledge of these species and their interaction with offshore wind development. All protected species data collected by DWSF during marine construction activities would be provided to the National Marine Fisheries Service (NMFS), BOEM, and other interested government agencies. In addition, the data, upon request, would be made available to educational institutions and environmental groups	Benthic habitat, EFH, invertebrates, and finfish
DWSF would require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.	Benthic habitat, EFH, invertebrates, and finfish
Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Benthic habitat, EFH, invertebrates, and finfish
The SFWF wind turbine generators (WTGs) would be widely spaced apart allowing bird species to avoid individual WTGs and minimize risk of potential collision.	Birds
The location of the SFWF, more than 18 miles (30 kilometers [km], 16 nm) offshore, would avoid the coastal areas, which are known to attract birds, particularly shorebirds and seaducks.	Birds
Lighting during operations would be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction or disorientation.	Birds
DWSF would require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.	Birds
Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Birds
The SFEC sea-to-shore transition would be installed via HDD to avoid impacts to the dunes, beach, and nearshore zone.	Birds
An avian management plan for listed species would be prepared for the SFEC onshore.	Birds
The SFEC onshore cable would be buried, therefore avoiding the risk to birds associated with overhead lines.	Birds
Exclusion and monitoring zones for marine mammals would be established for pile driving and high resolution geophysical (HRG) survey activities.	Marine mammals
Mitigation measures would be implemented for pile-driving and HRG survey activities. These measures would include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and National Oceanic and Atmospheric Administration (NOAA)–approved protected species observers (PSOs), and noise attenuation systems such as bubble curtains, as appropriate. Passive acoustic monitoring (PAM) would be used to support visual monitoring efforts when visibility is limited or when nighttime operations are conducted. PAM operators would serve as acoustic PSOs and would communicate detections to project personnel to ensure the implementation of the appropriate mitigation measure.	Marine mammals
Every monopile installation would begin with a soft start procedure. A soft start procedure is used to allow animals potentially in the exclusion zone (EZ) to detect the presence of the noise-producing activities and to depart the area before full power impact pile-driving activity begins. A soft start of impact pile driving would not begin until the EZ has been cleared by the PSOs (and PAM operators when applicable).	Marine mammals, sea turtles
If a sea turtle or marine mammal is observed entering or within the respective EZ after impact pile driving has commenced, an immediate shut down of pile driving would be implemented unless DWSF and/or its contractor determines shut down is not feasible because of an imminent risk of injury or loss of life to an individual; or risk of damage to a vessel that creates risk of injury or loss of life for individuals. There are two scenarios, approaching pile refusal and pile instability, where this imminent risk could be a factor: (i) If a shut down is called for but DWSF and/or its contractor determines shut down is not feasible because of a risk of injury or loss of life, reduced hammer energy must be implemented. (ii) After a shut down, impact pile driving must only be initiated once all EZs are confirmed by PSOs to be clear of marine mammals and sea turtles for the minimum species-specific time periods.	Marine mammals, sea turtles

Description	Resource Area Mitigated
Impact pile-driving activities would not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right whale (NARW), which would also have a protective effect for other marine mammal species.	Marine mammals
Vessels would follow NOAA guidelines for marine mammal strike avoidance measures, including vessel speed restrictions.	Marine mammals
To mitigate potential impacts of vessel strikes, DWSF would adhere to the following base conditions: Base conditions: Training: All personnel working offshore would receive training on marine mammal, sea turtle, and Atlantic sturgeon awareness. Speed/approach constraints: All vessels would adhere to current NOAA vessel guidelines and regulations in place. Approach constraints: Vessels would maintain, to the extent practicable, separation distances of 500 meters (m) for North Atlantic right whales; 100 m for other whales; and 50 m for dolphins, porpoises, seals, and sea turtles. Monitoring/mitigation: Vessel operators and crew would maintain a vigilant watch for marine mammals and sea turtles, and slow down or maneuver their vessels, as appropriate, to avoid a potential intersection with a marine mammal or sea turtle. Situational awareness/common operating picture: DWSF would establish a situational awareness network for marine mammal and sea turtle detections through the integration of sighting communication tools such as Mysticetus, Whale Alert, Whale Map, etc. Sighting information would be made available to all project vessels through the established network. DWSF's Marine Coordination Center would serve to coordinate and maintain a Common Operating Picture. In addition, systems within the Marine Coordination Center, along with field personnel, would monitor the NMFS North Atlantic right whale reporting systems daily; monitor U.S. Coast Guard (USCG) VHF Channel 16 throughout the day to receive notifications of any sighting; and monitor any existing real-time acoustic networks. In addition to the above base conditions, DWSF would implement a standard plan or an adaptive plan, as presented below. DWSF intends for these plans to be interchangeable and implemented throughout both the construction and operations phases of the Project. Standard plan: Implement base conditions described above. Vessels of all sizes would operate port to port at 10 knots or less between November 1 and April 30, except for vessels while transiting in Narragansett Bay or Long Island Sound, which have not been demonstrated by best available science to provide consistent habitat for North Atlantic right whales. Vessels of all sizes would operate at 10 knots or less in any Dynamic Management Areas (DMAs). Adaptive plan: An adaptive plan would be developed in consultation with NMFS to allow modification of speed restrictions for vessels. Should DWSF chose not to implement this adaptive plan or a component of the adaptive plan is offline (e.g., equipment technical issues), DWSF will default to the standard plan (described above). Proposed measures may include the following: Implement base conditions described above. A semipermanent acoustic network consisting of near real-time bottom-mounted and/or mobile acoustic monitoring platforms would be installed year-round such that confirmed North Atlantic right whale detections are regularly transmitted to a central information portal and disseminated through the situational awareness network. Year-round, if any DMA is established that overlaps with an area where a Project vessel would operate, that vessel regardless of size when entering the DMA, would transit that area at a speed of 10 knots or less unless a trained, dedicated person-on-watch and alternative visual detection system (e.g., thermal cameras) are present. If PAM and/or thermal systems are offline, the standard plan measures would apply for the respective zone (where PAM is offline) or vessel (if thermal systems offline). The transit corridor and wind development area (WDA) would be divided into detection action zones. Localized detections of North Atlantic right whales in an action zone would trigger a slow down to 10 knots or less in the respective zone for the following 12 hours. Each subsequent detection would trigger a 12-hour reset. A zone slow down expires when there has been no further visual or acoustic detection in the past 12 hours within the triggered zone. A trained, dedicated person-on-watch and alternative visual detection system (e.g., thermal cameras) would be stationed during transits on all vessels that intend to operate at greater than 10 knots from November 1 through April 30. The primary role of the person-on-watch is to alert the vessel navigation duties crew to the presence of marine mammals and sea turtles and to report transit activities and protected species sightings to the designated DWSF information system.	Marine mammals, sea turtles
All personnel working offshore would receive training on marine mammal awareness and marine debris awareness.	Marine mammals
DWSF would require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.	Marine mammals
Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Marine mammals
The SFWF inter-array cable and SFEC offshore would be buried to a target depth of 4 to 6 feet.	Marine mammals
The SFEC sea-to-shore transition would be installed via HDD to avoid impacts to the dunes, the beach, and the nearshore zone. SFEC onshore is sited within previously disturbed existing rights-of-way (ROWs).	Terrestrial coastal habitats and fauna
SFEC onshore would be sited within previously disturbed existing ROWs.	Terrestrial coastal habitats and fauna
The SFEC sea-to-shore transition would be installed via HDD to avoid impacts to the dunes, beach, and nearshore zone. Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Terrestrial coastal habitats and fauna
A stormwater pollution prevention plan, including erosion and sedimentation control measures, and a spill prevention, control, and countermeasures plan, would minimize potential impacts to water quality during construction of the SFEC onshore.	Terrestrial coastal habitats and fauna
Exclusion and monitoring zones would be established for sea turtles during pile-driving activities and HRG survey activities.	Sea turtles
Mitigation measures would be implemented for impact pile-driving and HRG survey activities. These measures would include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate. Pile-driving activities would not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the NARW, which would also have a protective effect for sea turtles. PSOs or the vessel crew would record all sea turtles inside and outside designated EZs and would advise operations regarding appropriate mitigation measures. Sea turtle observations would be recorded and reported using digital data recording platforms and applicable electronic reporting systems. The following information would be recorded during each sea turtle observation: Species Life stage (e.g., adult, juvenile, hatchling) Time entered and duration within the EZ (if applicable) Range and bearing at first and last detection Activity and swim speed Closest point of approach to activity	Sea turtles
Vessels would follow NOAA guidelines for sea turtle strike avoidance measures, including vessel speed restrictions.	Sea turtles
All personnel working offshore would receive training on sea turtle awareness and marine debris awareness.	Sea turtles
DWSF would require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.	Sea turtles
Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Sea turtles
The SFWF inter-array cable and SFEC offshore would be buried to a target depth of 4 to 6 feet.	Sea turtles

Description	Resource Area Mitigated
Proposed measures to be implemented for sea turtles during impact pile driving include the following: An EZ of either the SELcum or SPLpk physiological threshold distance (whichever is greater) from the pile would be established. A noise mitigation system (NMS) would be used, and if the NMS extends beyond the EZ, then the EZ would be the extent of the NMS. Two PSOs would conduct watch from the construction vessel and two PSOs would conduct watch from a secondary, dedicated PSO vessel. PSOs would use reticle binoculars and the naked eye during daylight visual conditions; at night and during low-visibility conditions, PSOs would use mounted infrared (IR) cameras and wearable night vision scopes. Prior to and during deployment of an NMS, the area would be surveyed visually for sea turtles that could become entrained in the NMS. NMS placement would be delayed if any sea turtles are present in the area between the NMS and pile. No impact pile driving shall take place if there is a sea turtle detected inside the NMS. Monitoring of the clearance zone would begin 60 minutes prior to the planned start of impact pile driving activities. The clearance zone must be free of sea turtles for 30 minutes, either by PSOs confirming the sea turtles have left the clearance zone or no new sightings in the clearance zone, prior to initiating any pile driving. Soft start would be delayed until sea turtles have been confirmed outside the EZ or 30 minutes have elapsed since the last sighting. If a sea turtle is observed within the EZ, piling would be shut down. Field measurements would be conducted on at least the first pile driven to confirm the range to physiological and behavioral thresholds for sea turtles.	Sea turtles
Proposed measures to be implemented during vibratory pile driving include the following: An EZ equal to the SELcum physiological threshold distance from the sheet pile would be established. Two PSOs would conduct watch from the construction vessel. PSOs would use reticle binoculars and naked eye during daylight visual conditions; at night and during low-visibility conditions, PSOs would use mounted IR cameras and wearable night vision scopes. Monitoring of the clearance zone would begin 60 minutes prior to the planned start of pile driving. The clearance zone must be free of sea turtles for 30 minutes, either by PSOs confirming the sea turtles have left the clearance zone or there are no new sightings in the clearance zone, prior to initiating any vibratory pile driving. Soft start would be delayed until sea turtles have been confirmed outside the EZ or 30 minutes have elapsed since the last sighting. If a sea turtle is observed within the EZ, pile driving would be stopped when practicable. Vibratory pile driving would not recommence until the sea turtle is observed outside the EZ or not re-sighted for 30 minutes.	Sea turtles
DWSF would adhere to Lease stipulations specific to sea turtles, ensuring that vessel operators and crew maintain a vigilant watch for sea turtles and would slow down the vessel to avoid striking these protected species. All vessels would comply with the sea turtle–specific Lease conditions except under extraordinary circumstances when the safety of the vessel or crew are in doubt or the safety of life at sea is in question. DWSF has implemented the sea turtle–specific Lease stipulations for all vessel operations since 2016, year-round, without incident. In addition to the base conditions described under marine mammals, the following protection measures for sea turtles would be implemented for vessel transits: All vessel crew members would be briefed in the identification of sea turtles and in regulations and best practices for avoiding vessel strikes. Reference materials would be available aboard all Project vessels for identification of sea turtles. The expectation and process for the reporting of sea turtles (including live, entangled, and dead individuals) would be clearly communicated and posted in highly visible locations aboard all Project vessels. Crew members conducting watch would be trained to recognize changing sea turtle habitat that could indicate a higher risk of sea turtles (e.g., high jellyfish density, large Sargassum mats). DWSF would ensure all vessels maintain a separation distance of 50 m or greater from any sighted sea turtle. Between June 1 and November 30, a trained, dedicated person-on-watch would watch for sea turtles during vessel transits operating above 10 knots. If a person-on-watch is already in place for North Atlantic right whale monitoring, they would concurrently watch for marine mammals and sea turtles; therefore, an additional person-on-watch is not required for sea turtles. DWSF would establish an internal communication/situational awareness system to record sightings and provide awareness to Project vessels of recent sea turtle sightings in the area. Vessels would avoid, as practicable, transiting through visibly high jellyfish aggregations and Sargassum mats.	Sea turtles
DWSF would adhere to all NMFS reporting requirements in the event of a vessel strike or sighting of a dead or injured sea turtle. If the Project nears a take number threshold of having 80% of the allowable ESA takes, DWSF would alert the appropriate agencies. DWSF would compile and submit draft monthly reports that include a summary of all Project activities carried out in the previous month, including vessel transits and piles installed, and all observations of sea turtles. DWSF would also contribute all recorded sea turtle sightings, as reported, to an agency-approved centralized database in coordination with the monthly reports.	Sea turtles
DWSF is committed to a spacing of approximately 1.15 mile (1.8 km), or one nautical mile (nm), between turbines.	Commercial fisheries and for-hire recreational fishing, navigation and vessel traffic
The inter-array cable and SFEC offshore would be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).	Commercial fisheries and for-hire recreational fishing
The SFEC sea-to-shore transition would be installed via HDD to avoid impacts to the dunes, beach, and nearshore zone, including. sensitive shoreline habitats and shoreline fishing areas.	Commercial fisheries and for-hire recreational fishing
As appropriate and feasible, Best Management Practices would be implemented to minimize impacts on fisheries, as described in the *Guidelines for Providing Information on Fisheries Social and Economic Conditions for Renewable Energy Development* (BOEM 2015).	Commercial fisheries and for-hire recreational fishing
Siting of the SFWF and SFEC offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys.	Commercial fisheries and for-hire recreational fishing
DWSF is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction.	Commercial fisheries and for-hire recreational fishing
Each WTG would be marked and lit with both USCG and approved aviation lighting.	Commercial fisheries and for-hire recreational fishing
DWSF would require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.	Commercial fisheries and for-hire recreational fishing
Accidental spill or release of oils or other hazardous materials would be managed through the OSRP (COP Appendix D).	Commercial fisheries and for-hire recreational fishing
Communications and outreach with the commercial and recreational fishing industries would be guided by the Project-specific Fisheries Communications Plan. This outreach would be led by the DWSF Fisheries Liaisons. Fisheries Representatives from the ports of Montauk, Point Judith, and New Bedford represent the fishing community.	Commercial fisheries and for-hire recreational fishing
A comprehensive communication plan would be implemented 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 USCG).	Commercial fisheries and for-hire recreational fishing
The location of SFWF WTGs, approximately 18 miles from Block Island, 19 miles from Martha's Vineyard, and 34 miles from Montauk, restricts available views from visually sensitive aboveground historic properties.	Cultural resources
SFWF WTGs would have uniform design, speed, height, and rotor diameter.	Cultural resources
The color of the SFWF WTGs (less than 5% gray tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips.	Cultural resources
The SFEC onshore cable would be buried, therefore minimizing potential visual impacts to aboveground historic properties.	Cultural resources
The SFEC interconnection facility would be located adjacent to an existing substation on parcel zoned for commercial and industrial/utility use.	Cultural resources
The SFEC interconnection facility land parcel is currently screened by mature trees. After construction, additional screening would be considered to further reduce potential visibility and noise impact.	Cultural resources
The SFWF and SFEC offshore would avoid or minimize impacts to potential submerged cultural sites, to the extent practicable.	Cultural resources
Native American tribes were involved, and would continue to be involved, in marine survey protocol design, execution of the surveys, and interpretation of the results.	Cultural resources
A plan for vessels would be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. An unanticipated discovery plan would be implemented that would include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.	Cultural resources

Description	Resource Area Mitigated
As appropriate, DWSF would conduct additional archaeological analysis and/or investigation to further assess potential sensitive areas.	Cultural resources
Geophysical and geotechnical (G&G) survey coverage is sufficient to support design changes, if minor refinement of SFWF facility locations is necessary to avoid paleo landforms.	Cultural resources
The route for the SFEC onshore would minimize impacts to, or avoid, potential terrestrial archeological resources, to the extent practicable.	Cultural resources
Native American tribes were involved, and would continue to be involved, in terrestrial survey protocol design, execution of the surveys, and interpretation of the results.	Cultural resources
Analysis shows that most of the SFEC onshore route has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits is minimized.	Cultural resources
An unanticipated discovery plan would be implemented that would include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.	Cultural resources
Where possible, local workers would be hired to meet labor needs for Project construction, O&M, and conceptual decommissioning.	Demographics, employment, and economics
The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers.	Demographics, employment, and economics
The SFEC onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.	Demographics, employment, and economics
At the SFEC interconnection facility, additional screening would be considered to further reduce potential visibility and noise.	Demographics, employment, and economics
New York State Law requires that the SFEC onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.	Demographics, employment, and economics
At the SFEC interconnection facility, additional screening would be considered to further reduce potential visibility and noise.	Land use and coastal infrastructure
New York State Law requires that the SFEC onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.	Land use and coastal infrastructure
New York State Law requires that the SFEC onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.	Land use and coastal infrastructure
DWSF would also coordinate with local authorities during SFEC – Onshore construction to minimize local traffic impacts.	Land use and coastal infrastructure
A comprehensive communication plan would be implemented during offshore construction. DWSF would submit information to the USCG to issue Local Notice to Mariners during offshore installation activities.	Navigation and vessel traffic
The SFWF and SFEC offshore would avoid, to the extent practicable, identified shallow hazards.	Navigation and vessel traffic
Install an operational automatic identification system (AIS) on all vessels associated with the construction and installation, O&M, and conceptual decommissioning of the Project. AIS would be required to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. AIS data would be archived for each calendar year and reported to BOEM annually within 90 days of the end of the preceding calendar year.	Navigation and vessel traffic, marine mammals, sea turtles, commercial fisheries and for-hire recreational fishing
The SFEC onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.	Recreation and tourism
The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers.	Recreation and tourism
A comprehensive communication plan would be implemented 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 Project website, public notices to mariners and vessel float plans, and a fisheries liaison. DWSF would submit information to the USCG to issue Local Notice to Mariners during offshore installation activities.	Recreation and tourism
The communication plan would also include outreach to stakeholders in the offshore recreational and tourism industry to minimize impacts to recreational events (e.g., sailboat races).	Recreation and tourism
New York State Law requires that the SFEC onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.	Recreation and tourism
DWSF would also coordinate with local authorities during SFEC onshore construction to minimize local traffic and noise impacts.	Recreation and tourism
The location of the SFWF, approximately 18 miles from Block Island, 19 miles from Martha's Vineyard, and 34 miles from Montauk, restricts available views from visually sensitive public resources and population centers.	Visual resources
SFWF WTGs would have uniform design, speed, height, and rotor diameter.	Visual resources
The color of the SFWF WTGs (less than 5% gray tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips.	Visual resources
The SFEC interconnection facility would be located adjacent to an existing substation on a parcel zoned for commercial and industrial use.	Visual resources
At the SFEC interconnection facility, additional screening would be considered to further reduce potential visibility and noise.	Visual resources
The SFEC onshore cable would be buried; therefore, minimizing potential impacts to adjacent properties.	Visual resources
The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers.	Visual resources

Table G-2. Potential Additional Mitigation and Monitoring Measures

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction and installation	Tree clearing time-of-year restriction	Require that trees greater than 3 inches (7.6 centimeters) diameter at breast height not be cleared from June 1 to July 31. If presence/probable absence surveys are conducted pursuant to current U.S. Fish and Wildlife Service (USFWS) protocols and no northern long-eared bats are documented, this measure may not be necessary for ESA compliance relative to this species.	Bats
Construction and installation	Nearshore time-of-year restrictions	Require time-of-year restrictions to avoid dredging activities within Lake Montauk during January through May spawning activities of winter flounder.	Benthic habitat, EFH, invertebrates, and finfish
Construction and installation	Onshore time-of-year restrictions	Eliminate onshore construction activities from Memorial Day through Labor Day that would impede traffic or access to recreational areas.	Recreation and tourism
Construction and installation, O&M, and conceptual decommissioning	Bird deterrent devices	Install bird deterrent devices (including painting a turbine blade black [May et al. 2020]) to minimize bird attraction to operating turbines and on the offshore substations (OSSs), where appropriate and where DWSF determines such devices can be employed safely.	Birds
O&M	Avian and bat post-construction monitoring program	A framework for an avian and bat post-construction monitoring program would be developed and implemented in coordination with applicable federal and state resource agencies (see Appendix F for details). The framework would include the following, at a minimum: Acoustic monitoring for birds and bats Installation of Motus receivers on wind turbine generators (WTGs) in the wind development area (WDA) and support with upgrades or maintenance of two onshore Motus receivers Deployment of up to 150 Motus tags per year for up to 3 years to track roseate terns, common terns, and/or nocturnal passerine migrants Pre- and post-construction boat surveys Avian behavior point count surveys at individual WTGs Annual monitoring reports that would be used to assess the need for reasonable revisions to the monitoring plan	Birds, bats

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M, and conceptual decommissioning	Annual bird mortality reporting	Require an annual report of any dead or injured birds discovered on Project vessels or structures. The report would contain the following information: species, photographs to confirm species, location, date, and other relevant information. Carcasses with federal or research bands must be reported to the U.S. Geological Survey Bird Band Laboratory, BOEM, and USFWS.	Birds
O&M	Aircraft Detection Lighting System (ADLS)	Require use of Federal Aviation Administration (FAA)–approved ADLS, which would only activate the FAA hazard lighting when an aircraft is in the vicinity of the wind facility, to reduce the visibility of nighttime lighting and thus reduce nighttime visual impacts.	Birds, cultural resources, recreation and tourism
Construction and installation, O&M, conceptual decommissioning	Anchoring plan	Require an anchoring plan for all areas where anchoring is being used to avoid construction impacts on sensitive habitats, including hard bottom and structurally complex habitats. Require that DWSF consider any new data on benthic habitats (Measure #16) to avoid/minimize impacts on benthic habitat. The anchoring plan should include the planned location of anchoring activities, sensitive habitats and locations, seabed features, potential hazards, and any related facility installation activities such as cables, WTGs, and OSSs, as appropriate. Require all vessels deploying anchors to use, whenever feasible and safe, mid-line anchor buoys to reduce the amount of anchor chain or line that touches the seafloor. The anchoring plan must be provided for BOEM and NOAA review and comment before construction begins.	Benthic habitat, EFH, invertebrates, and finfish
O&M	Post-installation cable monitoring	DWSF must provide BOEM with a cable monitoring report within 45 calendar days following each inter-array and export cable inspection to determine cable location, burial depths, state of the cable, and site conditions. An inspection of the inter-array cable and export cable is expected to include HRG methods, such as a multi-beam bathymetric survey equipment, and identify seabed features, natural and man-made hazards, and site conditions along federal sections of the cable routing. In federal waters, the initial inter-array and export cable inspection would be carried out within 6 months of commissioning and subsequent inspections would be carried out at years 1, 2, and every 3 thereafter and after a major storm event. Major storm events are defined as when metocean conditions at the facility meet or exceed the 1 in 50-year return period calculated in the metocean design basis, to be submitted to BOEM with the Facility Design Report (FDR). If conditions warrant adjustment to the frequency of inspections following the Year 2 survey, a revised monitoring plan may be provided to BOEM for review. In addition to inspection, the export cable would be monitored continuously with the as-built Distributed Temperature Sensing System. If Distributed Temperature Sensing data indicate that burial conditions have deteriorated or changed significantly and remedial actions are warranted, the Distributed Temperature Sensing data, a seabed stability analysis, and report of remedial actions taken or scheduled must be provided to BOEM within 45 calendar days of the observations. The Distributed Temperature Sensing data, cable monitoring survey data, and cable conditions analysis for each year must be provided to BOEM as part of the Annual Compliance Reports, required by 30 CFR § 585.633(b).	Benthic habitat, EFH, invertebrates, and finfish; commercial fisheries and for-hire recreational fishing
Construction, O&M	Monitoring and minimizing foundation scour protection	DWSF would conduct post-construction monitoring to document habitat disturbance and recovery and inspection of scour protection and monitoring of performance at 20% of locations every 3 years starting year 3 (see also benthic habitat monitoring plan). Require that DWSF consult with NMFS and BOEM prior to conducting monitoring and address any agency comments prior to implementation. As appropriate, based on Project design and engineering, DWSF would apply foundation scour protection to only the minimum area needed for sufficient protection.	Benthic habitat, EFH, invertebrates, and finfish
Construction	Pile-driving sound source verification plan	To ensure that the required 10 dB (decibel) re: 1 micropascal (μPa) noise attenuation is met, field verification during pile driving would be conducted. A Sound Source Verification Plan would be submitted to the U.S. Army Corps of Engineers (USACE), BOEM at renewable_reporting@boem.gov, and NMFS at incidental.take@noaa.gov for review 90 days prior to the commencement of field activities for pile driving. Sound source verification must be carried out for the first two monopiles and first two jacket foundations to be installed. Should larger diameter piles be installed, or greater hammer size or energy used, additional field measurements must be conducted. The plan must describe how DWSF would ensure that the location selected is representative of the rest of the piles of that type to be installed and, in the case that it is not, how additional sites would be selected for sound source verification or how the results from the first pile can be used to predict actual installation noise propagation for subsequent piles. The plan must describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. The plan must be sufficient to document sound propagation from the pile and distances to isopleths for potential injury and harassment. The measurements must be compared to the Level A and Level B harassment zones for marine mammals (and the injury and behavioral disturbance zones for sea turtles and Atlantic sturgeon). The plan must describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. To ensure an average of 10 dB re: 1 μPa noise attenuation across all frequencies, field verification during pile driving must be conducted for each different combination of foundation, pile diameter, and hammer type if different hammers are used. For all measurements, a measurement with a sound reduction system and an attenuated measurement must both occur. No additional piles can be driven until the results of the sound source verification and sound attenuation evaluation are reviewed by NMFS and BOEM. If necessary, secondary noise reduction technology must be deployed to achieve the required noise attenuation.	Benthic habitat, EFH, invertebrates, and finfish; marine mammals; sea turtles
Construction	Pile-driving time-of-year restriction	No pile-driving activities would occur from January 1 to April 30.	Marine mammals
Construction	Pile-driving weather and time restrictions	To minimize the effects of sun glare on visibility, no pile driving may begin until at least 1 hour after (civil) sunrise to ensure effective visual monitoring can be accomplished in all directions. To minimize the effects of sun glare on visibility and to minimize the potential for pile driving to continue after sunset when visibility would be impaired, no pile driving may begin within 1.5 hours of (civil) sunset. Pile driving must only commence when all exclusion zones (EZs) are fully visible (i.e., are not obscured by darkness, rain, fog, etc.) for at least 30 minutes. If conditions (e.g., darkness, rain, fog, etc.) prevent the visual detection of marine mammals in the EZs, construction activities must not be initiated until the full extent of all EZs are fully visible. The lead protected species observer (PSO) would make a determination as to when there is sufficient light to ensure effective visual monitoring can be accomplished in all directions. DWSF must develop and implement measures for enhanced monitoring in the event that poor visibility conditions unexpectedly arise and pile driving cannot be stopped due to safety or operational feasibility. DWSF must prepare and submit an Alternative Monitoring Plan to NMFS and BOEM for NMFS review and approval at least 90 days prior to the planned start of pile driving. This plan may include deploying additional observers, alternative monitoring technologies (i.e., night vision, thermal, infrared), and/or use of passive acoustic monitoring (PAM) with the goal of ensuring the ability to maintain all EZs for all ESA-listed species in the event of unexpected poor visibility conditions.	Marine mammals, sea turtles
Construction	Pile-driving monitoring plan and PSO requirements	A pile-driving monitoring plan must be submitted to BOEM and NMFS for review and approval a minimum of 90 days prior to the commencement of pile-driving activities. The plan must: Contain information on the visual and PAM components of the monitoring plan; Ensure that the full extent of the harassment distances from piles are monitored for marine mammals and sea turtles to ensure that all potential take is documented; Include number of PSOs and Native American monitors that would be used, the platforms and/or vessels upon which they would be deployed, and contact information for the PSO provider(s); and Include measures for enhanced monitoring capabilities in the event that poor visibility conditions unexpectedly arise, and pile driving cannot be stopped. The plan may also include deploying additional observers, use of night vision goggles, or use of PAM with the goal of ensuring the ability to maintain all EZs in the event of unexpected poor visibility conditions. A communication plan detailing the chain of command, mode of communication, and decision authority must be described. PSOs must be previously approved by NMFS to conduct mitigation and monitoring duties for pile-driving activity. An adequate number of PSOs must be used to adequately monitor the area of the EZ. The size of the EZ may vary with specific time-of-year requirements for North Atlantic right whales (NARWs) and should be described in the plan.	Marine mammals

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction	Pile-driving monitoring plan and PSO reporting requirements for sea turtles	A pile-driving monitoring plan must be submitted to BOEM and NMFS for review and approval a minimum of 90 days prior to the commencement of pile-driving activities. The plan must: Ensure that the full extent of the harassment distances (175 dB foot mean square [RMS]) from piles are monitored for sea turtles to ensure that all potential take is documented; Include (1,640 feet [500 m]) EZs and EZ modification protocols and approvals required; Include number of PSOs and Native American monitors that would be used, the platforms and/or vessels upon which they would be deployed, and contact information for the PSO provider(s); and Include measures for enhanced monitoring capabilities in the event that poor visibility conditions unexpectedly arise, and pile driving cannot be stopped. The plan may also include deploying additional observers, use of night vision goggles with the goal of ensuring the ability to maintain all EZs in the event of unexpected poor visibility conditions. A communication plan detailing the chain of command, mode of communication, and decision authority must be described. PSOs must be previously approved by NMFS to conduct mitigation and monitoring duties for pile-driving activity. An adequate number of PSOs must be used to adequately monitor the area of the EZ. Daily PSO forms including electronic effort, survey, and sightings forms, must be submitted to BOEM at renewable_reporting@boem.gov monthly on the 15th day of each month for the previous calendar month of activities. Required data and reports may be archived, analyzed, published, and disseminated by BOEM.	Benthic habitat, EFH, invertebrates, and finfish; sea turtles
Construction	Pile-driving noise reporting and clearance zone adjustment	Before driving any additional piles following underwater noise measurements, DWSF must review the initial field measurement results and make any necessary adjustments to the sound attenuation system and/or the exclusion or monitoring zones as detailed below. If the initial field measurements indicate that the isopleths of concern are larger than those considered, in coordination with BOEM, NMFS, and USACE, DWSF must ensure that additional sound attenuation measures are put in place before additional piles are installed. Additionally, the exclusion and monitoring zones must be expanded to match the actual distances to the isopleths of concern. If the EZs are expanded beyond 4,921.3 feet (1,500 m), additional observers must be deployed on additional platforms, with each observer responsible for maintaining watch in no more than 180 degrees an area with a radius no greater than 0.93 mile (1.5 kilometers [km]). The EZs established in the Proposed Action must be considered minimum EZs and may not be reduced based on sound source verification results. DWSF must provide the initial results of the field measurements to NMFS, USACE, and BOEM as soon as they are available; NMFS, USACE, and BOEM would discuss these as soon as feasible with a target for that discussion within two business days of receiving the results. BOEM and NMFS would provide direction to DWSF on whether any additional modifications to the sound attenuation system or changes to the exclusion or monitoring zones are required. BOEM must also discuss with NMFS the potential need for re-initiation of consultation if appropriate.	Sea turtles
Construction	Pile-driving EZs (no-go zones) for sea turtles	To ensure that pile-driving operations are carried out in a way that minimizes the exposure of listed sea turtles to noise that may result in injury or behavioral disturbance, PSOs would establish a 1,640.4-foot (500-m) EZ for all pile-driving activities.	Sea turtles
Construction	Protocol when marine mammals are sighted during pre-pile driving exclusion	If a marine mammal is observed entering or within the relevant EZs prior to the initiation of pile-driving activity, pile-driving activity must be delayed (unless activities must proceed for human safety or installation feasibility) until the animal is verified to have voluntarily left and heading away from the exclusion area; or when 30 minutes have elapsed without re-detection (for mysticetes, sperm whales, Risso's dolphins and pilot whales); or 15 minutes have elapsed without re-detection of other marine mammals.	Marine mammals
Construction	Enhanced time-of-year pile-driving shut-down and restart procedures for NARWs (May 1 to May 14 and November 31 to December 30)	Should a NARW be observed/detected within the EZ, pile-driving activities must stop (unless activities must proceed for human safety or installation feasibility concerns) and may not resume until the following day, or until a follow-up aerial or vessel-based survey is able to confirm all NARW(s) have departed the 6.2-mile (10-km) extended EZ, as determined by the lead PSO after a full day of monitoring to confirm NARW(s) have left the 6.21-mile (10-km) EZ (May 1 to 14); confirmation that all NARW(s) have left the 6.21-mile (10-km) EZ (November 1 to December 31); or confirmation that all of NARW(s) have left the 0.62-mile (1-km) EZ after 60 minutes of monitoring (May 15 to October 31).	Marine mammals
Construction	Submittal of raw field data collection of marine mammals and sea turtles in the pile-driving EZ	All marine mammals and sea turtles in the EZ that result in a shut down or a power down must be submitted to BOEM within 24 hours at renewable_reporting@boem.gov. The data report, which is the raw data collected in the field, must be submitted by the PSO provider and include the daily form, including the date, time, species, pile identification number, GPS coordinates, time and distance of the animal when sighted, time the shut down or power down occurred, behavior of the animal, direction of travel, time the animal left the EZ, time the pile driver was restarted or powered back up, and any photographs that may have been taken.	Marine mammals, sea turtles

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M	PSO and reporting requirements for pile driving	PSOs must be previously approved by NMFS to conduct mitigation and monitoring duties for pile-driving activity. An adequate number of PSOs must be used to adequately monitor the area of the EZ. Daily PSO forms including electronic effort, survey, and sightings forms, must be submitted to BOEM at renewable_reporting@boem.gov monthly on the 15th day of each month for the previous calendar month of activities. Required data and reports may be archived, analyzed, published, and disseminated by BOEM. **Detection Information for Protected Species** Date (YYYY-MM-DD) Sighting ID (V01, V02 or sequential sighting number for that day) (multiple sightings of same animal or group should use the same ID) Date and Time at first detection in Coordinated Universal Time (UTC) (YY-MM-DDT HH:MM) Time at last detection in UTC (YY-MM-DDT HH:MM) PSO Name(s) (Last, First) Effort (On=source on; Off = source off) Latitude (decimal degrees dd.ddddd), Longitude (decimal degrees dd.ddddd) Compass heading of vessel (degrees) Water depth (meters) Swell height (meters) Beaufort scale Precipitation Visibility (km) Cloud coverage (%) Glare Sightings including common name, scientific name, or family Certainty of identification Number of adults Number of juveniles Total number of animals Bearing to animal(s) when first detected (ship heading + clock face) Range from vessel (reticle distance in meters) Description (include features such as overall size; shape of head; color and pattern; size, shape, and position of dorsal fin; height, direction, and shape of blow, etc.) Detection narrative (note behavior, especially changes in relation to survey activity and distance from source vessel) Direction of travel / first approach (relative to vessel) Behaviors observed: Indicate behaviors and behavioral changes observed in sequential order (use behavioral codes) If any bow-riding behavior observed, record total duration during detection (HH:MM) Initial heading of animal(s) (degrees) Final heading of animal(s) (degrees) Source activity at initial detection Source activity at final detection (on or off) EZ size during detection (meters) Was the animal inside the EZ? Closest distance to vessel (reticle distance in meters) Time at closest approach (UTC HH:MM) Time animal entered EZ (UTC HH:MM) Time animal left EZ (UTC HH:MM) If observed/detected during ramp up / power up: First distance (reticle distance in meters). Closest distance (reticle distance in meters), Last distance (reticle distance in meters), Behavior at final detection Shut-down or power-down occurrences Detections with PAM **Monitoring Effort Information for Pile Driving** Date Effort (ON=source on; OFF= source off) If visual, how many PSOs on watch at one time? PSOs (Last, First) Start time of observations End time of observations Duration of visual observation Wind Speed (knots), from direction Beaufort scale Swell (meters) Water depth (meters) Visibility (km) Glare severity Block name and number Location: Latitude and Longitude	Marine mammals, sea turtles
Construction, O&M, decommissioning	Injured/protected species reporting	Any potential takes, strikes, or dead/injured protected species regardless of the cause, should be reported immediately to NMFS Protected Resources Division, incidental.take@noaa.gov; NOAA Fisheries 24-hour Stranding Hotline number (866-755-6622); and BOEM at renewable_reporting@boem.gov. In the event that an injured or dead marine mammal or sea turtle is sighted, DWSF must report the incident to NMFS Protected Resources Division, incidental.take@noaa.gov and NOAA Fisheries 24-hour Stranding Hotline number (866-755-6622) as soon as feasible, but no later than 24 hours from the sighting. The report must include the following information: (1) time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable); (2) species identification (if known) or description of the animal(s) involved; (3) condition of the animal(s) (including carcass condition if the animal is dead); (4) observed behaviors of the animal(s), if alive; (5) if available, photographs or video footage of the animal(s); and (6) general circumstances under which the animal was discovered. Staff responding to the hotline call would provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles. In the event of a suspected or confirmed vessel strike of a sea turtle by any project vessel, DWSF must report the incident to NMFS Protected Resources Division, incidental.take@noaa.gov; NOAA Fisheries 24-hour Stranding Hotline (866-755-6622); and BOEM at renewable_reporting@boem.gov as soon as feasible. The report must include the following information: (1) time, date, and location (latitude/longitude) of the incident; (2) species identification (if known) or description of the animal(s) involved; (c) vessel's speed during and leading up to the incident; (4) vessel's course/heading and what operations were being conducted (if applicable); (5) status of all sound sources in use; (6) description of avoidance measures/ requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike; (7) environmental conditions (e.g., wind speed and direction, Beaufort scale, cloud cover, visibility) immediately preceding the strike; (8) estimated size and length of animal that was struck; (9) description of the behavior of the animal immediately preceding and following the strike; (11) estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and (12) to the extent practicable, photographs or video footage of the animal(s). In addition, any occurrence of dead non-ESA-listed fish of 10 or more individual fish within established exclusion and/or monitoring zones must also be reported to BOEM at renewable_reporting@boem.gov as soon as feasible.	Benthic habitat, EFH, invertebrates, and finfish; marine mammals; sea turtles
Construction, O&M	Marine debris awareness and elimination	Marine debris is defined by the Bureau of Safety and Environmental Enforcement (BSEE) as any object or fragment of wood, metal, glass, rubber, plastic, cloth, paper, or any other manmade item or material that is lost or discarded in the marine environment. DWSF must ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the COP are briefed on marine debris prevention. BOEM must ensure that DWSF employees and contractors receive training to understand and implement best practices to ensure that debris is not intentionally or accidentally discharged into coastal or marine environments. Training must occur for all employees and contract personnel on the proper storage and disposal practices at-sea to reduce the likelihood of accidental discharge of marine debris at all at-sea and dockside operations that can impact protected species through entanglement or incidental ingestion. Training must include the environmental and socioeconomic impacts associated with marine trash and debris, as well as their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into coastal and marine environments. In the event that any materials unexpectedly enter the water, personnel must follow best practices to recover it if conditions are safe to do so, or notify the appropriate officials if conditions are unsafe. Briefing materials on marine debris awareness, prevention, and protected species are available at https://www.bsee.gov/debris	Marine mammals, sea turtles

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction	EZs (no-go zones) for marine mammals	Reduce impact on marine mammals through the use of continuous PAM, visual monitoring by PSOs, and Native American monitors during pile-driving activities following standard protocols and data collection requirements specified by BOEM. PSOs would establish the following EZs for NARWs 60 minutes prior to pile-driving activities through 30 minutes post-completion of pile-driving activity: At all times of year that pile driving takes place, for purposes of monitoring the EZ, any large whale sighted by a PSO within 3,281 feet (1,000 m [a NARW EZ]) that cannot be identified to species must be treated as if it were a NARW. Additionally, a NARW observation at any distance from the pile must be treated as an observation within the EZ and trigger any required delays or shut downs in pile installation. From November 1 to December 31 and May 1 to May 14, establish a 6.21-mile (10-km) EZ for NARWs (DWSF has the option to use aerial or vessel-based surveys from May 1 to May 14). For any piles driven May 15 to May 31, the EZ must be extended from 3,281 feet (1,000 m) to 6,562 feet (21,578 m) for monopiles and 5,249 feet (1,600 m) for jacket (i.e., half the distance to the Level B threshold) to minimize the extent of any take of NARWs. From May 15 to May 31, establish a 6,562-foot (2-km) clearance zone for monopiles and a 5,249-foot (1.6-km) clearance zone for jackets. For any pile driving June 1 to October 31, establish a 5,249-foot (1-km) clearance zone with the exception as follows. Where the predicted Level B harassment zone would overlap with a DMA or Right Whale Slow Zone, the EZ must be extended from 3,281 feet to 6,562 feet (1,000 to 2,000 m) for monopiles and 5,249 feet (1,600 m) for jacket piles (i.e., half the distance to the Level B threshold) to minimize the extent of any take of NARWs. For all pile-driving activity, DWSF must designate clearance zones with radial distances as follows: All other mysticete whales (including humpback, fin, sei, and minke whale): 1,649-foot (500-m) EZ at all times; harbor porpoise: 394-foot (120-m) EZ at all times; and all other marine mammals not listed above (including dolphin and pinnipeds): 164-foot (50-m) EZ at all times. Monitoring for marine mammals must occur over the entire Level B distance for all marine mammals to document impacts and any potential take.	Marine mammals
Construction	NARW PAM monitoring	A PAM plan describing all equipment, procedures, and protocols must be prepared and submitted to BOEM and NMFS at least 90 days prior to initiation of pile-driving activities. The PAM system must be designed such that detection capability extends to 6.21 miles (10 km) from the pile-driving location. The PAM operator has at least 75 percent confidence that a vocalization originated from a right whale located within 6.21 miles (10 km) of the pile-driving location to inform any decision regarding the presence of NARWs in the EZ. DWSF must continue to deploy the PAM system that is in place for May 1- May 14 through May 31 and implement an extended PAM monitoring zone of 6.21 miles (10 km) around any pile to be driven with all detections of right whales provided to the visual PSO to increase situational awareness and to be considered as pile driving is planned. At all times of year that pile driving takes place, any PAM detection of a right whale within the clearance/EZ (May 1–May 14: radius 6.2 miles [10,000 m]; May 15–May 31: 1.24 miles [2,000 m] for monopiles, 1 mile [1,600 m] for jacket; June 1–October 31: radius 0.62 miles [1,000 m] with the exceptions noted below; November 1–December 31: radius 6.2 miles [10,000 m]) surrounding a pile must be treated the same as a visual observation and trigger any required delays in pile installation. Between June 1 and October 31, if a DMA or Right Whale Slow Zone is designated that overlaps with a predicted Level B harassment zone (monopile foundation: 13,520 feet [4,121 m], jacket foundation: 10,564 feet [3,220 m]) from a pile to be installed, the PAM system in place during this period must be extended to the largest practicable detection zone to increase situational awareness of the visual PSOs and for purposes of planning pile installation. At all times of year any visual or PAM detection in the seasonal EZs must be treated the same as a visual observation and trigger any required delays or shut downs in pile installation.	Marine mammals
Construction	Protocols for shut down and power down when marine mammals are sighted during pile driving	If a marine mammal is observed entering or within the relevant exclusion during pile driving, the hammer must be shut down (unless activities must proceed for human safety or installation feasibility) until: The animal is verified to have voluntarily left and heading away from the exclusion area; or When 30 minutes have elapsed without re-detection (for mysticetes, sperm whales, Risso's dolphins, and pilot whales); or 15 minutes have elapsed without re-detection of other marine mammals; or Enhanced time-of-year NARW protocols are followed. If shut down is called for but DWSF determines shut down is not technically feasible due to human safety concerns or to maintain installation feasibility, reduced hammer energy must be implemented, when the lead engineer determines it is technically feasible.	Marine mammals

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction	Weekly and monthly pile-driving reports	During the pile driving/construction period, DWSF must compile and submit weekly reports that document start and stop of all pile driving daily, the start and stop of associated observation periods by the PSOs, details on the deployment of PSOs, and a record of all observations of marine mammals and sea turtles. These weekly reports must be submitted by the POS providers to BOEM at renewable_reporting@boem.gov and NMFS at incidental.take@noaa.gov and can consist of raw data. Weekly reports are due on Wednesday for the previous week (Sunday–Saturday). Required data and reports may be archived, analyzed, published, and disseminated by BOEM. PSO data must be reported weekly (Sunday through Saturday) from the start of visual and/or PAM effort during construction activities, and every week thereafter until the final reporting period. Weekly reports are due on Wednesday for the previous week. Any editing, review, and quality assurance checks must only be completed by the PSO provider prior to submission. Monthly summary reports must be submitted by the DWSF in coordination with PSO providers as needed. Qualified PSOs must monitor watch zones and EZs when using geological and geophysical equipment that may adversely affect protected species. **Reporting Instructions** DWSF must submit a monthly summary report of construction activities on the 15th of each month including summaries of pile driving, vessel operations (including port departures, number, type of vessel, and route), protected species sightings, vessel strike-avoidance measures taken, and any shut downs or takes that may have potentially occurred. DWSF must require PSO providers to submit PSO data in Excel format every 7 days. Data must be collected in accordance with standard reporting forms, software tools, or electronic data forms approved by BOEM for the particular activity. Forms must be filled out for each vessel with PSOs aboard. Do not use NA for unfilled cells; leave them empty. Submit report in Word and Excel formats (do not submit a pdf). All dates must be entered as YYYY-MM-DD. All times must be entered in 24 Hour UTC as HH:MM. Please note that new entries should be made on the Effort form each time a pile segment or weather conditions change, and at least once an hour as a minimum. Both weekly and monthly reports must be submitted to BOEM at renewable_reporting@boem.gov. Always check forms for completeness and resolve any problems before submittal. Name the file: Lease#_ ProjectName_PSOData_YearMonthDay to YearMonthDay.xls. The following Project, Operations, Detection, and Effort data fields required to be reported in Excel format as weekly reports during construction. These data may be generated through software applications or otherwise recorded electronically by PSOs. Applications developed to record PSO data are encouraged as long as the data fields listed below can be recorded and exported to Excel. Alternatively, BOEM has developed an Excel spreadsheet with all the necessary data fields that is available upon request. **Project Information for Pile Driving** Project Name Lease Number State Coastal Zones PSO Contractor(s) Vessel Name(s) Reporting dates Sound sources including hammer type(s) and power levels used Visual monitoring equipment used (e.g., bionics, magnification, IR cameras, etc.) Distance finding method used PSO names and training Observation height above sea surface **Operations Information for Pile Driving** Date Hammer type (make and model) Greatest hammer power used for each pile Pile identifier and pile number for the day (e.g., pile 2 of 3 for the day) Pile diameters Pile length Pile locations (latitude and longitude) Time pre-exclusion visual monitoring began in UTC (HH:MM) Time pre-exclusion monitoring ended in UTC (HH:MM) Time pre-exclusion PAM monitoring began in UTC (HH:MM) Time PAM monitoring ended in UTC (HH:MM) Duration of pre-exclusion and PAM visual monitoring Time power up/ramp up began Time equipment full power was reached Duration of power up/ramp up Time pile driving began (hammer on) Time pile-driving activity ended (hammer off) Duration of activity Did a shut down/power down occur? Time shut down was called for (UTC) Time equipment was shut down (UTC) Record any habitat or prey observations Record any marine debris sighted	Marine mammals, sea turtles

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M	Monthly reporting for protected species	The following data fields for geological and geophysical surveys are required to be reported in Excel format. Monthly reporting of survey activities must be submitted by the PSO provider on the 15th of each month for each vessel until the last reporting period for a survey. Any editing, review, and quality assurance checks must only be completed by the PSO provider prior to submission. These data may be generated through software applications or otherwise recorded electronically by PSOs. Applications developed to record PSO data are encouraged as long as the data fields listed below can be recorded and exported to Excel. Alternatively, BOEM has developed an Excel spreadsheet with all the necessary data fields that is available upon request. Final reports should be submitted by DWSF in coordination with PSO Providers 90 days following completion of a survey. Final reports must contain departure and return ports, PSO names and training certifications, the PSO provider contact information, dates of the survey, a vessel track, a summary of all PSO sightings, shut downs that occurred, vessel strike-avoidance measures taken, takes that occurred, and any injured or dead protected species that were observed. PSOs must be approved by NMFS prior to the start of a survey. Application requirements to become a NMFS-approved PSO for geological and geophysical surveys can be obtained by sending an inquiry to nmfs.psoreview@noaa.gov. PSO names and training must be provided in all reports and DWSF must provide to BOEM, upon request, documentation of NMFS approval for individual PSOs. **Project Information for Surveys** Project Name Lease Number State Coastal Zones Survey Contractor Vessel Name Survey Type (typically HRG) Reporting start and end dates Sound sources including equipment type, power level, and frequencies used Greatest RMS source level Visual monitoring equipment used (e.g., bionics, magnification, IR cameras, etc.) Distance finding method used PSO names and training Observation height above sea surface Operations Information for Surveys Date Time pre-exclusion visual monitoring began in UTC (HH:MM) Time pre-exclusion monitoring ended in UTC (HH:MM) Duration of pre-exclusion visual monitoring Was pre-exclusion conducted during day or night? Time power up/ramp up began Time equipment full power was reached Duration of power up/ramp up Time survey activity began (equipment on) Time survey activity ended (equipment off) Duration of activity Did a shut down/power down occur? Time shut down was called for (UTC) Time equipment was shut down (UTC) Vessel positions must be logged every 30 seconds Record any habitat or prey observations Record any marine debris sighted Detection Information for Protected Species Date (YYYY-MM-DD) Sighting ID (V01, V02, or sequential sighting number for that day; multiple sightings of same animal or group should use the same ID) Date and Time at first detection in UTC (YY-MM-DDT HH:MM) Time at last detection in UTC (YY-MM-DDT HH:MM) PSO Name(s) (Last, First) Effort (On=source on; Off = source off) Latitude (decimal degrees dd.ddddd), Longitude (decimal degrees dd.ddddd) Compass heading of vessel (degrees) Water depth (meters) Swell height (meters) Beaufort scale Precipitation Visibility (km) Cloud coverage (%) Glare Sightings including common name, scientific name, or Family Certainty of identification Number of adults Number of juveniles Total number of animals Bearing to animal(s) when first detected (ship heading + clock face) Range from vessel (reticle distance in meters) Description (include features such as overall size; shape of head; color and pattern; size, shape, and position of dorsal fin; height, direction, and shape of blow, etc.) Detection narrative (note behavior, especially changes in relation to survey activity and distance from source vessel) Direction of travel/first approach (relative to vessel) Behaviors Observed: Indicate behaviors and behavioral changes observed in sequential order. If any bow-riding behavior observed, record total duration during detection (HH:MM) Initial heading of animal(s) (degrees) Final heading of animal(s) (degrees) Source activity at initial detection Source activity at final detection (on or off) EZ size during detection (meters) Was the animal inside the EZ? Closest distance to vessel (reticle distance in meters) Time at closest approach (UTC HH:MM) Time animal entered EZ (UTC HH:MM) Time animal left EZ (UTC HH:MM) If observed/detected during ramp up/power up: first distance (reticle distance in meters), closest distance (reticle distance in meters), last distance (reticle distance in meters), behavior at final detection Shut down or power down? Detected with IR? (Y/N) Monitoring Effort Information for Surveys Date Effort (ON=source on; OFF= source off) If visual, how many PSOs on watch at one time? PSOs (Last, First) Start time of observations End time of observations Duration of visual observation Wind speed (knots), from direction Beaufort scale Swell (meters) Water depth (meters) Visibility (km) Glare severity Block name and number Location: Latitude and Longitude	Marine mammals, sea turtles

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M, decommissioning	PSO training requirements	PSOs must be provided by a third-party provider. PSOs must have no tasks other than to conduct observational effort, collect and report data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements (including brief alerts regarding maritime hazards). PSOs and/or PAM operators must have completed a commercial PSO training program for the Atlantic with an overall examination score of 80% or greater (Baker et. al 2013). Training certificates for individual PSOs must be provided to BOEM upon request. PSOs and PAM operators must be approved by NMFS prior to the start of a survey. Application requirements to become a NMFS-approved PSO for construction activities can be found at https://www.fisheries.noaa.gov/new-england-mid-atlantic/careers-and-opportunities/protected-species-observers or for geological and geophysical surveys by sending an inquiry to nmfs.psoreview@noaa.gov. DWSF must provide to BOEM upon request, documentation of NMFS approval for individual PSOs. For each shift, one PSO must be designated as lead observer or monitoring coordinator. The lead observer must have approval from NMFS to be a lead or unconditional PSO. PSOs on duty must be clearly listed on daily data logs for each shift. A sufficient number of PSOs, consistent with the NMFS BO (NMFS 2020) and as prescribed in the final IHA, must be deployed to record data in real time and effectively monitor the affected area for the Project, including visual surveys in all directions around a pile, PAM, and continuous monitoring of sighted right whales in the area to meet the number of PSOs required for enhanced seasonal monitoring requirements. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not work for more than 12 hours in any 24-hour period (NMFS 2013) unless an alternative schedule is approved by BOEM. Visual monitoring must occur from the most appropriate vantage point on the associated operational platforms that allows for 360-degree visual coverage around a vessel. DWSF must ensure that suitable equipment is available to PSOs including binoculars, range-finding equipment, a digital camera, and electronic data recording devices (e.g., a tablet) to adequately monitor the distance of the watch zone and EZ, to determine the distance to protected species during surveys, to record sightings and verify species identification, and to record data. Observations must be conducted while free from distractions and in a consistent, systematic, and diligent manner.	Marine mammals
Construction, O&M, decommissioning	Vessel crew training requirements	Project-specific training must be conducted for all vessel crew prior to the start of in-water construction activities. Confirmation of the training and understanding of the requirements must be documented on a training course log sheet. The log sheets must be provided to BOEM upon request. All vessel crewmembers must be briefed in the identification of sea turtles and marine mammals and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of sea turtles and marine mammals. The expectation and process for reporting of sea turtles and marine mammals (including live, entangled, and dead individuals) must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.	Marine mammals, sea turtles
Construction	Daily pre-construction surveys	PAM and visual surveys must be conducted each day before pile driving begins to establish the numbers, surface presence, behavior, and travel directions of protected species in the area. These surveys would follow standard protocols and data collection specified by BOEM. In addition to standard daily surveys, DWSF must include an enhanced survey plan for November–December and May 15–May 30 to minimize risk of exposure of NARWs to pile-driving noise that includes daily pre-construction surveys.	Marine mammals, sea turtles
Construction, O&M, decommissioning	Vessel strike avoidance	Vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any marine mammal as long as it is safe to do so. Vessel speeds must be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed within the path of the vessel. Avoidance measures must occur for listed whales or any other unidentified whale sighted within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard) at a distance of 1,640 feet (500 m) or less from a survey vessel. PSOs must notify the vessel captain of any whale within 1,640 feet (500 m) of vessel within this area. The vessel captain must immediately implement strike-avoidance procedures to maintain a separation distance of 1,640 feet (500 m) from listed whales including changing vessel direction or reducing vessel speed to allow the animal to travel away from the vessel. Any time a listed species (sea turtles or whales) is within 656 feet (200 m) of an underway vessel, a full stop is required if safety permits. If a whale is observed but cannot be confirmed as a species other than a right whale, the vessel operator must assume that it is a right whale and take appropriate action. For all other non-listed protected species, all vessels must maintain a minimum separation distance of 164 feet (50 m) to the maximum extent practicable with an exception made for those animals that approach the vessel. When marine mammals are sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distance, e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area. If marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area.	Marine mammals
Construction, O&M, decommissioning	Vessel strike avoidance (non-geophysical survey vessels)	During all phases of the project, vessel operators and crews must maintain a vigilant watch for all sea turtles and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any sea turtles as long as it is safe to do so. All vessels must maintain a minimum separation distance of 328 feet (100 m) from sea turtles whenever possible. Trained crew lookouts must monitor seaturtlesightings.org daily and prior to each trip to note and report any observations of sea turtles in the vicinity of the planned transit to all vessel operators/captains and lookouts on duty that day. If a sea turtle is sighted within 328 feet (100 m) of the operating vessels' forward path, the vessel operator must slow down to 4 knots (unless unsafe to do so) and may resume normal vessel operations once the vessel has passed the sea turtle. If a sea turtle is sighted within 164 feet (50 m) of the forward path of the operating vessel, the vessel operator must shift to neutral when safe to do so and then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 m) at which time normal vessel operations may be resumed. Between June 1 and November 30, vessels must avoid transiting through areas of visible jellyfish aggregations or floating vegetation lines or mats. In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.	Sea turtles
Construction, O&M, decommissioning	Vessel observer requirements	DWSF must ensure that vessel operators and crew maintain a vigilant watch for marine mammals or sea turtles by slowing down or stopping the vessel to avoid striking marine mammals or sea turtles. Vessel personnel must be provided an Atlantic reference guide that includes and helps identify marine mammals and sea turtles that may be encountered in the project area and material regarding NARW SMAs, sightings information, and reporting. When not on active watch duty, members of the monitoring team must consult NMFS' NARW reporting systems for the presence of NARWs in the project area. A visual observer aboard the vessel must monitor a vessel strike-avoidance zone around the vessel. All vessels transiting to and from the WDA and traveling over 10 knots must have a visual observer on duty at all times. DWSF must also have a trained lookout on all vessels during all phases of the project between June 1 and November 1 to observe for sea turtles and communicate with the captain to take required avoidance measures as soon as possible if one is sighted. If a vessel is carrying a visual observer for the purposes of maintaining watch for NARWs, an additional lookout is not required and this visual observer must maintain watch for whales and sea turtles. If the trained lookout is a vessel crewmember, this must be their designated role and primary responsibility while the vessel is transiting. Any designated crew observers should be trained in the identification of sea turtles and in regulations and best practices for avoiding vessel collisions. The trained lookout must monitor seaturtlesightings.org prior to each trip and report any observations of sea turtles in the vicinity of the planned transit to all vessel operators/captains and lookouts on duty that day.	Marine mammals, sea turtles
Construction, O&M, decommissioning	Vessel speed requirements November 1 through May 14	From November 1 through May 14, all vessels must travel at 10 knots or less when transiting to/from or within the WDA, except within Nantucket Sound (unless an active DMA is in place) and except crew transfer vessels as described below. From November 1 through May 14, crew transfer vessels may travel at more than 10 knots if there is at least one visual observer on duty at all times aboard the vessel to visually monitor for large whales, and real-time PAM is conducted. If a NARW is detected via visual observation or PAM within or approaching the transit route, all crew transfer vessels must travel at 10 knots or less for the remainder of that day.	Marine mammals

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M, decommissioning	Vessel speed requirements in DMAs	All vessels, regardless of length, must travel at 10 knots or less within any NMFS-designated DMA, with the exception of crew transfer vessels as described above. Crew transfer vessels traveling within any designated DMA must travel at 10 knots or less, unless NARWs are confirmed to be clear of the transit route and WDA for two consecutive days, as confirmed by either vessel-based surveys conducted during daylight hours and PAM, or by an aerial survey conducted once the lead aerial observer determines adequate visibility. If confirmed clear by one of these measures, vessels transiting within a DMA must employ at least two visual observers on duty to monitor for NARWs. If a NARW is observed within or approaching the transit route, vessels must operate at 10 knots or less until clearance of the transit route for two consecutive days is confirmed by the procedures described above.	Marine mammals
Construction, O&M, decommissioning	Vessel speed requirements in SMAs	All vessels greater than or equal to 65 feet (19.8 m) in overall length must comply with the 10-knot speed restriction in any SMA (see https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-ship-strikes-north-atlantic-right-whales)	Marine mammals
Construction, O&M, decommissioning	Reporting of all NARW sightings	If a NARW is observed at any time by PSOs or personnel on any project vessels, during any project-related activity or during vessel transit, DWSF must immediately report the sighting information to NMFS and BOEM (the time, location, and number of animals) to the NOAA Fisheries 24-hour Stranding Hotline number (866-755-6622), the USCG via channel 16, and through the WhaleAlert app (http://www.whalealert.org/).	Marine mammals
Construction, O&M, decommissioning	Vessel communication of threatened and endangered species sightings	Whenever multiple Project vessels are operating, any visual observations of listed species (marine mammals and sea turtles) must be communicated to a PSO and/or vessel captains associated with other Project vessels.	Marine mammals, sea turtles
Construction, O&M, decommissioning	Marine mammals (other than NARW) and sea turtle geophysical survey EZs	For sparkers and similar sub-bottom profiler equipment, minimum EZ distances for ESA-listed species must be monitored at all times and be demarcated within the watch zone with effective distance-finding methods (e.g., reticle binoculars, range finding sticks, monitoring system software). A 1,640-foot (500-m) watch zone would be established in every direction around each survey vessel. All threatened and endangered species within this distance would be monitored by a third-party PSOs. A 656-foot (200-m) EZ must be established around each survey vessel for endangered and threatened marine mammals and sea turtles. EZs for non-ESA-listed marine mammals must be followed as required by NMFS through Project-specific mitigation and monitoring requirements of ITAs. If an ITA is not required, DWSF must monitor default EZs of 328 feet (100 m) for all non-listed marine mammals. The EZs must be established within the watch zone with accurate distance finding methods (e.g., reticle binoculars, range finding sticks, calibrated video cameras, and software). If the EZs cannot be adequately monitored for animal presence (i.e., a PSO determines conditions are such that ESA listed species cannot be reliably sighted within the EZs), the survey must be stopped until such time that the EZs can be reliably monitored. This monitoring must be carried out by approved PSOs (see specific details on PSO requirements below).	Marine mammals, sea turtles
Construction, O&M, decommissioning	Geophysical survey off-effort PSO monitoring	During good daylight conditions during periods when survey equipment is not operating (e.g., daylight hours; Beaufort sea state 3 or less), to the maximum extent practicable, visual PSOs must conduct observations for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods.	Marine mammals; sea turtles
Construction, O&M, decommissioning	Geophysical survey EZ, power up, and shut down	At the beginning of each survey, active sparker and other sub-bottom profiling acoustic sound sources less than 180 kHz requiring EZs (excludes the Innomar), must not be activated until a PSO has verified the 328-foot (100-m) and 656-foot (200-m) EZs to be clear of all whales for a full 30 minutes and all other marine mammals for a full 15 minutes. Any time a marine mammal is sighted within the EZ, the PSO would require the resident engineer or other authorized individual to cause a shut down of the survey equipment. Geophysical survey equipment may be allowed to continue operating if marine mammals voluntarily approach the vessel (e.g., to bow ride) when the sound sources are at full operating power. The vessel operator must comply immediately with any call for a shut down by the PSO. Any disagreement or discussion must occur only after shut down. Following a shut down, ramp up of the equipment may begin immediately only if visual monitoring of the EZ continues throughout the shut down, the animals causing the shut down were visually followed and confirmed by PSOs to be outside of the EZ and heading away from the vessel, and the EZ remains clear of all protected species All shut downs of geophysical survey equipment due to protected species sightings that are not re-sighted require the following monitoring periods before ramp-up procedures: 15 minutes for small cetaceans and seals, and 30 minutes for ESA-listed whales, humpback whales, Kogia, and beaked whales. Following a shut down for any reason, ramp up of the equipment may begin immediately only if visual monitoring of the EZ continues throughout the shut down, the animals causing the shut down were visually followed and confirmed by PSOs to be outside of the EZ and heading away from the vessel, and the EZs remain clear of all protected species. All shut downs of HRG survey equipment due to protected species sightings that are not re-sighted require the full pre-exclusion and ramp-up protocols. Geophysical exclusion, survey power up, and post-shut-down exclusion protocols must be followed for all ESA-listed species, in addition to any future ITA requirements under the MMPA for marine mammals. For non-ESA-listed marine mammals, requirements must be followed as required by the NMFS through project-specific mitigation and monitoring requirements of ITAs. If an ITA is not obtained, DWSF must follow the measures above for non-listed species.	Marine mammals
Construction, O&M, decommissioning	Geophysical survey vessel whale strike-avoidance and shut down protocol	Avoidance measures must occur for listed whales or any other unidentified whale sighted within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard) at a distance of 1,640 feet (500 m) or less from a survey vessel. PSOs must notify the vessel captain of any whale within 1,640 feet (500 m) of vessel within this area. The vessel captain must immediately implement strike-avoidance procedures to maintain a separation distance of 1,640 feet [500 m]) from listed whales including changing vessel direction or reducing vessel speed to allow the animal to travel away from the vessel. Shut down and strike-avoidance procedures for listed whales. Any time a listed species (sea turtles, whales, and manta rays) is within a 656-foot (200-m) EZ in any direction around a survey vessel, PSOs must notify the vessel captain that a full stop is required if safety permits. The PSO must also notify the resident engineer that a shut down of all active acoustic sources below 180 kHz is immediately required. The vessel operator and crew must comply immediately with any call for a shut down by the PSO. Any disagreement or discussion must occur only after shut down.	Marine mammals
Construction, O&M, decommissioning	Sea turtle avoidance and EZs during geophysical survey	Vessel operators and crews must maintain a vigilant watch for all marine protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any ESA-listed species. The presence of a single species at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. A visual observer aboard the vessel must monitor a vessel strike-avoidance zone (species-specific distances detailed below) around the vessel according to the parameters stated below, to ensure the potential for strike is minimized. Minimum EZ distances for ESA-listed sea turtles must be monitored at all times and be demarcated within the watch zone with effective distance finding methods (e.g., reticle binoculars, range finding sticks, monitoring system software). A 1,640-foot (500-m) watch zone would be established in every direction around each survey vessel. All threatened and endangered species within this distance would be monitored by a third-party PSOs and survey operations and listed species data recorded. A 656-foot (200-m) EZ must be established around each survey vessel for endangered and threatened sea turtles. The EZ is the distance within which vessel avoidance measures to maintain a distance of 656-feet (200 m) or greater is not possible, and a sparker or boomer source must be shut down. Survey vessel crewmembers responsible for navigation duties must receive site-specific training on ESA-listed species sighting/reporting and vessel strike-avoidance measures. Visual observers monitoring the vessel strike-avoidance zone can be either third-party PSOs or crewmembers, but crewmembers responsible for these duties must be provided sufficient training to distinguish ESA-listed species to broad taxonomic groups and have no other responsibilities during the time of observation. If the EZs cannot be adequately monitored for animal presence (i.e., a PSO determines conditions are such that ESA-listed species cannot be reliably sighted within the EZs), the survey must be stopped until such time that the EZs can be reliably monitored. This monitoring must be carried out by NMFS-approved PSOs.	Sea turtles

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M, decommissioning	Geophysical survey EZ, power up, and shut down	At the beginning of each survey, active acoustic sound sources operating at less than 200 kHz must not activated until a PSO has verified the 656-foot (200-m) EZs to be clear of all sea turtles for a full 30 minutes. Any time a sea turtles is sighted within the EZ, the PSO would require the resident engineer or other authorized individual to shut down the survey equipment if power-up procedures have started. The vessel operator must comply immediately with any call for a shut down by the PSO. Any disagreement should be discussed-only after shut down. Following a shut down for any reason, ramp up of the equipment may begin immediately only if visual monitoring of the EZ continues throughout the shut down, the animals causing the shut down were visually followed and confirmed by PSOs to be outside of the EZ and heading away from the vessel, and the EZ remains clear of all protected species. All shut downs of geophysical survey equipment due to protected species sightings that are not re-sighted require the 30-minute clearance period before ramp-up procedures.	Sea turtles
Construction, O&M, decommissioning	Geophysical survey vessel sea turtle strike avoidance and shut down protocol	Avoidance measures must occur for sea turtles sighted within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard) at a distance of 328 feet (100 m) or less from a survey vessel. PSOs must notify the vessel captain that a full stop is required if safety permits. The PSO must also notify the resident engineer that a shut down of all active acoustic sources below 5 kHz is immediately required. The vessel operator and crew must comply immediately with any call for a shut down by the PSO. Any disagreement or discussion must occur only after shut down. Between June 1 and November 30, vessels must avoid transiting through areas of visible jellyfish aggregations or floating sargassum lines or mats. In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas. If a sea turtle is sighted within the observer's field of views (≤ 28 feet [100 m] from the vessel, 90 degrees port to 90 degrees starboard), the vessel must shift to neutral and only proceed once it is safe to do so. "Safe to do so" entails that there was a sighting of the turtle again and that it was at a distance > 328 feet (100 m) and not on the vessel's intended course OR, if the turtle is out of sight, the vessel must carefully and slowly (4 knots) proceed as the turtle may be out of sight because it is under the vessel.	Sea turtles
Construction	Avoid identified shipwrecks, debris fields, and submerged landform features that can be avoided	Require DWSF to avoid the shipwrecks, potentially significant debris fields, and as many as possible of the submerged, landform features identified during marine archaeological surveys of the WDA and OECC. While avoidance of shipwrecks and debris fields is typically simple, avoidance of all submerged landform features is typically not possible due to their size and orientation.	Cultural resources
Construction, O&M, decommissioning	Submarine cable system burial plan	A copy of the submarine cable system burial plan shall be submitted by DWSF as part of their FDR and Fabrication and Installation Report that depict precise planned locations and burial depths of the entire cable system. This plan shall be reviewed by the USCG and BOEM.	Navigation and vessel traffic
Construction	Boulder relocation reporting	The locations of any boulder (which would protrude >2 m or more on the sea floor) relocated during cable installation activities must be reported to BOEM, USCG, NOAA, and the local harbormaster within 30 days of relocation. These locations must be reported in latitude and longitude degrees to the nearest 10 thousandth of a decimal degree (roughly the nearest meter), or as precise as practicable.	Navigation and vessel traffic
Construction, O&M, decommissioning	Vessel safety practices	All Project vessels involved in construction, operations, maintenance, and decommissioning activities would comply with U.S. or SOLAS standards, as applicable, with regards to vessel construction, vessel safety equipment, and crewing practices.	Navigation and vessel traffic
Construction, O&M, decommissioning	WTG and OSS marking	Each WTG and OSS would be marked with PATONs, subject to the approval of the Commander (dpw-1), First Coast Guard District. DWSF would do the following: Provide BOEM and USCG with a proposed lighting, marking, and signaling plan, which must be approved by BOEM after consultation with the USCG. The plan should conform to the International Association of Marine Aids to Navigation and Lighthouse Authorities Recommendation O-139, The Marking of Man-Made Offshore Structures. Should any part of the recommendation conflict with federal law or regulation, or if DWSF seeks an alternative to the recommendation, DWSF must consult with the USCG. Mark each individual WTG and OSS with clearly visible, unique, alphanumeric identification characters. Light each WTG and OSS in a manner that is visible by mariners in a 360-degree arc around the WTG and OSS. Apply to the First Coast Guard District to establish PATONs for the facility. Approval for all PATONs must be obtained before installation of the DWSF structures begins. Ensure each WTG is lighted with red obstruction lighting consistent with the FAA Advisory Circular 70/7460-1L Change 2 (FAA 2018), so long as this requirement does not preclude the use of an ADLS. Provide signage that covers 360-degrees of the wind turbine structures warning vessels of the air draft of the turbine blades as determined at highest astronomical tide. Cooperate with USCG and NOAA to ensure that cable routes and wind turbines are depicted on appropriate government produced and commercially available nautical charts. Provide mariner information sheets on DWSF's website with details on the location of the turbines and specifics such as blade clearance above sea level.	Navigation and vessel traffic
Construction, O&M, decommissioning	WTG shut-down mechanism	Equip all WTG rotors (blade assemblies) with control mechanisms operable from the DWSF control centers available 24 hours a day, 7 days a week. The control mechanisms shall enable control room operators to shut down the requested WTGs within an agreed upon time of notification between the USCG and DWSF. A formal shut-down procedure would be part of the standard operating procedures and periodically tested. Normally, USCG-ordered shut downs 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.	Navigation and vessel traffic
Construction, O&M, decommissioning	USCG Training and Exercises	DWSF would participate in periodic USCG-coordinated training and exercises to test and refine notification and shut-down procedures and to provide SAR training opportunities for USCG vessels and aircraft.	Navigation and vessel traffic
Construction, O&M, decommissioning	Mooring attachments, and access ladders	Mooring attachments (for securing vessels) and access ladders for use in emergencies shall be placed on each WTG. Plans for the design and placement of safety lines and access ladders shall be submitted for USCG review and BOEM approval.	Navigation and vessel traffic
Construction, O&M, decommissioning	Operations and maintenance plan	Prior to operation of the Project, DWSF shall submit a written plan for operations and maintenance, which includes control center(s), for review by BOEM and the USCG. The plan must demonstrate that the control center(s) would be adequately staffed to perform standard operating procedures, communications capabilities, and monitoring capabilities. The plan shall include, but not be limited to, the following topics, which may be modified through ongoing discussions with the USCG: Standard Operating Procedures: Methods for establishing and testing WTG rotor shut-down; methods of lighting control; method(s) for notifying the USCG of mariners in distress or potential/actual SAR incidents; method(s) for notifying the USCG of any events or incidents that may impact maritime safety or security; and methods for providing the USCG with environmental data, imagery, communications and other information pertinent to SAR or marine pollution response. Staffing: Number of personnel intended to staff the control center(s) to ensure continuous monitoring of WTG operations, communications, and surveillance systems. Communications: Capabilities to be maintained by the control center(s) to communicate with the USCG and mariners within and in the vicinity of the Project area. Communications capability shall at a minimum include VHF marine radio and landline and wireless for voice and data. Monitoring: The control center(s) should maintain the capability to monitor the DWSF installation and operations in real time (including night and periods of poor visibility) for determining the status of all PATONs; searching for and locating mariners in distress upon notification of a maritime distress incident; and detection of a survivor who has climbed to the survivor's platform, if installed, on any WTG or OSS.	Navigation and vessel traffic
Construction, O&M, decommissioning	WTG/OSS installation	No WTG/OSS installation work shall commence at the Project site (i.e., on or under the water) without prior review by BOEM and USCG of a plan to be submitted by DWSF that describes the schedule and process for erecting each WTG, including all planned mitigations to be implemented to minimize any adverse impacts on navigation while installation is ongoing. Appropriate Notice to Mariners submissions would accompany the plan.	Navigation and vessel traffic

Proposed Project Phase	Mitigation or Monitoring Measure	Description	Resource Area Mitigated
Construction, O&M, decommissioning	USCG reporting	**Complaints**: On a monthly basis during installation, DWSF shall provide USCG with a description of any complaints received (either written or oral) by boaters, fishermen, commercial vessel operators, or other mariners regarding impacts on navigation safety allegedly caused by construction vessels, crew transfer vessels, barges, or other equipment. Describe any remedial action taken in response to complaints received. **Correspondence**: DWSF shall provide to USCG copies of any correspondence received by DWSF from other federal, state, or local agencies that mention or address navigation safety issues. **Maintenance Schedule**: DWSF would provide the USCG with its planned WTG maintenance schedule, forecasted out to at least one quarter. Appropriate Notice to Mariners submissions would accompany each maintenance schedule.	Navigation and vessel traffic
Construction, O&M, decommissioning	Public participation	To ensure sufficient opportunity for the public to receive information directly from the owners/operators of the wind energy facility, DWSF would attend periodic meetings of the Southeastern Massachusetts and Rhode Island Port Safety Forums to provide briefs on the status of construction and operations and on any problems or issues encountered with respect to navigation safety.	Navigation and vessel traffic
Construction, O&M, decommissioning	Helicopter landing platforms	If DWSF's OSSs include helicopter-landing platforms, those platforms would be designed and built to accommodate USCG HH60 rescue helicopters.	Navigation and vessel traffic
Construction, O&M, decommissioning	Scientific survey mitigation	Requirement to implement a proponent-funded mitigation program to address adverse impacts from the DWSF project on recurring scientific surveys including: **Evaluation of survey designs**: Evaluate and quantify effects and impacts of proposed Project-related wind development activities on scientific survey operations and on provision of scientific advice to management. **Identification and development of new survey approaches**: Evaluate or develop appropriate statistical designs, sampling protocols, and methods, while determining if scientific data quality standards for the provision of management advice are maintained. **Calibration of new survey approaches**: Design and carry out necessary calibrations and required monitoring standardization to ensure continuity, interoperability, precision, and accuracy of data collections. **Development of interim provisional survey indices**: Develop interim ad hoc indices from existing non-standard data sets to partially bridge the gap in data quality and availability between pre-construction and operational periods while new approaches are being identified, tested, or calibrated. **Wind energy monitoring to fill regional scientific survey data needs**: Apply new statistical designs and carryout sampling methods to effectively mitigate survey impacts due to offshore wind activities from DWSF operations for the operational life span of the project. **Development and communication of new regional data streams**: New data collections would require new data collection, analysis, management, dissemination, and reporting systems. Changes to surveys and new approaches would require substantial collaboration with fishery management, fishing industry, scientific institutions, and other partners.	Other marine uses
Construction	Dredging window	Establish a no-work window for dredging at Montauk through the USACE permitting process	Water quality

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APPENDIX H

Assessment of Other Resources

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EXCERPT FROM CHAPTER 3. ASSESSMENT OF OTHER RESOURCES

This appendix provides an assessment of resources with negligible to minor impacts from implementation of the Proposed Action and other considered alternatives. Because these sections were originally part of DIES Chapter 3, chapter and section naming and numbering were maintained for simplicity. All abbreviations and references for these sections are provided in the main DEIS and Appendix B, respectively.

3.1 ANALYSIS APPROACH (*see section in main DEIS*)

3.2 MITIGATION IDENTIFIED FOR ANALYSIS IN THE ENVIRONMENTAL IMPACT STATEMENT (*see section in main DEIS*)

3.3 PHYSICAL RESOURCES

3.3.1 Air Quality

3.3.1.1 Affected Environment

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 Clean Air Act (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. Non-attainment occurs if any criteria air pollutant concentration exceeds its NAAQS. If a region is designated as non-attainment for a NAAQS, the federal 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. 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 permitting authority are outside of any non-attainment area and therefore not subject to the requirement to show conformity.

The EPA (2018a) reports the following:

- Rhode Island is currently in attainment for all criteria pollutants.
- The greater Connecticut area, encompassing Hartford, New London, Tolland, and Windham Counties, Connecticut, is currently in marginal non-attainment with the 2015 8-hour O_3 standard.
- The New York-Northern New Jersey-Long Island area, also known as the New York Metro Area, which encompasses Middlesex County, Connecticut, and Suffolk County, New York, is currently in moderate non-attainment with the 2015 8-hour O_3 standard.
- Massachusetts is currently in attainment for all criteria pollutants with the exception of Dukes County, which is currently in marginal non-attainment for the 8-hour O_3 standard.

Connecticut, New York, and Massachusetts have all adopted SIPs to mitigate the impact that regulated air pollutant emissions have on air quality.

Depending on the final Project design, Project air emissions could affect seven non-attainment areas in the analysis area: Hartford, Middlesex, New London, Tolland, and Windham Counties, Connecticut; Dukes County, Massachusetts; and Suffolk County, New York. The EPA classifies these seven counties as being in non-attainment for 2015 8-hour O_3. The EPA reports no other pollutants in non-attainment status in these counties.

Hartford County, Connecticut, includes urban areas, such as Hartford, with a high population density and a sizable industrial base. Emission sources within the boundaries of Hartford County, as well as sources in other neighboring metro areas outside of the county, affect the county's air quality. Although the EPA currently classifies Hartford County as being in moderate non-attainment for the 2008 8-hour O_3 standard and marginal non-attainment for the 2015 8-hour O_3 standard, ambient air quality monitors located in Hartford County reported a steady decrease in O_3 levels from 2014 to 2017 (EPA 2018b). Hartford County reported an average concentration of 45.4 parts per billion (ppb) between 2014 and 2016 and 43.6 ppb between 2017 and 2018 (EPA 2018b). A photochemical reaction between volatile organic compounds (VOCs), NO_2 or other nitrogen oxides (generically termed NO_x), and sunlight forms O_3.VOC and NO_x are known as O_3 "precursor" pollutants. In Hartford County, NO_x emissions are primarily from on-road vehicles, with non-road engines used for industrial purposes and the generation of electricity being the second largest source. VOC emissions are primarily from solvent use in industry, highway vehicles, and vegetation sources.

Middlesex, New London, Tolland, and Windham Counties are rural counties in Connecticut with a low population density and small industrial bases. Neighboring metro areas outside of their respective boundaries heavily affect the air quality of these counties. For this reason, changes to pollutant emissions by sources within their boundaries have little impact on the overall air quality trends. Although the EPA currently classifies these counties as being in moderate non-attainment for the 2008 8-hour O_3 standard and marginal non-attainment for the 2015 8-hour O_3 standard, ambient air quality monitors in these counties reported a small decrease in O_3 levels from 2014 to 2018 (EPA 2018b). Middlesex County reported an average concentration of 47.3 ppb between 2014 and 2016 and 46.0 ppb between 2017 and 2018 (EPA 2018b). New London County reported an average concentration of 44.9 ppb between 2014 and 2016 and 44.6 ppb between 2017 and 2018 (EPA 2018b). Tolland County reported an average concentration of 44.1 ppb between 2014 and 2016 and 43.0 ppb between 2017 and 2018 (EPA 2018b). Windham County reported an average concentration of 42.6 ppb between 2014 and 2016 and 42.2 ppb between 2017 and 2018 (EPA 2018b). NO_x emissions in these counties are primarily from on-road vehicles, with non-road engines used for industrial purposes (as well as electrical generation in Middlesex County) being the second largest source. Vegetation sources and highway vehicles are the primary VOC emissions in these counties.

Dukes County is an island community with a relatively low population density and little heavy industry. Although the EPA currently classifies Dukes County as being in marginal non-attainment for the 2008 8-hour O_3 standard, ambient air quality monitors in Dukes County reported a steady decrease in O_3 levels from 2009 to 2011 (EPA 2018b). The EPA also recently (August 2018) designated Dukes County in attainment for the more stringent 2015 8-hour O_3 standard of 70 ppb, based on the average, monitored 2014–2016 O_3 concentration of 64.3 ppb (EPA 2018b). Non-road engines used for construction activities and on-road vehicle traffic are the main sources of NO_x in Dukes County (EPA 2014). Vegetation sources and non-road engines are the primary VOC emission sources in Dukes County.

Suffolk County is an area with a high population density and a large industrial base. Emissions from the New York Metro Area, outside of Suffolk County, heavily affect the county's air quality. For this reason, changes to pollutant emissions by sources within Suffolk County have little impact on overall air quality trends. Monitoring data have shown little improvement in O_3 levels over time. The monitored ambient O_3 concentration level observed at the Riverhead air monitor in Suffolk County was 72.7 ppb averaged from 2014 to 2016, 76.7 ppb averaged from 2015 to 2017, and 75.3 ppb averaged from 2016 to 2018 (EPA 2018b). Thus, the EPA currently classifies Suffolk County as being in moderate non-attainment for 8-hour O_3 according to both the 2008 and 2015 8-hour standards. The EPA reports that on-road vehicles are the primary source of NO_x emissions in Suffolk County; non-road engines used for industrial purposes are the second-largest source. Solvent use in industry, vegetation sources, off-highway engines, and highway vehicles provide the most VOC emissions in Suffolk County.

Because of Project developments, the Project may affect an additional 14 non-attainment counties, depending on whether DWSF uses the ports considered for temporary use to support construction and installation, O&M, and conceptual decommission. These counties are New Castle County, Delaware; Anne Arundel, Baltimore City, Baltimore, and Harford Counties, Maryland; Atlantic, Burlington, Camden, Cumberland, Gloucester, and Salem Counties, New Jersey; and Bucks, Delaware, and Philadelphia Counties, Pennsylvania. The EPA classifies these 14 counties as being in marginal non-attainment for 2015 8-hour O_3.

Table 3.3.1-1 presents the total emission inventory in tons per year (tpy) for select regulated pollutants in non-attainment counties in 2014.

Table 3.3.1-1. Non-Attainment Counties, 2014 Emission Inventory

County, State	Regulated Pollutant (tpy)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Hartford County, CT	94,687.64	14,943.60	5,666.06	2,557.65	2,388.40	27,947.57
Middlesex County, CT	22,819.31	4,041.62	1,957.19	943.96	864.43	10,583.17
New London County, CT	34,173.86	6,632.33	3,533.87	1,472.50	1,182.98	16,101.12
Tolland County, CT	18,404.54	2,521.90	2,187.13	955.54	541.65	9,568.20
Windham County, CT	16,656.61	2,216.22	2,131.16	991.68	465.39	10,930.68
New Castle County, DE	65,329.94	14,452.02	5,408.50	1,807.17	2,255.55	13,269.91
Dukes County, MA	7,916.67	1,053.48	951.27	250.09	75.96	3,288.24
Anne Arundel County, MD	67,098.71	16,007.90	5,476.64	1,894.54	13,696.22	17,744.57
Baltimore City, MD	38,751.84	9,711.55	4,333.03	1,328.66	899.60	9,782.78
Baltimore County, MD	83,511.39	16,336.40	15,618.77	3,110.76	2,671.17	17,203.00
Harford County, MD	31,337.65	5,446.76	6,266.03	1,800.60	395.01	11,574.30
Atlantic County, NJ	31,428.25	5,752.32	1,807.86	1,025.15	446.83	16,429.90
Burlington County, NJ	86,135.47	8,111.33	5,874.11	3,975.90	524.93	27,836.14
Camden County, NJ	48,441.78	7,136.52	2,747.87	1,605.71	346.61	13,087.05
Cumberland County, NJ	24,321.58	3,464.18	2,777.23	1,607.67	439.82	14,855.49
Gloucester County, NJ	33,717.01	6,204.21	2,518.69	1,511.17	948.39	12,617.49
Salem County, NJ	9,087.42	3,005.88	1,204.21	679.02	1,136.98	6,377.47
Suffolk County, NY	198,729.99	29,737.19	12,875.34	4,997.61	3,384.59	47,849.06
Bucks County, PA	77,247.00	12,606.67	7,886.27	3,141.60	1,549.47	21,762.39
Delaware County, PA	51,050.37	12,502.29	4,053.81	1,898.85	2,671.13	12,532.23
Philadelphia County, PA	80,613.62	18,970.27	7,564.30	3,517.50	1,698.98	22,385.81

Source: EPA (2014).

Note: CT = Connecticut, DE = Delaware, MA = Massachusetts, MD = Maryland, NJ = New Jersey, NY = New York, PA = Pennsylvania.

Designation as a Class I area allows only very small increments of new pollution above already existing air pollution levels. Class I areas include national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. No federal Class I areas are located within 100 km of the Lease Area; therefore, no visibility or deposition modeling was conducted as part of this DEIS.

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 2016 were an estimated 6,511 million metric tons (EPA 2018c). Section 4.2.4 of the COP provides additional weather information, including wind and extreme weather events (cyclones, hurricanes).

3.3.1.2 Environmental Consequences

3.3.1.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.3.1-2 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS. Jacobs (2020) provides detailed methodology for emission calculations presented in this DEIS.

Table 3.3.1-2. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Air Quality

Issue	Impact Indicator	Significance Criteria
Compliance with NAAQS	Emissions (tpy) from construction marine vessels, vehicles, and equipment activity within 25 nm of the center of the Lease Area	Negligible: Project emissions would not be detectable. Minor to moderate: Project emissions would be detectable but would not exceed NAAQs or de minimis thresholds. Major: Project emissions would exceed NAAQS.
GHG emissions	GHG emissions (tpy) during construction; operational GHG and O3 precursors emissions (tpy) reductions	There are currently no significance thresholds for GHG emissions.

3.3.1.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing air quality trends from past and present activities. Attachment 2 in Appendix E provides additional information regarding past and present activities and associated air quality impacts. Future non-Project sources of air pollution include future energy development (onshore and offshore wind, tidal, liquefied natural gas, and other fossil fuels), marine mineral use, and other construction activities. Attachment 2 in Appendix E also discloses future non-offshore wind activities and associated air quality impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

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 air emissions. Specific impacts would depend on the type of fossil fuel used (natural gas, oil, coal), the technology and pollution control systems chosen, and site-specific issues associated with individual electric generation facilities. However, the continued use of existing fossil fuel–generation sources would result in annual emissions that could have been avoided by using non–fossil fuel energy sources. These emissions, presented in Table 3.3.1-3, were estimated using the EPA's Avoided Emissions and geneRation Tool (AVERT) for the New York region based on the design capacity of the offshore wind projects that would not be developed.

Table 3.3.1-3. Estimated Annual Avoided Emissions (tpy) for the Operation of Future Offshore Wind Projects within the Air Quality Geographic Analysis Area

Pollutant	CO_2	NO_X	SO_X	$PM_{2.5}$
Lower limit	16,506,291.00	4,845.64	2,526.22	731.97
Upper limit	21,272,422.61	6,236.17	3,244.05	942.84

Notes: Emissions are presented in tons and were obtained using EPA's AVERT (EPA 2020a). 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 any project within the geographic analysis area with a generation capacity greater than 1,300 MW, the avoided emissions were scaled up from an input capacity of 1,300 MW for an upper limit, with 1,300 MW used as the lower limit.

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 more traditional fossil fuel power generation in the region, and could result in improved air quality by increasing the proportion of energy generated from renewables contributing to the grid. 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, adverse impacts from future wind development activities on air quality under the No Action alternative would be temporary and minor to moderate, 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 3.3.1-4, construction of a subset of these projects in the geographic analysis area with sufficient details to estimate emissions would generate an estimated 12,804 tons of NO_x, 98 tons of SO_2, 444 tons of PM_{10}, and 822,461 tons of CO_2. For comparison purposes, according to the EPA's 2014 National Emissions Inventory, Suffolk County reported 14,531 tons of NO_X, 172 tons of SO_2, and 1,844 tons of PM_{10} from highway vehicles; 8,472 tons of NO_X, 88 tons of SO_2, and 619 tons of PM_{10} from off-highway vehicles; and 1,726 tons of NO_X, 2,083 tons of SO_2, and 268 tons of PM_{10} from electrical utilities' combustion of fuel (EPA 2014).

As shown in Table 3.3.1-5, the operations phase of future offshore wind projects in the geographic analysis area would have a proportionally very small contribution of long-term and intermittent emissions, including 183 tons of NO_x, 0.3 ton of SO_2, 5 tons of PM_{10}, and 14,161 tons of CO_2. Similarly, future offshore wind project GHG emissions during construction would be negligible (14,161 tons of CO_2) as compared to aggregate global emissions, and these projects may beneficially contribute to a broader combination of actions to reduce future impacts from climate change over the long term.

Table 3.3.1-4. Projected Construction Emissions for a Subset of Projects in the Air Quality Geographic Analysis Area from 2022 to 2030

Project	CO_2	Regulated Pollutant (tons)					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	VOC
Vineyard Wind 1, part of OCS-A 0501	318,660	4,961	38	1,116	172	166	122
Sunrise, parts of OCS-A 0500 and OCS-A 0487	161,242	2,510	19	565	87	84	61
Revolution, OCS-A 0486	22,306	347	3	78	12	12	9
Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	320,253	4,986	38	1,121	173	167	122
Total	**822,461**	**12,804**	**98**	**2,880**	**444**	**429**	**314**

See EIS Appendix E Attachment 4 for calculation details.

Note: Additional projects are planned in the geographic analysis area but do not yet have emission estimates available. These include the Bay State Wind Project and the OCS-A 0500 and OCS-A 0487 remainder.

Table 3.3.1-5. Projected Operations and Maintenance Emissions for a Subset of Projects in the Air Quality Geographic Analysis Area from 2022 to 2030

Project	CO_2	Regulated Pollutant (tons)					
		NO_X	SO_2	CO	PM_{10}	$PM_{2.5}$	VOC
Vineyard Wind 1, part of OCS-A 0501	5,487	71	0.3	18	2	2	2
Sunrise, parts of OCS-A 0500 and OCS-A 0487	2,776	36	0	9	1	1	1
Revolution, OCS-A 0486	384	5	0	1	0	0	0
Vineyard Wind South OCS-A 0501 remainder (Park City Wind)	5,514	71	0	18	2	2	2
Total	**14,161**	**183**	**0.3**	**46**	**5**	**5**	**5**

See EIS Appendix E Attachment 4 for calculation details.

Note: Additional projects are planned in this area, but do not yet have emission estimates available. These include the Bay State Wind Project and the OCS-A 0500 and OCS-A 0487 remainder.

Accidental releases: Air quality impacts associated with accidental spills from other reasonably foreseeable projects could also occur; however; releases would be short term, localized, generally small volume, and would not contribute to air quality in measurable amounts (see Section 3.3.2.2.2).

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual 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 range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**. As described in Attachment 2 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **negligible** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area 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 small and the resource would recover completely.

3.3.1.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Table 3.3.1-6 presents a summary of the Project's estimated construction emissions. Estimated emissions would represent a small (< 0.10% to 10.0%), temporary increase in air pollutants for most counties within the geographic analysis area over 1 to 2 years. These emission totals presented in the analysis represent a worst-case construction scenario in which all construction activities would occur in a single year. Though NO_x emissions resulting from the construction of the SFWF appear to be a large portion of Dukes County's total emission inventory, Dukes County is an island with a low population density and low overall NO_x emissions. Non-attainment for this county has been attributed more to drifting pollutants from other counties and not from the emissions occurring within the county (EPA 2018b). Therefore, Project construction activities would only have a minor to moderate, temporary adverse impact on Dukes County's air quality. Similarly, the emissions from Project construction appear to be a large portion of Bristol County, Rhode Island's annual emission inventory. However, adverse impacts to Bristol County's air quality would also be minor to moderate because Bristol County is in attainment with the NAAQS, and construction emissions would be temporary and localized. The development of the Project could result in improved air quality conditions in the geographic analysis area once operational by reducing levels of pollutants over the No Action alternative.

Table 3.3.1-7 presents a summary of Project emissions. Estimates for the amount of selected pollutants emitted during a worst-case scenario in which all construction activities would occur in a single year are also compared to the emission inventories of the impacted counties. Offshore emissions at any port considered would exceed the de minimis threshold for NO_x in the non-attainment counties evaluated, except in Hartford, Middlesex, New London, Tolland, and Windham Counties, Connecticut, under the scenario that considers the Port of New London, Connecticut, as the base of operations for shipping activities. However, these emissions would be temporary and could be reduced by staggering construction timeframes and implementation of DWSF-proposed EPMs (see Table G-1 in Appendix G). Total Project emissions would account for less than 15% of affected counties' total emission inventories and would be temporary in nature. The maximum impact relative to the counties' emission inventories is predicted to occur in Salem County, New Jersey, with Project NO_x emissions being equal to 14.3% of the county's total NO_x emissions.

Onshore emissions at any considered port would not exceed the de minimis threshold, except in Suffolk County, New York. Estimated onshore emissions that would occur in this county are calculated to be 101.3 tpy of NO_x because of the proposed interconnection facility, which is planned to be constructed in Long Island, New York. However, these estimates would be temporary and could be reduced by staggering construction timeframes and implementation of DWSF-proposed EPMs (see Table G-1 in Appendix G). Therefore, minor to moderate, temporary adverse impacts to air quality are anticipated.

Operations and Maintenance and Conceptual Decommissioning

Table 3.3.1-8 and Table 3.3.1-9 present a summary of Project O&M emissions. 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. There could, however, be some tailpipe emissions from onshore vehicles and minor VOC emission during routine changes of lubricating and cooling fluids and greases. The primary source of offshore emissions during operation would be vessel travel (three crew transport vessels, one floating/jack-up crane barge, and two feeder barges) to and from the Lease Area. Planned maintenance and unplanned maintenance activities are each expected to require only 1 week of work each year and should have minor, temporary adverse air quality impacts. Emissions that would impact non-attainment counties during the Project O&M would fall well below the de minimis thresholds.

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 70% of its power through the combustion of natural gas (U.S. Energy Information Administration 2019). 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 turbines found that there is a net reduction in emissions within 6 months of the commencement of operations, meaning that there is a very short period of time before benefits from the Project begin to be realized (Inderscience Publishers 2014).

Table 3.3.1-6. Estimated Project Construction Air Emissions in Outer Continental Shelf Air Permit Area

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
OCS permit construction emissions (worst-case port – Paulsboro Marine Terminal)	33,772	0.2	1.6	34,253.8	80.7	521.5	17.5	16.9	3.6	11.7
Percentage of Barnstable County, MA inventory	–	–	–	–	0.2	7.8	0.5	1.3	0.3	< 0.1
Percentage of Bristol County, MA inventory	–	–	–	–	0.1	3.0	0.2	0.6	0.1	< 0.1
Percentage of Dukes County, MA inventory	–	–	–	–	1.0	49.5	1.8	6.8	4.7	0.4
Percentage of Newport County, RI inventory	–	–	–	–	0.6	20.8	2.5	4.6	0.8	0.3
Percentage of Washington County, RI inventory	–	–	–	–	0.4	8.5	1.2	1.9	0.6	0.1

Sources: Jacobs (2020); EPA (2014).

Note: MA = Massachusetts, RI = Rhode Island.

Table 3.3.1-7. Estimated Annual Project Construction Air Emissions in the Geographic Analysis Area

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X*	PM_{10}	$PM_{2.5}$	SO_2	VOC
Port New Bedford, MA										
Emissions within 25 miles of MA	3,767.0	0.0	0.2	3,826.6	12.3	57.0	1.9	1.8	1.3	2.4
Emissions within 25 miles of NY	19,732.0	0.0	0.4	19,851.2	76.8	218.6	7.4	7.3	21.5	27.6
Percentage of Dukes County, MA inventory	–	–	–	–	0.2%	5.4%	0.2%	0.7%	1.7%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	0.2%	2.8%	0.2%	0.5%	1.3%	0.2%
Port of Providence, RI										
Emissions within 25 miles of NY	19,732.0	0.0	0.4	19,851.2	76.8	218.6	7.4	7.3	21.5	27.6
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.7%	< 0.1%	0.1%	0.6%	< 0.1%
Port of New London, CT										
Emissions within 25 miles of CT	2,844.0	0.0	0.1	2,873.8	9.7	41.8	1.4	1.4	1.2	2.0
Emissions within 25 miles of NY	19,732.0	0.0	0.4	19,851.2	76.8	218.6	7.4	7.3	21.5	27.6

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X*	PM_{10}	$PM_{2.5}$	SO_2	VOC
Percentage of Hartford County, CT inventory	–	–	–	–	< 0.1%	0.3%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Middlesex County, CT inventory	–	–	–	–	< 0.1%	1%	< 0.1%	0.1%	0.1%	< 0.1%
Percentage of New London County, CT inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	< 0.1%	0.1%	< 0.1%
Percentage of Tolland County, CT inventory	–	–	–	–	< 0.1%	1.7%	< 0.1%	0.1%	0.2%	< 0.1%
Percentage of Windham County, CT inventory	–	–	–	–	< 0.1%	1.9%	< 0.1%	0.1%	0.3%	< 0.1%
Percent of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.7%	< 0.1%	0.1%	0.6%	< 0.1%
Paulsboro Marine Terminal, NJ										
Emissions within 25 NM of NJ	26,358.0	0.2	1.3	26,750.4	77.2	428.8	14.5	13.9	5.1	12.3
Emissions within 25 NM of NY	27,192.0	0.1	0.7	27,403.1	98.2	341.4	11.6	11.2	22.8	30.9
Percentage of New Castle, DE inventory	–	–	–	–	0.2%	2.4%	0.2%	0.6%	1%	0.2%
Percentage of Atlantic County, NJ inventory	–	–	–	–	0.2%	7.5%	0.8%	1.4%	1.1%	< 0.1%
Percentage of Burlington County, NJ inventory	–	–	–	–	< 0.1%	5.3%	0.2%	0.3%	1%	< 0.1%
Percentage of Camden County, NJ inventory	–	–	–	–	0.2%	6%	0.5%	0.9%	1.5%	< 0.1%
Percentage of Cumberland County, NJ inventory	–	–	–	–	0.3%	12.4%	0.5%	0.9%	1.2%	< 0.1%
Percentage of Gloucester County, NJ inventory	–	–	–	–	0.2%	6.9%	0.6%	0.9%	0.5%	< 0.1%
Percentage of Salem County, NJ inventory	–	–	–	–	0.8%	14.3%	1.2%	2%	0.4%	0.2%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	1.4%	0.1%	0.3%	0.2%	< 0.1%
Percentage of Bucks County, PA inventory	–	–	–	–	0.1%	2.7%	0.1%	0.4%	1.5%	0.1%
Percentage of Delaware County, PA inventory	–	–	–	–	0.2%	2.7%	0.3%	0.6%	0.9%	0.2%
Percentage of Philadelphia County, PA inventory	–	–	–	–	0.1%	1.8%	0.2%	0.3%	1.3%	0.1%
Sparrows Point, MD										
Emissions within 25 NM of MD	18,405.0	0.1	0.9	18,675.7	54.4	297.9	10.1	9.6	3.8	8.8
Emissions within 25 NM of NY	22,820.0	0.1	0.5	22,971.5	85.7	269.4	9.1	8.9	22.1	29
Percentage of Anne Arundel County, MD inventory	–	–	–	–	< 0.1%	1.9%	0.2%	0.5%	< 0.1%	< 0.1%
Percentage of Baltimore City, MD inventory	–	–	–	–	0.1%	3.1%	0.2%	0.7%	0.4%	< 0.1%

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X*	PM_{10}	$PM_{2.5}$	SO_2	VOC
Percentage of Baltimore County, MD inventory	–	–	–	–	< 0.1%	1.8%	< 0.1%	0.3%	0.1%	< 0.1%
Percentage of Harford County, MD inventory	–	–	–	–	0.2%	5.5%	0.2%	0.5%	1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.9%	< 0.1%	0.2%	0.7%	< 0.1%
Port of Norfolk, VA										
Emissions within 25 nm of NY	22,781.0	0.1	0.5	22,932.5	85.5	268.8	9.1	8.9	22.1	29
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	1.4%	0.1%	0.3%	0.2%	< 0.1%

Sources: Jacobs (2020); EPA (2014).

Note: DE = Delaware, CT = Connecticut, MA = Massachusetts, MD = Maryland, NY = New York, PA = Pennsylvania, RI = Rhode Island, VA = Virginia.

* NO_x emissions within 25 miles of New York include onshore cable/substation construction totaling 101.3 tpy for all considered port locations.

Table 3.3.1-8. Estimated Project Air Emissions Resulting from Operations and Maintenance in Outer Continental Shelf Air Permit Area

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
OCS permit O&M emissions (worst-case port – Paulsboro Marine Terminal)	5,716.0	0.0	0.3	5,806.4	17.3	92.9	3.0	2.8	0.5	1.9
Percentage of Barnstable County, MA inventory	–	–	–	–	< 0.1%	1.4%	< 0.1%	0.2%	< 0.1%	< 0.1%
Percentage of Bristol County, MA inventory	–	–	–	–	< 0.1%	0.5%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Dukes County, MA inventory	–	–	–	–	0.2%	8.8%	0.3%	1.1%	0.7%	< 0.1%
Percentage of Newport County, RI inventory	–	–	–	–	0.1%	3.7%	0.4%	0.8%	0.1%	< 0.1%
Percentage of Washington County, RI inventory	–	–	–	–	< 0.1%	1.5%	0.2%	0.3%	< 0.1%	< 0.1%

Sources: Jacobs (2020); EPA (2014).

Note: MA = Massachusetts, RI = Rhode Island.

Table 3.3.1-9. Estimated Project Air Emissions Resulting from Operations and Maintenance in the Geographic Analysis Area

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Port New Bedford, MA										
Emissions within 25 nm of MA	303.0	0.0	0.0	303.0	0.9	5.2	0.2	0.2	0.0	0.1
Emissions within 25 nm of NY	1,154.0	0.0	0.1	1,184.1	4.0	16.0	0.5	0.5	0.1	0.3
Percentage of Dukes County, MA inventory	–	–	–	–	< 0.1%	0.5%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Port of Providence, RI										
Emissions within 25 nm of NY	1,154.0	0.0	0.1	1,184.1	4.0	16.0	0.5	0.5	0.1	0.3
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Port of New London, CT										
Emissions within 25 nm of CT	196.0	0.0	0.0	196.0	0.6	3.4	0.1	0.1	0.0	0.1
Emissions within 25 nm of NY	1,154.0	0.0	0.1	1,184.1	4.0	16.0	0.5	0.5	0.1	0.3
Percentage of Hartford County, CT inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Middlesex County, CT inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of New London County, CT inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Tolland County, CT inventory	–	–	–	–	< 0.1%	0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Windham County, CT inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Paulsboro Marine Terminal, NJ										
Emissions within 25 nm of NJ	2,915.0	0.0	0.1	2,945.3	8.4	50.1	1.5	1.5	0.4	1.1
Emissions within 25 nm of NY	2,017.0	0.0	0.1	2,047.1	6.5	30.8	1.0	1.0	0.2	0.7
Percentage of New Castle, DE inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Atlantic County, NJ inventory	–	–	–	–	< 0.1%	0.9%	< 0.1%	0.1%	< 0.1%	< 0.1%
Percentage of Burlington County, NJ inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Camden County, NJ inventory	–	–	–	–	< 0.1%	0.7%	< 0.1%	< 0.1%	0.1%	< 0.1%
Percentage of Cumberland County, NJ inventory	–	–	–	–	< 0.1%	1.4%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Gloucester County, NJ inventory	–	–	–	–	< 0.1%	0.8%	< 0.1%	< 0.1%	< 0.1%	< 0.1%

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Percentage of Salem County, NJ inventory	–	–	–	–	< 0.1%	1.7%	0.1%	0.2%	< 0.1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Bucks County, PA inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Delaware County, PA inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Philadelphia County, PA inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Sparrows Point, MD										
Emissions within 25 nm of MD	1,995.0	0.0	0.1	2,025.1	5.7	34.3	1.1	1.0	0.3	0.8
Emissions within 25 nm of NY	1,511.0	0.0	0.1	1,541.1	5.1	22.1	0.7	0.7	0.1	0.5
Percentage of Anne Arundel County, MD inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Baltimore City, MD inventory	–	–	–	–	< 0.1%	0.4%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Baltimore County, MD inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Harford County, MD inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%
Port of Norfolk, VA										
Emissions within 25 nm of NY	1,507.0	0.0	0.1	1,536.8	5.1	22.0	0.7	0.7	0.1	0.5
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%	< 0.1%

Sources: Jacobs (2020); EPA (2014).

Note: DE = Delaware, CT = Connecticut, MA = Massachusetts, MD = Maryland, NY = New York, PA = Pennsylvania, RI = Rhode Island, VA = Virginia.

BOEM obtained avoided emissions from EPA's AVERT for the New York region. The estimated annual and lifetime (25 years, plus up to an additional 2 years for conceptual decommissioning) emissions are based on design capacity of the Project (180 MW). As presented in Table 3.3.1-10, the Project would annually displace CO_2, NO_X, and SO_2 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 3.3.1-10. Estimated Annual and Lifetime Avoided Emissions (tons) for the Operation of the South Fork Wind Farm over a 25-year Period

Pollutant	CO_2	NO_X	SO_X	$PM_{2.5}$
Annual avoided emissions	319,080	97.39	53.20	14.28
Lifetime avoided emissions	7,977,000	2,434.75	1,329.88	356.88

Note: Emissions are presented in tons and were obtained from AVERT (EPA 2020a).

The EPA's CO-Benefits Risk Assessment (COBRA) screening model was used to estimate the health impacts of avoided emissions in the geographic analysis area. The geographic analysis area comprises Hartford, Middlesex, New London, Tolland, and Windham Counties in Connecticut; Dukes County in Massachusetts; Suffolk County in New York; and Bristol, Newport, and Washington Counties in Rhode Island (Figure C-1). The model provides estimated ranges of reduced occurrences of health events due to 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. The EPA recommends using both for a bounding approach. For the geographic analysis area, COBRA estimates the 2023 total health benefit ranges to be $665,529 to $1,500,852 at a 3% discount rate and $593,863 to $1,338,499 at a 7% discount rate. COBRA estimates statistical lives saved within the geographic analysis area for calendar year 2023 to range from 0.06 to 0.14 (EPA 2020b). This would represent a long-term, minor beneficial impact due to avoided health events.

Conceptual decommissioning activities would take approximately 1 year and would include the removal of the piles, the scour protection, and underwater cable as well as the decommissioning of the turbines. Table 3.3.1-11 presents a summary of emissions resulting from the decommissioning of the Project in the OCS air permit area. Table 3.3.1-12 presents a summary of emissions resulting from the conceptual decommissioning of the Project. Decommissioning-related emissions would be temporary, would fall below the de minimis thresholds, and would therefore have a minor, temporary adverse impact on both the overall air quality of the region and non-attainment counties.

Table 3.3.1-11. Estimated Project Air Emissions Resulting from Conceptual Decommissioning in Outer Continental Shelf Air Permit Area

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
OCS permit decommissioning emissions (worst-case port – Paulsboro Marine Terminal)	6,382.0	0.0	0.3	6,471.4	15.8	99.1	3.3	3.2	0.7	2.3
Percentage of Barnstable County, MA inventory	–	–	–	–	< 0.1%	1.5%	< 0.1%	0.2%	< 0.1%	< 0.1%
Percentage of Bristol County, MA inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	0.1%	< 0.1%	< 0.1%
Percentage of Dukes County, MA inventory	–	–	–	–	0.2%	9.4%	0.3%	1.3%	0.9%	< 0.1%
Percentage of Newport County, RI inventory	–	–	–	–	0.1%	4%	0.5%	0.9%	0.2%	< 0.1%
Percentage of Newport County, RI inventory	–	–	–	–	< 0.1%	1.6%	0.2%	0.4%	0.1%	< 0.1%

Sources: Jacobs (2020); EPA (2014).

Note: MA = Massachusetts, RI = Rhode Island.

Table 3.3.1-12. Estimated Project Air Emissions Resulting from Conceptual Decommissioning

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Port New Bedford, MA										
Emissions within 25 nm of MA	841	0.0	0.0	841	2.7	12.9	0.4	0.4	0.3	0.0
Emissions within 25 nm of NY	3,720	0.0	0.1	3,750	14.3	41.3	1.4	1.4	3.9	0.0
Percentage of Dukes County, MA inventory	–	–	–	–	< 0.1%	1.2%	< 0.1%	0.2%	0.4%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.1%	< 0.1%	< 0.1%	0.1%	< 0.1%
Port of Providence, RI										
Emissions within 25 nm of NY	3,720	0.0	0.1	3,750	14.3	41.3	1.4	1.4	3.9	0.0
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.1%	< 0.1%	< 0.1%	0.1%	< 0.1%
Port of New London, CT										
Emissions within 25 nm of CT	635	0.0	0.0	635	2.2	9.4	0.3	0.3	0.3	0.0
Emissions within 25 nm of NY	3,720	0.0	0.1	3,750	14.3	41.3	1.4	1.4	3.9	0.0

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	CH_4	N_2O	CO_2e	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Percentage of Hartford County, CT inventory	–	–	–	–	0.7%	< 0.1%	< 0.1%	24.8%	< 0.1%	< 0.1%
Percentage of Middlesex County, CT inventory	–	–	–	–	2.8%	< 0.1%	< 0.1%	67.3%	0.3%	< 0.1%
Percentage of New London County, CT inventory	–	–	–	–	1.9%	< 0.1%	< 0.1%	43.1%	0.2%	< 0.1%
Percentage of Tolland County, CT inventory	–	–	–	–	3.5%	< 0.1%	< 0.1%	66.5%	0.4%	< 0.1%
Percentage of Windham County, CT inventory	–	–	–	–	3.8%	< 0.1%	< 0.1%	64%	0.5%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	1%	< 0.1%	< 0.1%	35.1%	< 0.1%	< 0.1%
Paulsboro Marine Terminal, NJ										
Emissions within 25 nm of NJ	5,941	0.0	0.3	6,030	17.3	98.0	3.3	3.2	1.3	0.0
Emissions within 25 nm of NY	5,405	0.0	0.2	5,465	19.1	69.4	2.4	2.3	4.3	0.0
Percentage of New Castle, DE inventory	–	–	–	–	< 0.1%	0.5%	< 0.1%	0.1%	0.2%	< 0.1%
Percentage of Atlantic County, NJ inventory	–	–	–	–	< 0.1%	1.7%	0.2%	0.3%	0.3%	< 0.1%
Percentage of Burlington County, NJ inventory	–	–	–	–	< 0.1%	1.2%	< 0.1%	< 0.1%	0.2%	< 0.1%
Percentage of Camden County, NJ inventory	–	–	–	–	< 0.1%	1.4%	0.1%	0.2%	0.4%	< 0.1%
Percentage of Cumberland County, NJ inventory	–	–	–	–	< 0.1%	2.8%	0.1%	0.2%	0.3%	< 0.1%
Percentage of Gloucester County, NJ inventory	–	–	–	–	< 0.1%	1.6%	0.1%	0.2%	0.1%	< 0.1%
Percentage of Salem County, NJ inventory	–	–	–	–	0.2%	3.3%	0.3%	0.5%	0.1%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	0.1%	< 0.1%
Percentage of Bucks County, PA inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	< 0.1%	0.3%	< 0.1%
Percentage of Delaware County, PA inventory	–	–	–	–	< 0.1%	0.6%	< 0.1%	0.1%	0.2%	< 0.1%
Percentage of Philadelphia County, PA inventory	–	–	–	–	< 0.1%	0.4%	< 0.1%	< 0.1%	0.3%	< 0.1%
Sparrows Point, MD										
Emissions within 25 nm of MD	4,145	0.0	0.2	4,205	12.2	68.0	2.3	2.2	0.9	0.0
Emissions within 25 nm of NY	4,418	0.0	0.1	4,448	16.3	52.9	1.8	1.8	4.1	0.0
Percentage of Anne Arundel County, MD inventory	–	–	–	–	< 0.1%	0.4%	< 0.1%	0.1%	< 0.1%	< 0.1%
Percentage of Baltimore City, MD inventory	–	–	–	–	< 0.1%	0.7%	< 0.1%	0.2%	0.1%	< 0.1%
Percentage of Baltimore County, MD inventory	–	–	–	–	< 0.1%	0.4%	< 0.1%	< 0.1%	< 0.1%	< 0.1%

	Pollutant (tpy) and Percentages by County Inventory									
	CO_2	**CH_4**	**N_2O**	**CO_2e**	**CO**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**
Percentage of Harford County, MD inventory	–	–	–	–	< 0.1%	1.2%	< 0.1%	0.1%	0.2%	< 0.1%
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	0.1%	< 0.1%
Port of Norfolk, VA										
Emissions within 25 nm of NY	4,409	0.0	0.1	4,439	16.3	52.8	1.8	1.8	4.1	0.0
Percentage of Suffolk County, NY inventory	–	–	–	–	< 0.1%	0.2%	< 0.1%	< 0.1%	0.1%	< 0.1%

Sources: Jacobs (2020); EPA (2014).

Note: DE = Delaware, CT = Connecticut, MA = Massachusetts, MD = Maryland, NY = New York, PA = Pennsylvania, RI = Rhode Island, VA = Virginia.

Cumulative Impacts

Air emissions and climate change: The Proposed Action would result in temporary minor and long-term minor beneficial incremental impacts to air quality through the generation of construction and installation, O&M, and conceptual decommissioning emissions. The Proposed Action's construction emissions (see Table 3.3.1-6 and Table 3.3.1-7) would increase construction emissions of regulated pollutants (NO_x, SO_2, PM_{10}, and CO_2) over the construction emissions generated by other offshore wind projects associated with the No Action alternative (see Table 3.3.1-4). Therefore, total cumulative construction-related air emissions in the OCS Air Permit Area would consist of an estimated 13,326 tons of NO_x, 102 tons of SO_2, 462 tons of PM_{10}, and 856,233 tons of CO_2. These effects would be localized and would cease when Project construction is complete. For context, the incremental construction emissions contributed by the Proposed Action within the OCS Air Permit Area would result in a 1.0% to 4.0% increase in regulated pollutants that are currently emitted due to highway vehicle emissions in Suffolk County.

Air quality impacts from O&M of the Proposed Action, provided in Table 3.3.1-8 and Table 3.3.1-9, would be combined with the air quality impacts from all other O&M activities that may occur under the No Action alternative (see Table 3.3.1-5), albeit at lower emission quantities as compared to the construction and installation period. Total cumulative operation-related air emissions in the OCS Air Permit Area would consist of an estimated 276 tons of NO_x, 1 ton of SO_2, 8 tons of PM_{10}, and 19,877 tons of $CO_{2.}$ Compared to electrical utilities' fuel combustion emissions in Suffolk County, however, the incremental O&M emissions contributed by the Proposed Action within the OCS Air Permit Area would only result in a 1.0% to 5.0% increase in regulated pollutants. O&M emissions would incrementally add emissions in localized areas, several times per year, for the lifetime of the Project.

Air quality in the region could be improved in the long term because an additional operating wind farm would offset emissions from fossil fuel–generated energy sources. As presented in Table 3.3.1-10, the Proposed Action would avoid an estimated 234 tons of NO_x, 164 tons of SO_2, and 217,653 tons of CO_2 every year by providing energy generation that existing fossil fuel–generated energy sources would have otherwise provided (EPA 2020a). This represents up to an estimated 1.6% to 2.4% increase in avoided emissions over the No Action alternative on an annual basis.

The Proposed Action would also have an incremental contribution on existing GHG emissions. The construction and installation, O&M, and the eventual conceptual decommissioning of the Proposed Action would cause a 1% to 4% increase in CO_2 emissions over the No Action alternative within the OCS Air Permit Area. However, these contributions would be negligible compared to aggregate global emissions. In 2018, United States GHG emissions totaled 6,677 million metric tons of carbon dioxide equivalents (CO2e) (EPA 2020a). The Proposed Action could also contribute to a long-term net decrease in GHG emissions because fossil fuel–generated energy facilities reduce operations from the increased energy generation from offshore wind projects.

Based on above findings, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in minor to moderate cumulative impacts to air quality due to air emissions, as well as a long-term minor beneficial impact to climate change due to reduced reliance on fossil fuel-generated energy sources.

Accidental releases: Accidental releases of air emissions could also occur from potential Project chemical spills. Surface evaporation of these potential chemical spills could lead to short-term, localized periods of toxic pollutant emissions. However, the potential volumes of oils, lubricants, and diesel spilled would result in very small emissions of pollutants into the atmosphere relative to construction and installation, O&M and conceptual decommissioning activities (see Section 3.3.2.2.3). BOEM estimates that the

Project would result in a negligible 2% incremental increase in total chemical usage over the No Action alternative. For this reason, the incremental additional of accidental releases from the Proposed Action would not be expected to contribute appreciably to overall impacts on air quality. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in negligible cumulative impacts to air quality due to accidental releases.

Conclusions

Project construction and installation and conceptual decommissioning would temporarily increase air emissions. Emissions from Project O&M would be much lower than those produced during construction and installation and conceptual decommissioning but could also result in limited emissions, primarily from vehicle and vessel traffic. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **minor** to **moderate**. Project O&M would also generate long-term, **minor** beneficial impacts by providing energy to the region from a renewable resource and reducing health events due to air pollution. Therefore, BOEM expects the overall impact on air quality from the Proposed Action alone to be **minor** because the overall effect would be small and would recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor** adverse and **minor 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** adverse impacts and **minor beneficial** impacts to air quality. BOEM made this call because the overall effect would be small and the resource would recover completely.

3.3.1.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would result in impacts on air quality from air emission and inadvertent spills due to construction and installation, O&M, and conceptual decommissioning. However, construction under this alternative could result in a decrease in Project-related emissions if DWSF requires less trenching and/or vessel traffic to install the reduced number of WTGs and their associated inter-array cables. Therefore, emissions from construction and installation would be minor to moderate, temporary, and reduced through implementation of EPMs (see Table G-1 in Appendix G). Additionally, although DWSF would construct fewer WTGs under this alternative, DWSF would use 12-MW WTGs to meet their 130-MW power purchase agreement. Therefore, during O&M, this alternative would also result in long-term beneficial impact on air quality by providing energy to the region from a renewable resource and reducing the region’s reliance on fossil fuels and reducing health events.

Cumulative Impacts

As noted above, the Transit alternative would result in incremental impacts to air quality at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative to air quality when combined with past, present, and reasonably foreseeable activities would be temporary, negligible to minor, and adverse during construction and installation, and long-term, minor, and beneficial during operations.

If the Transit alternative is implemented, the WTGs for other reasonably foreseeable offshore wind projects may need to be relocated or eliminated within lease areas to avoid the transit lanes. These shifts could shorten or increase vessel trips, transmission cable lengths, and installation times for other future projects, depending on what WTG changes occur. If WTG shifts require additional fossil fuel consumption for vessel and equipment activity, these effects could increase cumulative, construction-related air emissions relative to the Proposed Action. Conversely, if these shifts result in WTG reductions that reduce fuel-consuming activities, these effects could decrease cumulative, construction-related air quality impacts relative to the Proposed Action.

Conclusions

Although the Transit alternative 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 the alternative alone would be similar to the Proposed Action and range from **minor** to **moderate**. Project O&M would also generate long-term, **minor beneficial** impacts by providing energy to the region from a renewable resource and reducing health events due to air pollution.

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

3.3.1.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would result in impacts on air quality from air emission and inadvertent spills due to construction and installation, O&M, and conceptual decommissioning. However, construction under this alternative could result in a decrease in Project-related emissions if DWSF requires less trenching and/or vessel traffic to install the reduced number of WTGs and their associated inter-array cables. Therefore, emissions from construction and installation would be minor to moderate, temporary, and reduced through implementation of EPMs (see Table G-1 in Appendix G). Additionally, DWSF would use 12-MW WTGs to meet their 130-MW power purchase agreement. Therefore, during O&M, this alternative would also result in long-term beneficial impact on air quality by providing energy to the region from a renewable resource and reducing the region’s reliance on fossil fuels and reducing health events.

Cumulative Impacts

As noted above, the Habitat alternative would result in incremental impacts to air quality at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative to air quality when combined with past, present, and reasonably foreseeable activities would be temporary, negligible to minor, and adverse during construction and installation, and long term and beneficial during operations.

Conclusions

Although the Habitat alternative 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 the alternative alone would be similar to the Proposed Action and range from **minor** to **moderate**. Project O&M would also generate long-term, **minor beneficial** impacts by providing energy to the region from a renewable resource and reducing health events due to air pollution.

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

3.3.1.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the number of WTGs and their associated inter-array cables vary slightly, BOEM expects that air quality impacts would range from **minor** to **moderate** and **minor beneficial** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor** and **minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor** and **minor beneficial**.

3.3.1.4 Mitigation

No potential additional mitigation measures for air quality are identified in Appendix G.

3.3.2 Water Quality

3.3.2.1 Affected Environment

3.3.2.1.1 ONSHORE SURFACE WATER

The onshore analysis area is located within the Georgica Pond-Frontal Atlantic Ocean subwatershed (Hydrologic Unit Code [HUC] 020302020606) and Moriches Bay-Atlantic Ocean subwatershed (HUC-020302020902). The Georgica Pond-Frontal Atlantic Ocean subwatershed falls within the western portion of the analysis area, which includes five named and 13 unnamed surface waterbodies or segments (Figure C-2). The Moriches Bay-Atlantic Ocean subwatershed encompasses the entire eastern portion of the analysis area, which includes one named and seven unnamed surface waterbodies. Within these two subwatersheds, two waterbodies that fall within the analysis area are currently listed as impaired. Fairfield Pond (Class C [supports fisheries and suitable for non-contact activities]) and Georgica Pond (Class SA [saline waters; shellfishing for market purposes; primary and secondary contact recreation and fishing]) were listed as impaired in 2016 because of low dissolved oxygen (DO) from undetermined causes and pathogens from agricultural sources, respectively (New York State Department of Environmental Conservation [NYSDEC] 2016a, 2016b).

3.3.2.1.2 ONSHORE GROUNDWATER

The Long Island aquifer supplies groundwater to the onshore analysis area and is designated by the EPA as a sole source aquifer, meaning it serves as a primary drinking water resource. Special Groundwater Preserve Areas, which are critical areas identified by NYSDEC (2019a) for protection because of their roles in providing drinking water resources, recharging groundwater, or protecting groundwater, are also located in the analysis area. Groundwater is measured at approximately 40 feet below grade at the proposed interconnection facility and is relatively shallower along the two onshore SFEC routes, with the depth to groundwater being approximately 4 to 5 feet around the landing sites (Beach Lane and Hither Hills).

Overall, existing groundwater quality in the analysis area appears to be good and meets NYSDEC (2018) groundwater quality standards. However, as indicated by NYSDEC (2019b), three NYSDEC Environmental Remediation Sites are mapped near the interconnection facility (NYSDEC 2019c). These are NYSDEC #152156, which served as an airport hangar for the East Hampton Airport before it was abandoned in 1991; NYSDEC #152213 (the Hortonsphere site), a gas storage facility east of the proposed interconnection facility and upgradient of the onshore SFEC route from the Hither Hills landing site; and NYSDEC #152219, a former gasoline refinery facility that predates the 1930s. Sampling and analysis at these sites have not confirmed or revealed elevated or significant remaining contamination. These sites are therefore not a concern for the onshore SFEC route.

3.3.2.1.3 OFFSHORE WATERS

Offshore waters comprise coastal waters (e.g., ports/harbors, rivers, bays, and estuaries; marine waters) located within the state territory (within 3 nm of shore) and within the federal waters. The coastal waters, including the Long Island Sound and Atlantic Ocean, are located offshore and include existing port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, and/or Virginia that could be used for the Project. Marine waters are considered temperate because of their highly seasonal variations in temperature, stratification, and productivity. Water currents in the analysis area generally flow southwest, although bottom water currents may flow northward. Currents near the shoreline flow east. Average year-round surface currents were measured at approximately 8 inches per second, with the strongest currents measured at 20 inches per second (Fugro 2019).

Offshore water quality is characterized by temperature, salinity, DO, nutrients, chlorophyll *a*, and turbidity. These parameters, which are described in detail in COP Section 4.2.2, influence coastal and marine environments and are indicators of ecosystem health.

Water quality in the Long Island Sound has improved over the last decade and is rated as “very good” with the exception of the western-most portion, which has been experiencing water quality degradation from nutrient (nitrogen) pollution (University of Maryland 2018). Coastal waters off Rhode Island, including Narragansett Bay and nearby coastal ponds, have also experienced degraded water quality from nutrients and storm water runoff carrying contaminants (Rhode Island Division of Planning 2016). Water quality in the area generally improves north to south with distance from pollutant sources in urbanized areas. The water quality of the coastal waters ranging from Maine to North Carolina, which include the SFWF and offshore SFEC, was rated as “good” to “fair” (EPA 2012). EPA surveyed four sites within the Block Island Sound and near the Lease Area. These surveys revealed surface and bottom water DO concentrations above established levels for the “highest quality marine waters.” Chlorophyll *a* was found at slightly elevated levels, resulting in “fair” water quality conditions. Currents and storms contribute to turbidity throughout the water column from the resuspension of clay, silt, and fine-grained sand making up the sediment. Federal marine waters typically have very low concentrations of total suspended solids (TSS). Little information exists on algal and bacteria dynamics within the analysis area. However, there have been no documented reports of harmful algal blooms or waterborne pathogen outbreaks (EPA 2012). Temperature of offshore waters fluctuates seasonally. Water temperatures are highest in July and August, with surface waters at approximately 68 degrees Fahrenheit (°F) and bottom waters at 50°F, and lowest in the winter, with surface waters at approximately 39°F to 41°F. Salinity also fluctuates throughout the year with lower concentrations in the spring because of water inflows from ice melt and precipitation and higher concentrations in the fall and winter. See Section 4.2.4 of the COP for additional information regarding physical oceanographic and meteorological conditions within the Lease Area.

Contaminants could also reside within the sediment column and contribute to water quality conditions. However, 12 cores obtained within the state marine waters for the offshore SFEC and analyzed for an array of anthropogenic contaminants did not reveal contamination, and the sediment met the Class A (No Appreciable Contamination) as defined in the Sediment Quality Thresholds described in the *Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1999).

3.3.2.2 Environmental Consequences

3.3.2.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.3.2-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.3.2-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Water Quality

Issue	Impact Indicator	Significance Criteria
Runoff, sedimentation, sediment movement, suspension or resuspension, changes to stratification or mixing patterns of sediments, or spills of hazardous materials	Changes to turbidity, nutrients, DO, temperature, salinity, and/or Chlorophyll *a* Introduction of new contaminants/oil or changes to sediments, or changes in flows	Negligible: Changes would be undetectable. Minor: Changes would be detectable but would not result in degradation of water quality in exceedance of water quality standards. Moderate: Changes would be detectable and would result in localized, short-term degradation of water quality in exceedance of water quality standards. Major: Changes would be detectable and would result in extensive, long-term degradation of water quality in exceedance of water quality standards.
Disturbance or seepage to groundwater resources		

3.3.2.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing water quality trends from past and present activities. Attachment 2 in Appendix E provides additional information regarding past and present activities and associated water quality impacts. Future non-Project onshore sources of water pollution include electrical transmission lines, port development and expansion, and U.S. Army Corps of Engineers (USACE) shore development and cleanup projects. Future non-Project offshore sources of water pollution include an undersea transmission line, a gas pipeline, submarine cable projects, one tidal energy project (the Roosevelt Island Tidal Energy Project), vessel traffic, and offshore wind projects. Attachment 2 in Appendix E also discloses future non–offshore wind activities and associated water quality impacts. Impacts associated with future onshore activities and future offshore wind activities are described below.

Onshore Future Activities (without the Proposed Action)

Reasonably foreseeable onshore activities could contribute to changes in water quality from erosion and sedimentation, discharges, and dispersal of contaminants during routine spills (i.e., spills less than 10 barrels, or 420 gallons). These activities would be expected to comply with any applicable permit requirements to implement erosion, storm water, and spill 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 NYSDEC (2018) water quality standards. Onshore water quality of impaired waterbodies, including Fairfield and Georgica Ponds, would also be maintained or improved through established total maximum daily loads (NYSDEC 2016a, 2016b). Other surface and ground waterbodies would be monitored and managed to meet water quality standards and drinking water resource protections. Ongoing onshore water quality impacts from these activities are anticipated to continue regardless of the offshore wind industry. As a result, adverse impacts from future activities on onshore water quality under the No Action alternative would be temporary to long term and minor to moderate.

Some onshore future projects, such as flood risk management, storm preparedness, climate adaptation planning, and sediment management projects identified in Appendix E could result in beneficial impacts to onshore water quality through reductions in erosion, sedimentation, storm water runoff, and flooding. Improvements to onshore water quality from these future projects could be localized or widespread, depending on the nature of the activities, and long term. Ongoing benefits to onshore water quality from these activities would continue regardless of the offshore wind industry. As a result, impacts from these future activities on onshore water quality under the No Action alternative would be long term, minor, and beneficial.

Offshore Future Activities (without the Proposed Action)

Accidental releases and discharges: Future offshore wind activities could contribute to changes in offshore water quality from a spill or release during routine vessel or equipment use, spill at an offshore wind facility, spill during construction due to a vessel allision or collision, or the accidental discharge of trash and debris.

Based on assumed construction schedules (see Appendix E), numerous offshore wind projects could occur with overlapping construction schedules between 2022 and 2030. This DEIS estimates that up to approximately 300,000 gallons of coolants and 4 million gallons of oils and lubricants could be stored within WTG foundations and the OSS within the water quality geographic analysis area. A total of approximately 850,000 gallons of coolants and 10.5 million gallons of oils and lubricants could be stored within WTG foundations and the OSS across all projected offshore wind projects along the Atlantic coast. 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 is very low (once per 1,000 years) due to vessel allisions, collisions, O&M activities, or weather events (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 the Bureau of Safety and Environmental Enforcement. 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 impact on affected resources from spills. WTGs and the OSS are generally self-contained and would not generate discharge. Vessels would also have their own onboard containment measures that would further reduce the impact of an allision. A release during construction or operation would generally be localized, short term, and result in little change to water quality. In the unlikely event an allision or collision involving project vessels or components resulted in a large spill, impacts on water quality would be minorly to moderately 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 because operators would comply with federal and international requirements for management of shipboard trash. All vessels would also need to comply with the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162; allowed vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids.

Anchoring: Offshore wind activities would contribute to changes in offshore water quality from resuspension and deposition of sediments during anchoring. BOEM estimates that approximately 88 acres of seabed could be impacted by anchoring under the No Action alternative within the water quality geographic analysis area. Disturbances to the seabed during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. As described in Section 3.3.2.1.3, 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 and temporary.

New cable emplacement/maintenance: BOEM estimates that approximately 2,977 acres of seabed could be impacted by cable placement under the No Action alternative due to reasonably foreseeable offshore wind development. As described under anchoring, these activities would contribute to changes in offshore water quality from the resuspension and deposition of sediment. Sediment modeling for the Proposed Action indicates that sediment suspension and deposition would occur within an approximate 1-acre area and would settle shortly (hours to days) after their release (Vinhateiro et al. 2018). BOEM anticipates that future offshore wind projects would use dredging only when necessary and rely on other cable laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. For these reasons, sediment suspension associated with other wind projects would be localized, minor, and temporary.

Port utilization: Offshore wind development would use nearby ports, and could also require port expansion or modification, resulting in increased vessel traffic or increased suspension and turbidity from any in-water work. These activities could also increase the risk of accidental spills or discharge. 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 to long term but minor.

Presence of structures: Reasonably foreseeable offshore wind projects are estimated to result in no more than 652 structures by 2030. These structures could disturb up to 932 acres of seabed from foundation, scour, and cable 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 may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016; Cazenave et al. 2016). Alterations in currents and mixing would affect water quality parameters such as temperature, DO, and salinity, but would vary seasonally and regionally. WTGs and the OSS 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 seabed disturbance from foundations, scour, and cable installation. As a result, adverse impacts on offshore water quality under the No Action alternative would be localized, short term, and minor.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on 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 onshore erosion and sedimentation, discharges, dispersal of contaminants during routine spills as well as 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 and onshore activities would be **minor to moderate,** and **minor beneficial**. As described in Attachment 2 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be **minor** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area 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.

3.3.2.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Onshore

Construction of the onshore portion of the Project would require temporary (up to 12 months) ground-disturbing activities including surficial digging, land clearing, trenching, HDD, use of equipment and vehicles, and installation of permanent (over the life of the Project) onshore infrastructure (e.g., underground transmission/export cables, O&M facility, and interconnection facility). Fill materials would be used for installation of structures. Equipment and vehicles would require the use of fuels and oils during onshore construction. Dredging to a depth of 12 feet below mean lower low water would be required at the Montauk O&M facility to allow for suitable depths for navigation and berthing. Initial dredging would occur during construction, and intermittent dredging would occur throughout maintenance.

None of the onshore Project facilities or SFEC routes directly intersect any surface waterbodies. However, onshore construction activities upgradient of surface waterbodies would expose soils and sediments, resulting in potential erosion and sedimentation into onshore surface waters and changes to flows that could affect water quality. Infrastructure construction would result in the long-term increase in impervious surfaces in the onshore water quality analysis area. If eroded soils or fill materials contain pollutants or contaminants, their direct release or indirect deposition in onshore surface waters could also lead to degradations to water quality, particularly for waterbodies with existing impairments, the causes of which could be exacerbated with additional pollutant loads. However, total maximum daily loads established for impaired waterbodies and continued water quality monitoring would help identify and manage water quality degradations, should they occur. Dredging may temporarily result in increased turbidity; however, in addition to navigation improvements, dredging material from the navigation channel would be placed in shoreline areas that have experienced erosional damages, thereby offering long-term coastal storm risk management benefits. Section 4.2.2.3 of the COP includes features that would avoid or minimize impacts on water quality, including encasement of the cable in areas where HDD is required. New impervious surfaces as a result of infrastructure would be minimal (up to 4 acres) compared to the extent of the entire analysis area. Onshore SFEC routes would also be located within public roadways and the Metropolitan Transportation Authority–owned LIRR ROW, or along roadway corridors that are characterized as impervious road surfaces or railroad beds, thereby minimizing impacts to undisturbed areas. Because overall construction activities and infrastructure would disturb more than 1 acre, discharges would be permitted through a general construction permit under the National Pollutant Discharge Elimination System program. DWSF would also develop a storm water pollution prevention plan (SWPPP) as part of the permitting process that would result in implementation of erosion and sediment controls prior to and during construction. Placement of dredged material on shorelines could result in temporary turbidity but would also help with beach erosion and provide coastal storm risk protections. Therefore, any adverse impact on water quality would be temporary and minor.

Fuels and oils would be required for onshore construction equipment and vehicles and for infrastructure. Most inadvertent spills of fuels and oils used during construction would be classified as routine because of their size (i.e., spills less than 10 barrels, or 420 gallons) and rapid dispersion (BOEM 2015). Routine spills could lead to direct (spill directly into waterbody) or indirect (spill reaches waterbody through soil erosion or water runoff) degradations to water quality in surface waterbodies downgradient of the onshore route or infrastructure. As previously noted, Table G-1 in Appendix G includes EPMs to avoid or minimize potential spill impacts on water quality, comply with all general construction permit requirements, and implement runoff controls and buffers. In addition, DWSF would develop and implement a spill prevention control and countermeasures (SPCC) 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 and minor to moderate, depending on the severity of potential spills.

There are no onshore construction activities under the Proposed Action that would require ground disturbance at depths at or near groundwater resources, and all activities would meet permit and regulatory requirements to continue protecting groundwater as drinking water resources. The use of HDD at the landing sites would negate the need for trenching in areas where shallow groundwater would intersect the trench excavation. Onshore subsurface ground-disturbing activities would not be placed at a depth that could encounter groundwater, and would therefore not result in impacts on water quality. As described for onshore surface water, potential spills would be avoided or managed through an SPCC plan and HDD inadvertent release plan and proper storage and handling procedures. Therefore, adverse impacts on groundwater quality would be short term and minor to moderate, depending on the severity of potential spills.

Offshore

Construction of the offshore portion of the Project would require temporary (up to 12 months) seafloor-disturbing activities including trenching, boulder relocation, HDD, use of equipment and vessels, vessel mooring/anchoring, dredging (depending on the port selected), and installation of in-water infrastructure (turbine foundations, transmission/export cables, and electrical service platform). Equipment and vessels would require the use of fuels and oils during offshore construction. The total area of the foundation footprint and scour protection is provided in Appendix D under the maximum-case scenario.

Offshore construction activities would contribute to the movement and resuspension of sediments into the water column. This movement and resuspension would contribute to turbidity, and deposition of these sediments would directly affect water quality or indirectly affect water quality through changes in flows. If sediments contain pollutants or contaminants, their resuspension would lead to degradations of water quality. Installation activities for turbine foundations on the seafloor could disrupt bottom current patterns, resulting from or leading to increased movement, suspension, and deposition of sediments (see Section 3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish).

EPMs in Table G-1 in Appendix G would avoid or minimize impacts on water quality, and DWSF would comply with all permit and regulatory requirements related to water quality. Vessels that support Project activities would be large enough to be subject to USCG regulations regarding waste and discharge. Foreign-flagged vessels would also have a USCG-compliant and certified ballast water management system. Any disturbance to sediment from vessel mooring/anchoring would be negligible because of the limited duration (minutes to hours) and magnitude (a total of 821 acres, limited to the immediate area where vessel mooring/anchoring would contact the seafloor) of disturbance. Modeling of the extent and timing of other offshore sediment releases concluded that sediment suspension and deposition would occur within an approximate 1-acre area and would settle shortly (hours to days) after their release

(Vinhateiro et al. 2018). For these reasons, sediment suspension would be localized and temporary. Changes to water quality would be detectable but would not result in degradation of water quality that would exceed water quality standards. DWSF-modeled TSS levels expected to result from offshore Project construction (Fugro 2019a, 2019b). Model results indicated that elevated TSS plumes could extend 330 feet and last up to 1 hour before returning to background levels. Elliott et al. (2017) monitored TSS levels during construction of the Block Island Wind Farm (BIWF). The observed TSS levels were far lower than levels predicted using the same modeling methods, dissipating to baseline levels less than 50 feet from the disturbance. Both the modeled and the observed TSS effects were short term in duration. Construction dredging activities at the Montauk O&M facility would temporarily increase TSS levels up to 100 milligrams (mg)/L (Vinhateiro et al. 2018) over the duration of activity. 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 2019), would help identify and manage water quality degradations, should they occur. Therefore, the adverse impact on water quality would be temporary and minor.

Offshore construction equipment, vessels, and infrastructure would require fuels and oils over the construction period. As described for onshore waters, most inadvertent spills in offshore waters during construction would be classified as routine and minor, such as the release of fuels and oils from vessels or turbines, which would disperse rapidly. In addition, secondary containment measures would be implemented for all diesel tanks at WTGs. Under the Project, the highest possible spill would be the inadvertent release of fuels and oils stored at WTGs and OSS, which would contain up to 2,582 gallons of fuels and oils. Project EPMs (see Table G-1 in Appendix G), permit requirements, controls, and procedures described above to reduce the potential or extent of onshore spills would also be applied in offshore waters, 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 2013), and minor to moderate, depending on the severity of the spill. The Project could also result in accidental releases of trash and debris; however, these releases would be infrequent and negligible because operators would comply with federal and international requirements for management of shipboard trash, and the extent of an accidental release would be limited to the localized area.

Operations and Maintenance and Conceptual Decommissioning

Onshore

O&M and conceptual decommissioning of the onshore portion of the Project would include the same permit requirements and erosion, storm water, and spill controls as described for onshore construction activities and would lead to the same types of minor to moderate adverse impacts on surface water and groundwater quality from erosion, sedimentation, and inadvertent spills. Impacts on water quality during O&M would be less in terms of frequency and intensity than impacts during construction and conceptual decommissioning.

Offshore

O&M and conceptual decommissioning of the offshore portion of the Project would include the same permit requirements and sediment controls as described for offshore construction activities and would lead to the same types of minor adverse impacts on water quality from sediment resuspension, deposition, and minor to moderate adverse impacts on water quality from inadvertent spills. Spills would be temporarily detectable and would disperse rapidly, thereby limiting the magnitude and extent of changes to water quality.

The presence of structures during O&M could disrupt bottom current patterns leading to scour from the increased movement, suspension, and deposition of sediments. Project EPMs (see Table G-1 in Appendix G), permit requirements, controls, and procedures described above for reducing or avoiding changes to sediment would also be applied during operation. Disturbed sediments would be limited to a localized area (within approximately 1 acre) and would settle shortly (hours to days) after their release. Alterations in currents and mixing would affect water quality parameters such as temperature, DO, and salinity, but would vary seasonally and regionally. Changes to water quality would be detectable but would not result in degradation of water quality that would exceed water quality standards. Therefore, the adverse impact on water quality would be temporary and minor.

Cumulative Impacts

Onshore

The Proposed Action would result in minor to moderate incremental impacts to onshore water quality impacts on surface water and groundwater due to erosion and sedimentation, discharges, and dispersal of contaminants during routine spills (i.e., spills less than 10 barrels, or 420 gallons). The Proposed Action would also incrementally add to other onshore habitat disturbance actions through the development of 2.4 acres for the interconnection facility and redevelopment of a small area (0.1 acre) of land at the selected O&M facility. State and local agencies would be responsible for minimizing and avoiding water quality and other impacts during construction. The Project and other reasonably foreseeable projects would be expected to comply with any applicable permit requirements to implement erosion, storm water, 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, and minor to moderate cumulative impacts on onshore water quality.

Offshore

Accidental releases and discharge: The Proposed Action could incrementally add accidental releases of fuel, fluids, or hazardous material; sediment; and/or trash and debris to conditions under the No Action alternative. BOEM estimates that the Project would result in a negligible, 2% increase in total chemical usage over the No Action alternative. This risk would be increased primarily during construction but also during O&M and conceptual decommissioning. When combined with other offshore wind projects, up to approximately 300,000 gallons of coolants and 4 million gallons of oils and lubricants could cumulatively be stored within WTG foundations and the OSS within the water quality geographic analysis area. As noted under Section 3.3.2.2.2 (No Action Alternative), approximately 850,000 gallons of coolants and 10.5 million gallons of oils and lubricants could be stored within WTG foundations and the OSS if all projected offshore wind projects along the Atlantic coast are developed. 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 G-1 in Appendix G) proposed for waste management and mitigation of marine debris would be required of SFWF 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 minor to moderate and short term or long term impacts.

Anchoring: The Proposed Action would result in localized, temporary, minor incremental impacts to water quality through an estimated 821 acres of anchoring and mooring-related disturbance, which would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to anchorage areas. The Proposed Action would add to the estimated 88 acres of seabed that could be impacted by anchoring from other reasonably foreseeable offshore wind activities. This would result in a cumulative total of 909 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 cumulative impacts to water quality.

New cable emplacement/maintenance: The Proposed Action would result in localized, short-term, minor incremental impacts to water quality through an estimated 913 acres of seafloor disturbance from SFEC and inter-array cable installation. This would result in additional turbidity effects, increasing seafloor disturbance due to cable installation by 31% over the No Action alternative. BOEM estimates a cumulative total of 3,890 acres of anchoring-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 approximate 1-acre area 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 cumulative impacts to water quality.

Port utilization: Although dredging or in-water work for the Port of Montauk could be required for the Proposed Action, these actions would occur within heavily modified habitats. BOEM expect impacts to water quality due to the incremental increase in port expansion resulting from the Proposed Action to be negligible to minor. Other offshore wind development would use nearby ports, and could also require port expansion or modification. However, DWSF 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.

Presence of structures: The Proposed Action would result in long-term, minor incremental impacts to water quality through the installation of 16 structures (15 WTGs and one OSS), as well as in-water dock structures. This represents a minor, 2% increase over total estimated WTG and OSS foundations under the No Action alternative. BOEM estimates a cumulative total of 668 structures for the Proposed Action plus all other future offshore wind projects within the geographic analysis area. 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 DWSF 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 and long-term impacts to water quality.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would expose soils and sediments, resulting in potential erosion and sedimentation into onshore surface waters and changes to flows that could affect water quality. Offshore, Project construction and installation and conceptual 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 conceptual decommissioning but could also result in erosion, sediment resuspension, deposition, and inadvertent spills. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **moderate**. Therefore, BOEM expects the overall impact on water quality from the Proposed Action alone to be **minor** because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate**. 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** impacts to water quality. BOEM made this call as the effect would be small and the resource would be expected to recover completely.

3.3.2.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would not affect Project onshore activities; therefore, effects would be similar to the Proposed Action and would lead to the same types of minor to moderate adverse impacts on surface water and groundwater quality from erosion, sedimentation, and inadvertent spills.

Offshore, the Project under the Transit alternative would lead to the same types of impacts on water quality from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, the reduced number of turbines under the Transit alternative would reduce the potential for vessel collisions or allisions with WTGs that could lead to accidental releases and result in degradations to water quality. This alternative could also result in decreased impacts to water quality during construction (due to decreased suspended sediment and turbidity) if less trenching and/or vessel traffic is needed to install a reduced number of WTGs and their associated inter-array cables. As a result, the Transit alternative would have negligible to moderate, short-term impacts on water quality related to spills, anchoring, cable emplacement and management, port expansion, structures, discharges, and sediment disturbance.

Cumulative Impacts

The Transit alternative would not affect Project onshore activities; therefore, cumulative effects would be the same as the Proposed Action and would lead to minor to moderate cumulative impacts on onshore water quality.

As noted above, the Transit alternative would result in incremental impacts to water quality at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative to water quality when combined with past, present, and reasonably foreseeable activities would be negligible to moderate and short term, mostly as a result of construction activities. Impacts related to spills could also be long term, depending on the severity of the spill.

If the Transit alternative is implemented, the WTGs for other reasonably foreseeable offshore wind projects may need to be relocated or eliminated within lease areas to avoid the transit lanes. These shifts could shorten or increase vessel trips, transmission cable lengths, and installation times for other future projects, depending on what WTG changes occur. If WTG shifts result in changes that increase turbidity and sedimentation, alter water currents, or increase risks of inadvertent spills, these effects could increase cumulative water quality impacts relative to the Proposed Action.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, 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 the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

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

3.3.2.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would not affect Project onshore activities; therefore, all onshore effects would be the same as the Proposed Action and would lead to the same types of minor to moderate adverse impacts on surface water and groundwater quality from erosion, sedimentation, and inadvertent spills.

Offshore, the Project under the Habitat alternative would lead to the same types of impacts on water quality from construction and installation, O&M, and conceptual decommissioning as described for the Proposed Action. However, this alternative could result in decreased impacts to water quality during construction (due to decreased suspended sediment and turbidity) if less trenching and/or vessel traffic is needed to install a reduced number of WTGs and their associated inter-array cables. As a result, this alternative would have negligible to moderate, short-term impacts on water quality related to spills, anchoring, cable emplacement and management, port expansion, structures, discharges, and sediment disturbance.

Cumulative Impacts

The Habitat alternative would not affect Project onshore activities; therefore, cumulative effects would be the same as the Proposed Action and would lead to minor to moderate cumulative impacts on onshore water quality.

As noted above, the Habitat alternative would result in incremental impacts to water quality at quantities and durations similar to, or slightly reduced from, the Proposed Action. Therefore, the overall cumulative impacts of this alternative to water quality when combined with past, present, and reasonably foreseeable activities are anticipated to be negligible to moderate and short term, mostly as a result of construction activities. Impacts related to spills could also be long term, depending on the severity of the spill.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, 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 the alternative alone would be similar to the Proposed Action and range from **negligible** to **moderate**.

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

3.3.2.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that water quality impacts would range from **negligible** to **moderate** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor.**

3.3.2.4 Mitigation

If the USACE requires establishment of a no-work window for dredging at Montauk through their permitting process, some adverse impacts to water quality would be further reduced although still identified as negligible to moderate.

3.4 BIOLOGICAL RESOURCES

3.4.1 Bats

3.4.1.1 Affected Environment

Species of bats that may occur in the offshore and onshore portions of the Lease Area include both long-distance migrant bats and non-migrant, cave-dwelling bats. Long-distance migrants include hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*). Non-migratory cave-dwellers include northern long-eared bat (*Myotis septentrionalis*), little brown bat (*Myotis lucifugus*), eastern small-footed bat (*Myotis leibii*), big brown bat (*Eptesicus fuscus*), and tri-colored bat (*Perimyotis subflavus*) (Stantec 2018a). During surveys for the Project, most bat calls were detected in August and September between 1 and 5 hours past sunset and primarily when wind speeds were < 5.0 meters per second and temperatures were ≥ 15.0 degrees Celsius (Stantec 2018b). Species detected within the SFWF and offshore SFEC include silver-haired bat, hoary bat, eastern red bat, tri-colored bat, and little brown bat (Stantec 2018b).

Bats use a variety of terrestrial environments on Long Island for foraging and roosting during summer breeding and migration periods. The location of the interconnection facility occurs in wooded habitat, which would provide suitable bat habitat. Although other onshore Project components occur in already developed areas, bats could use other types of nearby undeveloped habitats. For more information regarding onshore bat abundance, seasonal use, and behavior (Stantec 2018a).

3.4.1.1.1 SPECIAL-STATUS BAT SPECIES

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) official species list for the Project, dated September 17, 2020, includes the northern long-eared bat as one of the potentially present species in the analysis area listed under the Endangered Species Act of 1973 (ESA) (VHB Engineering, Surveying and Landscape Architecture, P.C [VHB] 2018). The northern long-eared bat is both federally and state-listed (6 New York Codes, Rules and Regulations 182) as threatened (with 4(d) rule). The final (4(d) rule for the northern long-eared bat, 81 *Federal Register* 9 [January 14, 2016]), conditionally exempts from prohibition the incidental take of the northern long-eared bat within the white nose syndrome zone from energy development and operation (USFWS 2019). A detailed species account is included in the biological assessment (BA) for this Project (BOEM 2020).

3.4.1.2 Environmental Consequences

3.4.1.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.1-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.4.1-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Bats

Issue	Impact Indicator	Significance Criteria
Collision/attraction	Qualitative estimate of collision	Negligible: There would be no measurable impacts.
Displacement/barrier effects/disturbance	Changes to noise levels Projected traffic patterns/volume changes	Minor: Most impacts could be avoided with EPMs; if impacts occur, the loss of one or a few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Habitat loss and modification	Acres of suitable habitat removed or modified	Moderate: Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function. Major: Impacts would result in severe, long-term habitat or population-level effects to species.

3.4.1.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing bat species and habitat trends from past and present activities. Attachment 2 in Appendix E provides additional information regarding past and present activities and associated bat impacts. Future non-Project actions include onshore and offshore wind projects, municipal development projects, communications towers, port upgrades, tidal energy, and dredging/port improvement projects. Attachment 2 in Appendix E also discloses future non-offshore wind activities and associated bat impacts. Impacts associated with future onshore and future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Onshore reasonably foreseeable activities could temporarily displace bats or could deter bats from using potentially suitable foraging habitat. These impacts would not be biologically significant because bats frequently switch roosts (Hann et al. 2017; Whitaker 1998). Onshore land development or port expansion activities could result in habitat loss for some bat species. However, such impacts would only represent a minor and temporary adverse impact because impacts would be limited in extent, as described further in Section 3.5.5.2.2 (No Action Alternative), and not expected to measurably impact bat population abundance or viability.

Impacts associated with future offshore wind activities are described below.

<u>Noise</u>: Numerous offshore wind projects could overlap construction between 2022 to 2030 (see Table E-3 in Appendix E). Construction noise from these projects, most notably from pile driving, would create noise and may temporarily impact some migrating bats if present during construction periods. However, these noise impacts are not expected because recent research indicates that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals so no temporary or permanent hearing loss would be expected (Simmons et al. 2016). Other noise impacts (i.e., displacement from potentially suitable habitats or migration routes) could occur as a result of construction noise (Schaub et al. 2008), but the likelihood of impact is low because little use of the OCS is expected and the use would occur only during spring and fall migration. As a result, adverse impacts to bats would be short to long term and minor.

Presence of structures: The primary threat to bats would be from collisions with offshore WTGs. Up to 2,050 structures (WTGs and OSS) could be constructed in the geographic analysis area (see Table E-3 in Appendix E), which could impact migration patterns or pose a collision risk to individual bats. Although adverse impacts to bats resulting from fatal interactions with operating WTGs cannot be quantified, some level of mortality during operation of offshore wind facilities is assumed. Any new operating wind facility would require a thorough regulatory and environmental review to appropriately site the facility to avoid, minimize, and mitigate adverse impacts on bat species. In addition, the likelihood of an individual bat encountering the rotor swept zone (RSZ) of one or more operating WTG would be negligible. Outside of migration, bats are infrequently present offshore. Because of 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 RSZ of project WTGs would also pass through projects with only slight course corrections, if any, to avoid operating WTGs. As a result, adverse impacts to bats would be short to long term and minor.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on bats associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on bats due to noise, collision, and habitat alteration.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities and onshore activities would be **minor**. As described in Attachment 2 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effect would be small and the resource would be expected to recover completely.

3.4.1.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Bats are expected to seasonally occur in the SFWF and offshore SFEC while migrating, commuting, or foraging. Although these structures or vessels might attract bats (Stantec 2016), these objects would not pose a collision risk because of a bat's ability to echolocate and detect stationary structures (Stantec 2018a). Therefore, adverse impacts to bats from offshore construction would be negligible. Bats would also not be impacted by seafloor disturbances during construction because they do not interact with the subsurface environment and their occurrence over open water is infrequent. Traffic and noise during construction could result in displacement or avoidance behavior; however, this adverse increase would be short term (see Section 3.5.5.2.3, Proposed Action Alternative). Additionally, bats are only anticipated to occur occasionally in the airspace of the SFWF during migration, so adverse impacts to bats would be negligible.

The onshore SFEC would be installed within existing ROWs (primarily existing roads and railroad ROWs), and negligible adverse impacts to bats are expected because this area has been previously developed and has limited habitat for bats. Installation of the interconnection facility would remove approximately 2.4 acres of deciduous forest. Although the facility would eliminate suitable foraging and roosting habitat, the affected area represents only 0.02% of available deciduous forest habitat within 3 miles of the facility. Removal of upland wildlife habitat and the in-water work at the Montauk O&M facility site would not result in impacts to bats because the area is currently zoned as commercial and has a mixture of structures, outbuildings, and paved surfaces with no suitable roosting habitat and limited foraging habitat. There would be noise and traffic associated with construction of the onshore SFEC and interconnection facility. Because these activities would predominately occur in already developed areas with existing sources of noise and human activity, however, only negligible, temporary adverse impacts to bats are expected.

Special-Status Species

As noted above, installation of the interconnection facility would convert approximately 2.4 acres of undeveloped deciduous forest to utility use. Although the facility would eliminate suitable foraging and roosting habitat, the affected area only represents 0.02% of available deciduous forest habitat within 3 miles of the facility, which is the typical home range of the northern long-eared bat (USFWS 2014). Per the Project BA prepared for the USFWS (BOEM 2020), construction activities would comply with 4(d) rule requirements for avoiding adverse effects on northern long-eared bat, meaning that tree removal, vegetation clearing, and other major noise-producing activities near potential bat habitat would take place during winter months when northern long-eared bats are not present, which would effectively avoid impacts to bats because there are no hibernacula present. Because northern long-eared bat summer habitat is not limited and summer habitat loss is not a range-wide threat to the species (USFWS 2014), construction of the interconnection facility would result in negligible, temporary adverse impacts to northern long-eared bats. Northern long-eared bats would not be impacted by the in-water work or by the removal of upland wildlife habitat during construction of the Montauk O&M facility, as described above.

Operations and Maintenance and Conceptual Decommissioning

During Project O&M, individual bats could collide with WTGs, resulting in mortality or injury. It is difficult to estimate the actual number of bats that could collide with turbines, and currently there is no way 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. 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, when 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 meters per second. Because average wind speeds in the SFWF are between 5 and 10 meters per second, 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, and thus, the risk of injury and/or mortality to bats would also be minor.

Specific WTGs could 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). A 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 susceptible (Stantec 2018a). Bats may also be attracted to the WTGs as potential roosting opportunities or use the structures for navigational purposes while migrating. Overall, collision-related mortality or injury could result in negligible to minor adverse impacts to bats at the SFWF, with long-distance migratory bats most at risk because they are most likely to seasonally occur in the airspace of the SFWF.

Boat activity and noise already occur within and adjacent to the SFWF area based on existing levels of vessel traffic as described in Section 3.5.6 (Navigation and Vessel Traffic). Increases in activity and associated disturbances during SFWF maintenance activities would have a negligible impact on bats because of the limited additional vessel activity and low likelihood of bat occurrence near the SFWF. There would also be no impacts to bats during O&M of the offshore SFEC because these components are underwater, and there would be no routine maintenance at these components.

Onshore, bats could be indirectly attracted to insect prey drawn by lighting at the interconnection facility. However, the surrounding area is currently developed, and lighting-related effects would be abated using minimum intensity, motion-activation, and shielding and downward angling of light sources where practicable. Therefore, adverse impacts would be long term but negligible.

Conceptual decommissioning of the Project would have similar impacts as construction.

Special-Status Species

Impacts from O&M of the SFWF to the listed northern long-eared bat are not expected because of their low collision risk and the rarity of their occurrence offshore (Stantec 2018b). Based on Project timing, the limited area of effect relative to available habitat, and proposed impact avoidance and minimization measures, adverse impacts of the Proposed Action on northern long-eared bat would be negligible.

Cumulative Impacts

Onshore construction and installation would incrementally add to other limited onshore bat habitat disturbance actions through the removal of 2.4 acres of deciduous forest for the interconnection facility and a small area (0.1 acre) of upland wildlife habitat at the selected O&M facility. This land disturbance could result in the loss of potentially suitable roosting and/or foraging habitat for bats. Additionally, DWSF 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 and negligible to minor adverse impacts to bats.

Offshore cumulative impacts would primarily consist of the following offshore wind IPFs.

<u>Noise</u>: Pile driving and other construction noise and activity associated with the Proposed Action would incrementally add to baseline noise and activity associated with other offshore wind projects with overlapping construction periods. However, the Proposed Action’s incremental contribution would be limited in duration, would be negligible, and would 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 to long-term negligible to minor adverse impacts to bats.

<u>Presence of structures</u>: The Proposed Action would incrementally add up to 15 additional WTGs and one OSS to the No Action alternative. Therefore, the total cumulative structures would be 2,066. Impacts to migration patterns or collision risk from these additional turbines would persist until conceptual decommissioning is complete. However, the Project’s incremental impacts on bats would be negligible because 1) the use of the OCS by migrating bats would be limited, and 2) the Project would account for less than 1% 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 and negligible to minor cumulative adverse impacts to bats.

Conclusions

Project construction and installation and conceptual decommissioning would introduce noise, lighting, human activity, and new structures and vessels (increasing potential collision risk) to the geographic analysis area and would alter existing bat habitat. Noise, lighting, and human activity impacts from Project O&M would occur, although at lower levels than those produced during construction and installation and conceptual decommissioning. Offshore structures would also represent a long-term collision risk. BOEM anticipates the impacts resulting from the Proposed Action alone would range from temporary to long term and **negligible** to **minor**. Therefore, BOEM expects the overall impact on bats from the Proposed Action alone to be **minor** because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor**. 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** impacts to bats. BOEM made this call as the effect would be small and the resource would be expected to recover completely.

3.4.1.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would not affect Project onshore activities; therefore, effects to bats would be the same as the Proposed Action: negligible, temporary, and adverse.

Offshore, the Project under the Transit alternative would lead to the same types of impacts on bat from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, this alternative could decrease the risk of migrating bats encountering an operating WTG because DWSF would reduce the number of turbines (although the decrease in risk might not be measurable). Therefore, this alternative would result in negligible to minor, short- and long-term adverse impacts on bats from Project construction and installation, O&M, and conceptual decommissioning.

Cumulative Impacts

The Transit alternative would not affect Project onshore activities; therefore, cumulative effects to bats would be the same as those described under the Proposed Action: negligible to minor.

Offshore, the Transit alternative would incrementally add sources of noise, human activity, and collision risk at quantities and durations similar to the Proposed Action. Therefore, the overall offshore cumulative impacts of the Transit alternative on bats when combined with past, present, and reasonably foreseeable activities would be negligible to minor.

If the Transit alternative is implemented, the WTGs for other reasonably foreseeable offshore wind projects may need to be relocated or eliminated within lease areas to avoid the transit lanes. If these shifts result in WTG reductions that further decrease risks of collision, these effects could decrease cumulative bat impacts relative to the Proposed Action. Conversely, if WTG shifts result in increased human activity, noise, and habitat disturbance or species displacement due to increased vessel trips, cable length, and installation times, these effects could increase cumulative bat impacts relative to the Proposed Action.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in potential collision risk, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from temporary to long term and **negligible** to **minor**.

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

3.4.1.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would not affect Project onshore activities; therefore, effects to bats would be the same as the Proposed Action: negligible, temporary, and adverse.

Offshore, the Project under the Habitat alternative would lead to the same types of impacts on bat from construction and installation, O&M, and conceptual decommissioning as described for the Proposed Action. However, this alternative could decrease the risk of migrating bats encountering an operating WTG because DWSF would reduce the number of turbines (although the decrease in risk might not be measurable). Therefore, this alternative would result in negligible to minor, short- and long-term adverse impacts on bats from Project construction and installation, O&M, and conceptual decommissioning.

Cumulative Impacts

The Habitat alternative would not affect Project onshore activities; therefore, cumulative effects to bats would be the same as those described under the Proposed Action: negligible to minor.

Offshore, the Habitat alternative would incrementally add sources of noise, human activity, and collision risk at quantities and durations similar to the Proposed Action. Therefore, the overall offshore cumulative impacts on bats when combined with past, present, and reasonably foreseeable activities would be negligible to minor.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in potential collision risk, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from temporary to long term and **negligible** to **minor**.

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

3.4.1.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that bat impacts would range from temporary to long term and **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor.**

3.4.1.4 Mitigation

If implemented, tree-clearing time-of-year restrictions would minimize the expected negligible onshore impacts on bats, if present, by limiting impacts on the time of year when both adults and young of the year are able to leave the area when tree clearing occurs. Should presence/probable absence surveys be conducted pursuant to current USFWS protocols and no northern long-eared bats are documented, this measure may not be necessary for ESA compliance relative to the species. Establishment of a post-construction monitoring program for bats would not reduce impacts, but the data gathered would be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR 585.633(b)).

3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish (*see section in main DEIS*)

3.4.3 Birds

3.4.3.1 Affected Environment

3.4.3.1.1 OFFSHORE

Despite the level of human development and activity present, the mid-Atlantic Coast plays an important role in the ecology of many bird species. The Atlantic Flyway is a major route for migratory birds, which are protected under the Migratory Bird Treaty Act of 1918 (MBTA). Chapter 4.2.9.3 of the Atlantic OCS EIS/EA (BOEM 2014) discusses the use of Atlantic Coast habitats by migratory birds. 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. Under Section 3 of Executive Order 13186, BOEM and USFWS established a memorandum of understanding (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)).

BOEM funds scientific studies and partners with USFWS to better understand how migratory birds use the OCS and to refine the understanding of the risks from development to migratory species (BOEM 2020a). BOEM uses information from these studies, USFWS, and the scientific literature to 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 MA-WEA resulted in the exclusion of 14 OCS blocks that overlapped with high value sea duck habitat (BOEM 2013).

BOEM worked with USFWS to develop standard operating conditions for commercial leases and as terms and conditions of plan approval and are intended to ensure that the potential for adverse impacts on birds is minimized. The standard operating conditions have been analyzed in recent EAs and consultations for lease issuance and site assessment activities, and BOEM's recent approval of the

Virginia Offshore Wind Technology Advancement Project (BOEM 2016a). Some of the standard operating conditions originated from best management practices 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* (MMS 2007:Section 2.7). BOEM and USFWS work with the lessees to develop post-construction plans aimed at monitoring the effectiveness of measures considered necessary to minimize impacts to migratory birds with the flexibility to consider the need for modifications or additions to the measures.

The SFWF would be located in deep water (approximately 108 to 125 feet where fish, crustaceans, and other zooplankton are available at different depths. Bird groups expected to use deeper offshore waters within the geographic analysis area at least seasonally include loons (*Gavia* spp.), shearwaters and fulmars (Procellariidae spp.), storm-petrels (Hydrobatidae spp.), gannets (*Morus* spp.), seaducks (Merginae spp.), jaegers (Stercorariidae spp.), gulls and terns (Laridae spp.), alcids (Alcidae spp.), and to a lesser extent, migrating shorebirds and land birds (see Table 4.3-43 in the COP). Shorebirds (except for phalaropes [*Phalaropus* spp.]) are not expected to occur offshore unless flying during migration (Stantec 2018).

The offshore SFEC is primarily a pelagic environment, and bird species composition, distribution, seasonality, and resource base are expected to be similar to that described for the SFWF (see Table 4.3-43 in the COP). Species known to occur near state waters include terns, gulls, cormorants (Phalacrocoracidae spp.), and shorebirds during summer and seaducks, bay ducks (Aythyinae spp.), fish ducks (Anatidae spp.), dabblers (*Anas* spp.), loons, grebes (Podicipedidae spp.), and alcids during migration and winter. Other more pelagic species that could occur include Cory's shearwater (*Calonectris borealis*), northern gannet (*Morus bassanus*), and black-legged kittiwake (*Rissa tridactyla*) (see Table 4.3-43 in the COP).

Bird populations in the analysis area that are more susceptible to collision with WTGs include gulls, terns, jaegers, phalaropes, cormorants, northern gannet, and scoters (*Melanitta* spp.). These populations are more susceptible because of their high occurrence in the OCS, their at-risk population status, and/or their relatively high proportion of flights in the RSZ (Stantec 2018). These species are most abundant within 1 to 2 miles of the shoreline (Northeast Regional Ocean Council 2019), as depicted in Figure C-4.

Populations with the lowest vulnerability to collision risk include passerines that would only cross the OCS during migration and would typically fly above the RSZ (i.e., approximately 840 feet). Many of the populations with low collision sensitivities also have large global populations, making them less sensitive to mortality impacts (Stantec 2018).

Bird populations considered most at risk of displacement impacts include seaducks, loons, and some alcids due to restrictions in their prey sources and high macro avoidance rates (Stantec 2018). These populations are most abundant within 1 to 2 miles of the shoreline (Northeast Regional Ocean Council 2019) as depicted in Figure C-5.

3.4.3.1.2 ONSHORE

The landcover types near the onshore SFEC routes and landing sites represent habitat for a variety of birds, including species commonly associated with marine shorelines, tidal and freshwater wetlands, surface waters, forests, successional habitats, agricultural fields, and developed areas. Breeding shorebirds on Long Island include American oystercatcher (*Haematopus palliatus*), piping plover (*Charadrius melodus*), and killdeer (*Charadrius vociferous*). Several species overwinter on Long Island (e.g., black-bellied plover [*Pluvialis squatarola*], sanderling [*Calidris alba*], dunlin [*C. alpina*], purple sandpiper [*C. maritima*], ruddy turnstone [*Arenaria interpres*]), and others migrate through. Species expected to occur on Long Island during migration include semipalmated plover (*Charadrius semipalmatus*), semipalmated sandpiper (*Calidris pusilla*), and short-billed dowitcher (*Limnodromus griseus*) (Stantec 2018).

Permanent resident land bird species in the analysis area include corvids (Corvidae spp.), chickadees (Paridae spp.), and tufted titmouse (*Baeolophus bicolor*) (Stantec 2018). A variety of passerines and other birds migrate along the Atlantic Coast and could fly over the onshore SFEC routes and landing sites. These migrants include species that breed locally, as well as species that only pass through in spring and fall. Bird species that could breed in the area include marsh and wading birds using nearby coastal wetlands and common swallows (Hirundinidae spp.), thrushes (Turdidae spp.), warblers (Parulidae spp.), sparrows (Passerellidae spp.), and blackbirds (Icteridae spp.) using residential, backyard, and small field habitats proximal to the onshore SFEC cable routes. Winter-resident species are fewer and could include snow bunting (*Plectrophenax nivalis*) and snowy owl (*Bubo scandiacus*). Surveys for the Project detected 87 bird species (VHB 2018:Appendix D [Table A]). The Montauk O&M facility contains a small portion of upland habitat and a sandy shoal immediately northwest of the in-water work area. These areas could be opportunistically used by shorebirds, raptors, or wintering birds; however, birds would not be expected to persist here for nesting or foraging in any significant capacity because of the overall lack of habitat and a high level of human disturbance.

3.4.3.1.3 SPECIAL-STATUS SPECIES

The USFWS IPaC official species list for the Project, dated September 17, 2020, contains the following three bird species: piping plover (federally threatened and state endangered), rufa red knot (*Calidris canutus rufa*) (federally threatened), and roseate tern (*Sterna dougallii*) (federally and state endangered) (VHB 2018). 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 2020b). The BA also provides detailed accounts for each of these species.

New York Natural Heritage Program (NYNHP) records include 21 New York State–listed and protected species for the analysis area (VHB 2018:Appendix F). State-listed bird species documented or potentially present in the SFWF and portions of the offshore and onshore SFEC include the state-threated northern harrier (*Circus hudsonius*), bald eagle (*Haliaeetus leucocephalus*), least tern (*Sternula antillarum*), and common tern (*Sterna hirundo*) (Stantec 2018:Table 5). Bald eagles are federally protected by the Bald and Golden Eagle Protection Act, 16 USC 668 et seq. No bald eagle nests have been recorded near onshore Project components, and suitable bald eagle habitat on Long Island is limited (Stantec 2018).

3.4.3.2 Environmental Consequences

3.4.3.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.3-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.4.3-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Birds

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Collision/injury/ electrocution</td><td>Qualitative estimate of species vulnerability to collision/electrocution</td><td rowspan="3">Negligible: There would be no measurable impacts
Minor: Most impacts could be avoided with EPMs; if impacts occur, the loss of one or a few individuals or temporary alternation of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate: Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.
Major: Impacts would result in severe, long-term habitat or population-level effects to species.</td></tr>
<tr><td>Displacement/ barrier effects</td><td>Changes to noise levels
Projected traffic patterns/volume changes</td></tr>
<tr><td>Habitat loss/ modification</td><td>Acres of habitat removal or modification</td></tr>
</table>

3.4.3.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing bird species and habitat trends from past and present activities. Attachment 2 in Appendix E provides additional information regarding past and present activities and associated bird impacts. Future non-Project actions include offshore and onshore wind development activities, tidal energy projects, dredging and port improvement projects, onshore development projects, and communications tower replacement (see Appendix E) and future marine transportation and fisheries use and management. Attachment 2 in Appendix E discloses future non-offshore wind activities and associated bird impacts. Impacts associated with future onshore and future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Onshore construction noise from other human activities could result in localized, minor, and temporary impacts to birds, including avoidance and displacement, though no population-level effects would occur. Onshore land development or port expansion activities could also result in limited loss of nesting and/or foraging habitat for some bird species. However, such minor impacts would be limited in extent, as described in Section 3.5.5.2 (Environmental Consequences), and would not measurably impact bird population abundance or viability.

Impacts associated with future offshore wind activities are described below.

Accidental releases and discharges: Offshore, future wind and non-wind activities could result in accidental releases of contaminants or trash into the water (see Section 3.3.2.2.2, No Action Alternative, for quantities and details). Blockages caused by both hard and soft plastic debris could result in mortality or adverse health effects such as decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (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. Small exposures that result in the oiling of feathers can lead to adverse effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities (Maggini et al. 2017). Based on estimated volumes of oils, lubricants, and diesel fuel needed for other offshore wind projects (see Section 3.3.2.2.2, No Action Alternative) and the low risk of spills due to implementation of safe handling, storage, and cleanup procedures, impacts from accidental spills and trash would represent a negligible impact to birds.

Noise: Table E-3 in Appendix E indicates that multiple offshore wind project construction periods would overlap between 2022 to 2030. Construction noise from these projects—most notably pile driving, but also noise from G&G surveys, offshore construction, and vessel traffic—would create noise and may temporarily impact some bird species by displacing them and changing their behavior. Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods.

Aircraft flying at low altitudes may cause birds to flush, resulting in increased energy expenditure. Disturbance to birds, if any, would be temporary and localized, with impacts dissipating once the aircraft has left the area. No individual or population-level effects to birds would be expected.

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 2014, 2016b). Vessel 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 impact to these birds.

Light: Nighttime lighting associated with offshore structures and vessels could also represent a source of bird attraction. Under the No Action alternative, up to 2,050 WTGs and OSS would have hazard and aviation lighting that would be incrementally added beginning in 2021 and continuing through 2030. Construction vessels are also a source of artificial lighting. Vessel lighting would result in temporary and minor impacts to birds; structure lighting may pose an increased collision or predation risk (Hűppop et al. 2006), though this risk would be localized in extent and minimized through the use of BOEM lighting guidelines (BOEM 2019; Kerlinger et al. 2010).

New cable emplacement/maintenance: Up to 7,951 acres of localized, temporary seabed disturbance and associated increased suspended sedimentation could occur during construction of proposed wind farm cables (see Table A-4 in Appendix E). Disturbed seafloor from construction of future offshore wind projects may affect diving birds' foraging success or may affect some prey species (e.g., benthic assemblages); however, impacts would be temporary and localized, birds would be able to successfully forage in adjacent areas and would not be affected by increased suspended sediments. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability for this location. Therefore, impacts would be minor, and no population-level effects on birds would occur. See Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) for detailed information on potential effects to benthic habitat.

Presence of structures: The primary threat to birds would be from collision with WTGs. In the contiguous United States, an estimated 234,000 birds are killed annually by onshore turbines (Loss et al. 2013). Based on a mortality rate of 6.9 birds per turbine in the eastern United States (Loss et al. 2013), an estimated 13,841 birds could be killed annually under the No Action alternative. This represents a worst-case scenario, and does not consider mitigating factors such as landscape and weather patterns, or bird species that are expected to occur. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter wind turbines (see Figures C-4 and C-5).

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 OCS would encounter WTGs, with most flying above or below spinning turbines; plus the spacing between turbines would also permit birds to fly through individual lease areas without changing course or only making minor course corrections to avoid operating WTGs. Any additional flight distances would be miniscule when compared with the overall migratory distances traveled by migratory birds. Therefore, impacts would be minor, and no population-level effects would be expected.

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 (Section 3.4.2.2.2, No Action Alternative, estimates that less than 1% of total benthic habitat would be affected by seabed-disturbing activities). Therefore, impacts would be minor, and no population-level impacts would occur.

The addition of new WTGs could also increase risk of entanglement with fishing gear, which could lead to bird injury or mortality. Impacts from fishing gear would be localized; however, the risk of occurrence would remain as long as structures remain. WTGs and foundations could also increase pelagic productivity in local areas (English et al. 2017), and 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 within the first year or two after construction (English et al. 2017; Causon and Gill 2018), indicating that offshore wind farms can generate beneficial long-term impacts on local ecosystems, translating to increased foraging opportunities for individuals of some marine bird species. Therefore, the presence of structures may also result in minor beneficial impacts for the duration of the Project (Dierschke et al. 2016). For details on the effects of WTGs on benthic habitat and recreational fishing, see Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) and Section 3.5.1 (Commercial Fisheries and For-Hire Recreational Fishing).

Climate change: Impacts associated with climate change, including increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, habitat conversion, and increased erosion and sediment deposition, could result in minor, long-term 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.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on birds associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on birds, due to noise, collision risk, entanglement or exposure to contaminants, lighting, habitat alteration, and climate change.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities and onshore activities would be **negligible** to **minor, and minor beneficial**. As described in Attachment 2 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effect would be small and the resource would be expected to recover completely.

3.4.3.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Offshore

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. 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). Brightly illuminated offshore structures such as research platforms also pose a risk to birds migrating at night when birds can become disoriented by sources of artificial light. Lighting used during construction would be limited to the minimum required for safety during construction to minimize potential impacts. Therefore, adverse impacts to birds from lighting would be negligible to minor.

Construction of the WTG foundations and the installation of the subsea cables could result in short-term habitat disturbance for foraging birds. However, adverse impacts would be negligible to minor given the localized nature of these impacts and the abundance of surrounding foraging habitat. Negligible to minor adverse impacts to birds from associated noise and vessel traffic are also expected during construction. These activities could flush birds in the path of vessels, causing temporary displacement from the area; alternatively, these activities could attract certain groups of birds. However, impacts would be temporary and similar to baseline conditions because vessel traffic already occurs in the analysis area (Stantec 2018). These impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. 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 (see Section 4.1.6 in the COP), resulting in negligible to minor, short-term adverse impacts.

Onshore

At the sea-to-shore transition, the use of HDD for SFEC installation would minimize potential construction impacts on the inter-tidal community near the selected landing site; no long-term changes in inter-tidal habitat structure or prey availability are expected. Any increase in turbidity and sedimentation would be temporary, localized, and minor, resulting in no lasting physical changes to coastal areas or beaches; see Section 3.3.2 (Water Quality) for additional discussion. No physical impacts to beach nesting areas are expected because installation for the SFEC would occur under the beach. However, noise and human activity from installation of the cofferdam, from HDD in the sea-to-shore transition, and at beach work areas could result in temporary, localized disturbance or displacement. Therefore, only negligible to minor adverse impacts to shorebirds are expected from onshore construction.

The onshore SFEC routes would be constructed within existing ROWs comprising predominantly developed land cover type (Homer et al. 2015) with limited bird use, thus minimizing possible disturbances to land birds. Approximately 2.4 acres of disturbed woodland habitat would be cleared for construction of the new interconnection facility, and a small amount of additional clearing could occur along the LIRR, resulting in negligible adverse impacts to bird habitats. 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.

Noise and traffic associated with construction of the onshore SFEC and the interconnection facility could also affect shorebirds, some seabirds, and land birds that use the terrestrial habitats in the immediate vicinity of construction activities. Noise- and traffic-related impacts would have temporary, minor adverse impacts on these birds because construction would occur in already developed areas where birds are habituated to these types of activities, and impacts associated with construction would be similar to existing sources of noise and traffic in the local area. At the Montauk O&M facility site, no construction activities are proposed in the small sandy shoal area immediately northwest of the dredge area, which provides only limited stopover habitat for shorebirds, raptors, or wintering birds and limited nesting substrate for shorebirds. Dredged materials used for beach renourishment would be placed outside of the shorebird breeding season. Therefore, no impacts to birds are expected from construction of the Montauk O&M facility.

Special-Status Species

Federally and state-listed bird species may be at risk of collision during construction, although risk of collision is considered low because these species are expected to infrequently occur over the SFWF (Stantec 2018). Although the loss of one or a few individuals to at-risk bird populations would represent an adverse impact, conservation measures identified during the ongoing ESA Section 7 consultation with the USFWS would minimize adverse impacts to federally listed bird species. Therefore, Project adverse effects would be minor.

Noise from installation of the cofferdam and from HDD in the sea-to-shore transition and activities at beach work areas could also result in temporary, localized disturbance or displacement of listed shorebirds. The plover and tern could nest, and all three species could forage or rest near the sea-to-shore transition and onshore SFEC routes. The potential for impacts to these species was considered during the Project siting process. As a result, to avoid nesting habitat and minimize the potential for impacts, the HDD work area was set back at least 650 feet from the MHWL so that the entrance point would be in interior land areas and the exit point would be offshore beyond the intertidal zone. Additionally, construction activities are scheduled to occur outside of the tern and plover breeding periods (i.e., April 1 through August 31); red knots do not nest in the United States. Because construction work at the selected landing site 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 at the landing sites would be minimal (Stantec 2018), adverse onshore impacts for listed species from noise and human activity would be negligible to minor. A detailed impacts analysis to federally listed birds from construction activities is in the BA (BOEM 2020b).

No federally listed land bird species are expected to nest near the interconnection facility location. Northern harriers could occur in the analysis area (eBird 2019) but are not expected to nest within the construction footprint based on land cover type; therefore, no adverse impacts are expected. Impacts to other special-status birds from construction would be similar to those described above.

Operations and Maintenance and Conceptual Decommissioning

Offshore

The primary impact expected for birds during O&M is collision with WTGs at the SFWF. However, the abundance of bird species with high collision sensitivity is low within the offshore portion of the Project during all seasons (Figure C-4), and that risk of collision would be reduced with implementation of EPMs listed in Table G-1 in Appendix G.

The presence and operation of the SFWF may result in displacement of waterbirds, waterfowl, seabirds, and phalaropes that use the area for foraging, resting, or nighttime roosting. 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. Generally, the abundance of bird species with high displacement sensitivity is low within the offshore portion of the Project during all seasons (Figure C-5).

The presence of WTGs may be a barrier to some migrating or commuting birds. As a result, these birds may avoid entering the wind farm and/or fly around the farm, potentially resulting in a greater expenditure of energy (Stantec 2018). The level of associated impacts resulting from barrier effects varies by species. Most bird species are expected to make minor changes to their flight trajectories when approaching WTGs, representing negligible increases in energy expenditure. Therefore, long-term, negligible adverse impacts associated with barrier effects are expected for many bird groups.

All other potential SFWF impacts (i.e., contaminant discharges or releases, traffic and noise, and trash and debris) are expected to generally be similar to offshore construction and result in negligible to minor adverse impacts with implementation of EPMs listed in Table G-1 in Appendix G.

No impacts to bird species are anticipated during the O&M phase for the offshore SFEC. The OSS could attract perching and pose an electrocution risk, which if realized would result in minor adverse impacts to birds from individual mortality or injury. Impacts to birds from conceptual decommissioning of the SFWF and offshore SFEC would be similar to those described for the construction phase.

Onshore

There would be no risk to bird species from electrocution because the onshore SFEC routes would be buried; however, the interconnection facility could pose an electrocution risk that might result in minor, long-term adverse impacts to bird species. No other impacts to bird species are anticipated during routine onshore operations. Conceptual decommissioning would have similar impacts as construction.

Special-Status Species

Federally and state-listed species are terrestrial or nearshore species that face low risk of collision during O&M. Although these species are not expected to frequent the SFWF, certain species (e.g., roseate tern) could cross the area during migration. The loss of individuals over the life of the SFWF, for a population already at risk, would represent an adverse impact; however, conservation measures identified during the ongoing ESA Section 7 consultation with the USFWS would be implemented to minimize adverse impacts to federally listed bird species. Additionally, the probability of these species' occurrence coupled with Project design and EPMs (Table G-1 in Appendix G) would render effects as minor over the long term (BOEM 2020b). Impacts to special-status birds from O&M and conceptual decommissioning activities would be similar to those described above for other bird species.

Cumulative Impacts

Onshore construction activities would incrementally add to noise and land disturbance through the removal of 2.4 acres of deciduous forest for the interconnection facility and a small area (0.1 acre) of upland wildlife habitat at the selected O&M facility. 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. For this reason, the incremental onshore impacts of the Proposed Action would range from negligible to minor because only a small amount of habitat loss, if any, would be expected. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in short term and negligible adverse cumulative impacts to birds.

Offshore cumulative impacts would primarily consist of the following offshore wind IPFs.

<u>Accidental releases and discharges</u>: The Proposed Action could incrementally contribute to accidental releases of fuel, fluids, or hazardous material; sediment; and/or trash and debris. The risk would increase primarily during construction but also during O&M activities and conceptual decommissioning. The Proposed Action would contribute a low percentage to the overall spill risk from ongoing and future activities, as described in detail in Section 3.3.2.2 (Environmental Consequences). All vessels would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on offshore bird species resulting from the release of debris, fuel, hazardous material, or waste (BOEM 2012). Additionally, SFWF Project personnel would require training and awareness of best management practices proposed for waste management and mitigation of marine debris. These releases, if any, would occur infrequently at discrete locations and vary widely in space and time, and for this reason, BOEM expects localized and temporary negligible Project impacts on birds. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in short term and negligible cumulative impacts to birds.

<u>Noise</u>: It is possible that pile driving and other construction noise and activity associated with the Proposed Action would incrementally 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 incremental 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, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in negligible to minor cumulative impacts to birds.

Aircraft flights associated with Project O&M activities would be negligible in comparison to the No Action alternative, and aircraft strikes with birds are highly unlikely. Aircraft flights associated with other past, present, and reasonably foreseeable activities passing through the SFWF lease area would be expected to be minimal and infrequent. Therefore, cumulative impacts to birds from aircraft traffic associated with O&M of the Proposed Action and past, present, and reasonably foreseeable activities would be negligible.

Light: The Proposed Action would incrementally add up to 15 new WTGs with red flashing aviation hazard lighting to the offshore environment (no more than a 1% increase in in-water structures with permanent lighting over the No Action alternative); these lights could attract birds and result in increased collision risk (Hűppop et al. 2006). Additionally, marine navigation lighting would include multiple flashing yellow lights on each WTG and the OSS and would be directed out and down to the water surface. Vessel lights during construction and installation, O&M, and conceptual decommissioning would be minimal and limited to vessels transiting to and from construction areas. 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.

New cable emplacement/maintenance: The Proposed Action would incrementally add 913 acres of seafloor disturbance from SFEC and inter-array cable installation to the No Action alternative, which equates to 11% of the total seafloor disturbance estimated under the No Action alternative as estimated by BOEM. 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 sedimentation, and only non-measurable negligible impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts. Therefore, incremental Project impacts would be negligible and would not be biologically significant. For these reasons, the Proposed Action in conjunction with other past, present, and reasonably foreseeable projects would result in short-term negligible to minor cumulative impacts to birds.

Presence of structures: The Proposed Action would incrementally add up to 15 additional WTGs and one OSS to the No Action alternative. The total cumulative structures on the OCS would be 2,066, and the Project would account for less than 1% of that total number. Adverse impacts to migration patterns or collision risk from these additional turbines would be negligible and persist until conceptual 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.

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 (although effects would still be minor).

Conclusions

Project construction and installation and conceptual decommissioning would introduce noise, lighting, human activity, debris and contaminants, and new structures and vessels (increasing potential collision risk) to the geographic analysis area, 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 conceptual 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**. Therefore, BOEM expects the overall impact on birds from the Proposed Action alone to be **minor** because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context with other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **temporary** to **long-term** and **negligible** to **minor** adverse, as well as **long-term** and **minor** 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** impacts to birds. BOEM made this call as the effect would be small and the resource would be expected to recover completely.

3.4.3.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would not affect Project onshore activities; therefore, effects would be similar to the Proposed Action: negligible to minor and temporary to long term.

No additional loss of suitable habitat for bird species with high displacement sensitivity would occur under this alternative.

Offshore, the Project under the Transit alternative would lead to the same types of impacts on birds due to construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, this alternative could decrease the risk of birds encountering an operating WTG because there would be fewer turbines (although the difference in risk might not be measurable). Therefore, this alternative could result in negligible to minor, temporary and long-term adverse impacts on birds during Project construction and installation, O&M, and conceptual decommissioning.

Cumulative Impacts

The Transit alternative would not affect Project onshore activities; therefore, cumulative effects would be the same as the Proposed Action: temporary to long-term and negligible to minor adverse, as well as long-term and minor beneficial.

Offshore, the Transit alternative would incrementally add sources of noise, human activity, and collision risk at quantities and durations similar to the Proposed Action. Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. Therefore, the overall cumulative impacts of the Transit alternative on birds when combined with past, present, and reasonably foreseeable activities would result in negligible to moderate, long-term adverse cumulative impacts to birds.

If the Transit alternative is implemented, the WTGs for other reasonably foreseeable offshore wind projects could need to be relocated or eliminated within lease areas to avoid the transit lanes. If these shifts result in WTG reductions that further decrease the risks of collision, these effects could decrease cumulative impacts to birds. Conversely, if WTG shifts result in increased human activity, noise, and habitat disturbance or species displacement due to increased construction vessel trips, cable length, and installation times, these effects could increase cumulative impacts to birds.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in potential collision risk, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Transit alternative’s incremental 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 the Transit alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor**.

3.4.3.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would not affect Project onshore activities; therefore, onshore effects to birds would be the same as the Proposed Action: negligible to minor and temporary to long term.

No loss of suitable habitat for bird species with high displacement sensitivity would occur under this alternative.

Offshore, this alternative could decrease the risk of birds encountering an operating WTG because there would be fewer turbines (although the difference might not be measurable). Therefore, this alternative would result in negligible to minor, short- and long-term adverse impacts on birds from Project construction and installation, O&M, and conceptual decommissioning.

Cumulative Impacts

This alternative would not affect Project onshore activities; therefore, cumulative effects to birds would be the same as those described under the Proposed Action: temporary to long-term and negligible to minor adverse, as well as long-term and minor beneficial.

Offshore, this alternative would incrementally add sources of noise, human activity, and collision risk at quantities and durations similar to the Proposed Action. Potential impacts could be greater if avoidance and displacement of birds occur during seasonal migration periods. Therefore, the overall offshore cumulative impacts of the Habitat alternative on birds when combined with past, present, and reasonably foreseeable activities would result in the same negligible to moderate, long-term adverse cumulative impacts to birds.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in potential collision risk, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Habitat alternative's incremental 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 the Habitat alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor**.

3.4.3.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that bird impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor** and **minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor.**

3.4.3.4 Mitigation

Use of ADLS and bird-deterrent devices would further reduce the expected negligible to minor long-term impacts on birds by reducing the potential for attraction to operating WTGs (see Appendix G for details). Establishment of a construction monitoring program for birds and annual bird mortality reporting would not reduce impacts, but the data gathered would be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR 585.633(b)).

3.4.4 Marine Mammals (*see section in main DEIS*)

3.4.5 Other Terrestrial and Coastal Habitats and Fauna

3.4.5.1 Affected Environment

3.4.5.1.1 TERRESTRIAL AND COASTAL HABITAT

The terrestrial and coastal habitats within the geographic analysis area include the area from state waters inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. Aquatic habitats are discussed in Section 3.3.2 Water Quality and 3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish. The habitats along the onshore SFEC routes generally include a successional shrubland community located adjacent to the various roadway ROWs and the LIRR ROW. Field surveys and desktop research for areas along the onshore SFEC routes identified habitat for a variety of terrestrial mammals, reptiles, and amphibians (VHB 2018).

The two cable landing sites consist of the marine intertidal gravel/sand beach and maritime beach communities as classified by the NYNHP Ecological Communities of New York State (ECNYS) (Edinger et al. 2014). According to the U.S. Geological Survey (USGS) National Land Cover Database (NLCD) (Homer et al. 2015), approximately 42% of the Hither Hills landing site comprises Developed land cover types, and the remaining area comprises Barren Land (23%) and Grassland/Herbaceous (35%) cover types. In contrast, the Beach Lane landing site comprises 91% Developed land cover types and the remaining 9% comprises Pasture/Hay (see Table 1, Section 2.0 in VHB [2018]).

The onshore SFEC routes would occur within roadway and LIRR ROWs, which largely comprise unvegetated habitats representative of the ECNYS Paved Road/Path and Railroad cover types (Edinger et al. 2014). Similarly, the Beach Lane cable route comprises 69% Developed land cover types, whereas the Hither Hills cable route comprises 99% Developed land cover types. Field surveys indicate that the onshore SFEC routes support significant amounts of nonnative-invasive vegetation (see Table 4.3-1 in the COP).

The interconnection facility site consists of ECNYS Paved Road/Path, Unpaved Road/Path, and Urban Structure Exterior cover types, as well as areas of Coastal Oak Hickory Forest and Successional Shrubland (Edinger et al. 2014). NLCD data indicate that the interconnection facility site comprises the Deciduous Forest land cover type. Field surveys reported that the forest and shrubland cover types at this site appear to have been subject to recent ground disturbance but do currently provide habitat for birds and other wildlife that are adapted to mid-successional communities (VHB 2018).

The onshore Montauk O&M facility site is located 100 feet east of the inlet that connects Lake Montauk to Block Island Sound and the Atlantic Ocean. Statewide mapping of SAV provided by NYSDEC indicates that, as recently as 2014, a small seagrass bed (approximately 0.07 acre) was located immediately north of the proposed facility site along the eastern side of the navigational channel. Seagrass beds are discussed in detail in Section 3.4.2 Benthic Habitat, Essential Fish Habitat, Invertebrates, and

Finfish. The small upland portion (approximately 0.1 acre) of the proposed facility site does not provide meaningful wildlife habitat. The area is currently zoned as commercial with a mixture of structures and outbuildings and paved surfaces. There is a small sandy shoal located immediately northwest of the in-water work area. Coastal wildlife may opportunistically transit through these upland portions but would not be expected to persist here because of the lack of habitat and high level of human disturbance (Stantec 2020).

3.4.5.1.2 TERRESTRIAL AND COASTAL FAUNA

In all, 33 herpetofauna species and 22 mammalian species could occur within the analysis area (VHB 2018:Appendix D [Tables B and C]). The following herpetofauna species were observed during field surveys in and near the Lease Area: eastern garter snake (*Thamnophis sirtalis*), Fowler's toad (*Bufo fowleri*), northern black racer (*Coluber c. constrictor*), green frog (*Rana clamitans*), eastern box turtle (*Terrapene carolina*), northern spring peeper (*Pseudacris crucifer*), and red-spotted newt (*Notophthalmus viridescens*). Of these, only the northern black racer was observed within the Beach Lane onshore SFEC route. The Beach Lane and Hither Hills landing sites do not represent significant habitat areas for terrestrial herpetofauna, although upland forests and mid-successional communities within the Hither Hills landing site represent potential habitat for herpetofauna adapted to dry, upland conditions. Mammals observed during field surveys near the Lease Area include whitetail deer (*Odocoileus virginianus*), eastern chipmunk (*Tamias striatus*), eastern cottontail (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), woodchuck (*Marmota monax*), muskrat (*Ondatra zibethicus*), red fox (*Vulpes vulpes*), and raccoon (*Procyon lotor*) (VHB 2018). None of these are federally or state-listed species.

3.4.5.1.3 SPECIAL-STATUS TERRESTRIAL AND COASTAL HABITATS AND FAUNA

According to the USFWS IPaC, there are no critical habitats within the analysis area. Federally listed wildlife species were identified as having the potential to occur in the analysis area; however, these species are discussed in their respective resource sections (e.g., bats and birds). Two plants were included on the IPaC special-status species list: sandplain gerardia (*Agalinis acuta*) (federally endangered) and seabeach amaranth (*Amaranthus pumilus*) (federally threatened) (VHB 2018). Seabeach amaranth has the potential to occur within the analysis area near the sea-to-shore transition area. Although sandplain gerardia is known to occur near the analysis area, it is unlikely to occur within the Lease Area due to lack of suitable habitat (BOEM 2019).

The NYNHP provided records for 21 New York State–listed rare/protected plant, bird, mammal, and insect species in and near the Lease Area (VHB 2018:Section 5.0 [Table 2]). During field surveys, four New York State–listed rare/protected plant species and one reptile species were observed: southern arrowwood (*Viburnum dentatum* var. *venosum*) (state threatened), northern blazing star (*Liatris scariosa*) (state threatened), Blue Mountain mint (*Pycnanthemum muticum*) (state threatened), serrate round-leaf boneset (*Eupatorium pubescens*) (state endangered), and eastern box turtle (state special concern species) (VHB 2018:Section 5.0 [Table 2]). Most of the rare/protected species observations (48 out of a total of 58 observations) were for occurrences of southern arrowwood located within the Hither Hills SFEC route, whereas no rare/protected species observations occurred within the Beach Lane SFEC route, within the landing sites, or at the interconnection facility site (VHB 2018:Section 5.0 [Tables 3 and 4]).

3.4.5.2 *Environmental Consequences*

3.4.5.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.5-1 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.4.5-1. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Other Terrestrial and Coastal Habitats and Fauna

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Habitat loss/ modification</td><td>Acres of impacted habitat</td><td rowspan="2">Negligible: No measurable loss or modification of habitat or change in habitat use would occur.
Minor: Most impacts to habitat and habitat use could be avoided with EPMs; if impacts occur, they would be temporary, and the habitat would recover completely.
Moderate: Impacts to habitat are unavoidable. Displacement would occur, but these impacts would be temporary, and the overall habitat function would not be threatened.
Major: Impacts to habitat and habitat use would be severe and long term.</td></tr>
<tr><td>Disturbance/ displacement</td><td>Changes to noise levels
Projected traffic patterns/volume changes
Qualitative assessment of potential ingestion or ensnarement from trash/debris</td></tr>
<tr><td>Collision/ Injury</td><td>Qualitative estimate of collision risk</td><td>Negligible: No measurable collisions/injuries to species would occur.
Minor: Most impacts to species could be avoided with EPMs; if impacts occur, the loss of one or a few individuals could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate: Impacts to species are unavoidable, but would not result in population-level effects.
Major: Impacts would result in mortality and/or collision/injury causing long-lasting population-level effects.</td></tr>
</table>

3.4.5.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing terrestrial and coastal habitats and fauna trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated impacts to terrestrial and coastal habitats and fauna. Future non-Project actions include existing and proposed communications towers, LIRR railroad improvements, and the Fire Island Montauk Point Project (FIMP Project). Attachment 3 in Appendix E discloses future non-offshore wind activities and associated terrestrial and coastal habitats and fauna impacts. These impacts are also briefly described below.

Future Activities (without the Proposed Action)

Future projects could contribute to individual displacement, injury, mortality, and habitat loss or modification via land disturbance, noise and light, and the potential for accidental spills. Activities from these projects would be temporary, and fauna would return to disturbed areas following completion of construction. BOEM is not aware of any future offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for terrestrial and coastal fauna. However, any onshore impacts associated with these future projects would be similar to the Proposed Action. As a result, adverse impacts on terrestrial and coastal habitats and fauna under the No Action alternative would be short term and negligible to minor.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on terrestrial and coastal habitats and fauna associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on terrestrial and coastal habitats and fauna, due to land disturbance, noise and light, and the potential for accidental spills.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities and onshore activities would be **negligible** to **minor**. As described in Attachment 3 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effect would be small and the resource would be expected to recover completely.

3.4.5.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Noise and human activity from trenching would be temporary and localized to the cable routes. Displaced wildlife could use adjacent habitat and would repopulate these areas once construction ceases. Because construction would predominately occur in already developed areas where wildlife is habituated to human activity and noise regardless of the cable route chosen, this would be a negligible, temporary adverse impact.

Collisions between wildlife and vehicles or construction equipment would be rare because most individuals are expected to avoid construction areas. However, species with limited mobility, especially herpetofauna, could be more vulnerable to this impact, resulting in minor, temporary adverse impacts to some species.

Impacts to the terrestrial and coastal flora and fauna habitat near the two landing sites would be avoided because the sea-to-shore transition vault would be located within the roadway and because HDD technology would be used to bury the cable beneath the beach and dune. However, during construction, there could be localized adverse impacts to coastal and terrestrial habitats along the onshore SFEC routes from trenching and vegetation removal within the construction ROW or from accidental spills. For the onshore SFEC routes, HDD would be used, as feasible, to avoid or minimize impacts to sensitive areas. The cable would also be located underground in previously disturbed areas, such as roadways and the LIRR ROW, and habitats disturbed during trench placement would be reseeded with native vegetation where practicable. Therefore, adverse impacts would be short term and negligible because disturbed habitats are expected to return to their previous condition and would not be re-disturbed.

The interconnection facility would require the clearing of approximately 2.4 acres of deciduous forest. These changes would be expected to have a minor and short-term adverse effect on terrestrial fauna because this type of forest habitat is common in the region based on NLCD land cover data (Homer et al. 2015). Construction of the interconnection facility could result in a short-term, negligible risk for invasive species primarily in newly disturbed areas. Increased sedimentation into nearby wetlands and streams during construction also could adversely impact populations of amphibians, fishes, and other fauna that rely on those wetlands and streams; however, DWSF would prepare and implement a SWPPP to minimize water quality impacts. Therefore, negligible and short-term adverse impacts to aquatic habitats are expected (see also Sections 3.3.2 and 3.5.5).

At the Montauk O&M facility, no impacts to onshore wildlife are expected because of the limited upland habitat present. If eelgrass is located adjacent to in-water work, sediments may be suspended during dredging activities and deposited elsewhere, resulting in burial and/or reduced water clarity and an associated reduction in photosynthetic activity thereby reducing its habitat value for associated fish, wildlife, and invertebrate species. See Section 3.4.2.2.3 for more detailed information in potential impacts to SAV.

Special-Status Coastal Fauna Species

The only federally listed terrestrial and coastal flora and fauna species potentially affected by construction of the onshore Project components is the seabeach amaranth. The Project BA indicates that this species could be present in the analysis area but that the Project would not disturb known or potential shoreline habitats (BOEM 2019). Therefore, any adverse effects would be negligible. Impacts to state-listed species from construction of the Project would be similar to those discussed for other terrestrial and coastal fauna.

Operations and Maintenance and Conceptual Decommissioning

Regular O&M activities would not cause further habitat alteration or impact terrestrial and coastal flora and fauna. However, when cable inspection or repairs require excavation, resulting in land disturbance, negligible, short-term, and localized adverse impacts could occur to coastal and terrestrial habitats. Light resulting from structures and vessels would lead to negligible impacts, if any, on terrestrial and coastal habitats because of the distance of the SFWF from the coastline. Considering the proposed cable burial depth and shielding, the extent of the generated EMFs would be less than 50 feet from the cable(s), and the intensity of impacts on terrestrial and coastal habitats would be negligible. Impacts to coastal and terrestrial habitats from conceptual decommissioning would be similar to construction impacts.

Overall, the Proposed Action would directly result in negligible to minor amounts of terrestrial habitat loss, depending on the onshore route selected, and negligible to minor impacts on terrestrial animals through mortality and temporary displacement.

Cumulative Impacts

Onshore construction and installation would incrementally add minor habitat conversion and habitat loss to the No Action alternative, changing the composition of terrestrial faunal assemblages and possibly reducing the abundance of terrestrial fauna through the removal of 2.4 acres of deciduous forest for the interconnection facility and a small area (0.1 acre) of upland wildlife habitat at the selected O&M facility. However, impacts would be avoided at the two cable landing sites by using HDD to bring the cable ashore. Due to the small amount of affected onshore habitat, the Proposed Action when added to other past, present, and reasonably foreseeable projects would result in negligible to minor incremental adverse impacts to terrestrial and coastal habitats and fauna.

Onshore construction would also produce temporary noise and light that would lead to short term negligible incremental impacts, if any, on terrestrial and coastal fauna and habitats. The onshore elements of the Proposed Action would be located in already developed areas with existing noise and light disturbance where wildlife is habituated to human activity. Accidental spills or release of trash and debris from other non-Project sources could also occur, but would be appropriately managed through implementation of the EPMs identified in Appendix G, Table G-1. Therefore, the cumulative impact of the Proposed Action on terrestrial and coastal fauna and habitats when combined with past, present, and reasonably foreseeable projects would be localized, short-term, and negligible to minor.

Conclusions

Project construction and installation and conceptual decommissioning would introduce noise, lighting, human activity, debris, and vehicles (increasing potential collision risk) to the geographic analysis area, as well as alter existing habitat. Noise, lighting, and human activity impacts from Project O&M would occur, although at lower levels than those produced during construction and conceptual decommissioning. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **minor** and short term. Therefore, BOEM expects the overall impact on terrestrial and coastal habitats and fauna from the Proposed Action alone to be **minor** because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor**. 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** impacts to terrestrial and coastal habitats and fauna. BOEM made this call as the effect would be small and the resource would be expected to recover completely.

3.4.5.2.4 VESSEL TRANSIT LANE ALTERNATIVE

Changes in offshore components under this alternative would not impact onshore species or habitats. Because onshore species or habitats are not affected by the number and placement of WTGs, all onshore Project components and activities, including construction and installation, O&M, and conceptual decommissioning, would be the same as the Proposed Action. Therefore, impacts of this alternative on terrestrial and coastal fauna and habitats would be the same as the Proposed Action: negligible to minor and adverse and temporary to short term.

Cumulative Impacts

For the same reasons described above, the cumulative impacts of this alternative when combined with other past, present, and reasonably foreseeable activities would be the same as the Proposed Action: negligible to minor and adverse.

Conclusions

Since reductions to the number of WTGs and their associated inter-array cables considered under this alternative would not impact onshore species or habitat, BOEM expects that the impacts resulting from the alternative alone would be the same as the Proposed Action and range from **negligible** to **minor**.

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

3.4.5.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Changes in offshore transit routes under the Habitat alternative would not impact onshore species or habitats. Therefore, the impacts of this alternative on terrestrial and coastal fauna and habitats would be the same as the Proposed Action: negligible to minor and adverse, and temporary to short term.

Cumulative Impacts

For the same reasons described above, the cumulative impacts of this alternative when combined with other past, present, and reasonably foreseeable activities would be the same as the Proposed Action: negligible to minor and adverse.

Conclusions

Since reductions to the number of WTGs and their associated inter-array cables considered under this alternative would not impact onshore species or habitat, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

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

3.4.5.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change across evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, these alterations would not impact onshore species or habitat. Therefore, BOEM expects that terrestrial and coastal fauna and habitats impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **minor**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor.**

3.4.5.4 Mitigation

No potential additional mitigation measures for terrestrial and coastal habitats and fauna are identified in Appendix G.

3.4.6 Sea Turtles

3.4.6.1 Affected Environment

Four species of sea turtles are known to occur in or near the area of direct effects,[1] and all are protected species under the ESA. These include the green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and Kemp's ridley sea turtle

[1] The area assessed for potential direct impacts to sea turtles includes the SFWF, offshore SFEC, and surrounding areas potentially affected by the Project during construction and installation, O&M, and conceptual decommissioning (see Figure C-33). Short-term, underwater noise from Project construction, specifically from pile driving and vessels supporting installation is the most extensive potential Project effect and is therefore used to define the analysis area based on current behavioral effects thresholds for these activities. This area extends approximately 1,716 feet from each monopile foundation, 175 feet from vibratory pile driving, and approximately 300 feet from the SFEC corridor and vessel transit lanes.

(*Lepidochelys kempii*). The potential impacts of the Proposed Action to these species are assessed in Section 3.4.6.2 (Environmental Consequences). The hawksbill sea turtle (*Eretmochelys imbricata*) is also protected under the ESA but is exceedingly rare in the area of direct effects (Kenney and Vigness-Raposa 2010) (Figure C-33). This area is outside the normal range of hawksbill turtles, which includes warmer waters to the south. The individual hawksbill turtles that have occasionally occurred in the area of direct effects and vicinity have been stunned by exposure to unusual cold water events and transported northward into the region by the Gulf Stream. These occurrences are not representative of normal behaviors or distribution, however. Similarly, while this species does occur in the larger geographic analysis area (defined in Appendix E), the Proposed Action is unlikely to contribute to any measurable cumulative effects and is therefore not considered further in this DEIS.

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). Such physiological traits and behavioral patterns allow them to spend as little as 3% to 6% of their time at the water surface (Lutcavage and Lutz 1997). 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 critical habitats in the vicinity of the SFWF (GARFO 2020), meaning that individuals occurring in the area of direct effects are either migrating or foraging. As such, these individuals likely to spend the majority of time below the surface.

The combination of sightings, strandings, and bycatch data provides the best available information on sea turtle distribution in the area of direct effects. This section summarizes data from sightings and surveys of the waters around the Lease Area (Kraus et al. 2016), NMFS Sea Turtle Stranding and Salvage Network (NMFS 2020), recent available density estimates (Pyć et al. 2018), and historic regional data (Kenney and Vigness-Raposa 2010). Pyć et al. (2018) summarized seasonal estimates of sea turtle densities using data from the U.S. Navy Operating Area Density Estimates database on the Strategic Environmental Research and Development Program Spatial Decision Support System (SERDP-SDSS) portal (Geo-Marine, Inc. 2007; Navy 2012). Those numbers were then adjusted by the Sea Mammal Research Unit (SMRU 2013), available in the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) (Halpin et al. 2009). Table 3.4.6-1 summarizes potential sea turtle occurrence in the southern New England coastal waters off Rhode Island and Massachusetts that encompass the area of direct effects. Potential effects to sea turtles, which are discussed in Section 3.4.6.2 (Environmental Consequences), are based on the likelihood of occurrence in the area of direct effects.

Table 3.4.6-1. Frequency of Sea Turtle Species Occurrence in the Area of Direct Effects

Common Name	Scientific Name	DPS*/ Population	ESA Status*	Frequency of Occurrence in Area of Direct Effects†	Seasonal Occurrence in Area of Direct Effects‡,§	Likelihood of Occurring in the Area of Direct Effects§,¶	Included in EIS Impact Analysis?
Green sea turtle	*Chelonia mydas*	North Atlantic	T	Uncommon, limits of range	May to November	Unlikely	Yes
Hawksbill sea turtle	*Eretmochelys imbricata*		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*	N/A	E	Regular	May to November	Likely	Yes

Note: Data from NMFS Sea Turtle Stranding and Salvage Network (NMFS 2020).

* DPS = distinct population segment, ESA status: 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 Greater Atlantic Regional Fisheries Office (2016).

§ Data from NEFSC and SEFSC (2018).

¶ Data from Kraus et al. (2016).

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). Juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991), including Long Island Sound and Cape Cod Bay (Cetacean and Turtle Assessment Program 1982). The primary nesting beaches are located in Costa Rica, Mexico, the United States (Florida), and Cuba. According to NMFS and USFWS (2015sa), 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. Kenney and Vigness-Raposa (2010) recorded one confirmed sighting within the RI/MA WEA in 2005. The Sea Turtle Stranding and Salvage Network 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 2020; WBWS 2018). However, no green sea turtle observations were recorded in an intensive, multiyear (2011–2015) shipboard and aerial survey of large pelagic species occurrence in the RI/MA WEA (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 area of direct effects is expected to be rare 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 U.S. continental shelf (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 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. The Sea Turtle Stranding and Salvage Network reported 19 offshore and 77 inshore leatherback sea turtle strandings between 2017 and 2019, the highest number among all turtle species reported (NMFS 2020). Pyć et al. (2018) estimated adult leatherback densities to be as high as three animals per 10,000 km^2; however, Kraus et al. (2016) data indicate that leatherbacks would be the most abundant sea turtle species in the area of direct effects, which is consistent with other available information on sea turtle occurrence in the vicinity. Based on this information, leatherback sea turtles are expected to occur commonly in the area of direct effects 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 the Gulf of Maine (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). AMAPPS 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 and September. Pyć et al. (2018) estimated adult loggerhead densities to be as high as 12 animals per 10,000 km^2. The Sea Turtle Stranding and Salvage Network reported six offshore and 58 inshore loggerhead sea turtle strandings between 2017 and 2019 (NMFS 2020). 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 continental shelf 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 area of direct effects 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 coastally oriented, 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 meters) deep (Seney and Landry 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. The population was severely decimated prior to 1985 due to intensive egg collection and fishery bycatch, with only 702 nests counted during the entire year (NMFS and USFWS 2015b). Recent models indicate a persistent reduction in survival and/or recruitment to the nesting population, suggesting that the population is not recovering (NMFS and USFWS 2015b). In 2006, the most recent year for which data are available, there were an estimated 7,000–8,000 nesting females (NMFS and USFWS 2015b). 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 SFWF in other survey efforts, mostly to the south and west of the RI/MA WEA (Right Whale Consortium 2019). Pyć et al. (2018) estimated Kemp's ridley densities to be as high as 1 animal per 10,000 km^2. The Sea Turtle Stranding and Salvage Network reported six offshore and 69 inshore Kemp's ridley sea turtle strandings between 2017 and 2019 (NMFS 2020). 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 in the area of direct effects as juveniles and subadults from July through September. The highest likelihood of occurrence is in coastal nearshore areas adjacent to Long Island where the SFEC is anticipated to make landfall. Juvenile Kemp's ridley sea turtles have been regularly encountered off the coast of Long Island, where there are more abundant protected shallow-water habitats (NYSDEC 2019). Occurrence in the RI/MA WEA is possible, but they are anticipated to be rarely present and in low numbers, particularly in the area of direct effects.

3.4.6.2 Environmental Consequences

3.4.6.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.6-2 lists the issues resulting from the Project that could impact sea turtles and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.4.6-2. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Sea Turtles

Issue	Impact Indicator	Significance Criteria
Underwater noise from construction/conceptual decommissioning	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: Behavioral effects:[*] 175 dB_{RMS} Injury/harm 207 dB_{peak}[†], 232 dB_{peak} (PTS)[‡], 226 dB_{peak} (TTS)[‡] 210 dB_{SEL}[†], 204 dB_{SEL} (PTS)[‡], 189 dB_{SEL} (TTS)[‡]	Negligible: No measurable impacts to individuals would occur. Minor: Most impacts to species could be avoided with EPMs; if impacts occur, the loss of one or a few individuals, relative to population size, could represent a minor impact, depending on the time of year and number of individuals involved. Moderate: Impacts to species are unavoidable, but would not result in population-level effects. Major: Impacts would affect the viability of the population and would not be fully recoverable, even if DWSF applies mitigation.
Underwater noise from operation	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: Behavioral effects:[*] 175 dB_{RMS}	
In-air noise/disturbance	Biologically significant behavioral response	
Vessel traffic	Qualitative estimate of potential collision risk	
Water quality impacts	Quantitative estimate of intensity and duration of suspended sediment effects	
	Qualitative analysis of potential discharges (fuel spills, trash, and debris) relative to baseline	
Artificial light	Intensity, frequency, and duration relative to baseline	
Power transmission	Theoretical extent of detectable EMF effects	
Seabed and water column disturbance/alteration	Water column volume and acres of seabed disturbance, loss, or conversion by structure presence	

[*] Behavioral effect threshold for impact and vibratory pile driving defined by Navy (2017). dB_{RMS} = root mean square decibels re: 1 micropascal (μPa).

[†] Injury/harm effect threshold defined by Popper et al. (2014). dB_{peak} = peak dB re: 1 μPa; dB_{SEL} = cumulative sound exposure level in dB re: 1 $μPa^2$/second.

[‡] Injury/harm effect threshold defined by Navy (2017). dB_{peak} = peak dB re: 1 μPa; dB_{SEL} = cumulative sound exposure level in dB re: 1 $μPa^2$/second.

3.4.6.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing sea turtle species and habitat trends due to past and present activities. Attachment 3 in Appendix E also provides additional information regarding past and present activities and associated species impacts. Future non-Project actions include offshore development projects, military activities, dredged material disposal, commercial fishing, marine transportation, and climate change. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated sea turtle impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Accidental releases and discharges: 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), as well as 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 the primary anthropogenic cause of mortality in both juvenile and adult sea turtles (National Research Council 1990 as cited in Shigenaka et al. 2010). Aquatic contaminant exposure could also result in mortality, and sublethal effects could impact many of the species' physiological systems during all life stages (Shigenaka et al. 2010; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Vargo et al. 1986). Furthermore, accidental releases may indirectly impact sea turtles through affecting 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 and aquatic contaminants. Therefore, potential accidental release volumes would not appreciably contribute to adverse impacts to sea turtle, and these effects would be negligible.

<u>EMF</u>: Under the No Action alternative, the future development of planned wind energy projects would result in up to 5,779 miles of new submarine electrical transmission cables in the geographic analysis area for sea turtles. Each cable would generate EMF effects within the immediate proximity. The available evidence indicates that sea turtles are magnetosensitive and orient to the Earth's magnetic field for navigation. Although they may be able to detect magnetic fields as low as 0.05 mG, they are unlikely to detect magnetic fields below 50 mG (Normandeau et al. 2011; Snoek et al. 2016). However, potential EMF effects would be reduced by cable shielding and burial to an appropriate depth. New submarine cables would be installed to maintain a minimum separation of at least 330 feet from other known cables to avoid damaging existing infrastructure during installation. This separation distance would avoid additive EMF effects from adjacent cables. While artificial EMF effects on sea turtles are not well studied, current construction and mitigation methods would limit projected EMF effects below levels that are likely to cause significant biological effects. Deviations in migration therefore would be small and would not be expected to significantly impact energy expenditure in sea turtles. Further discussion of potential EMF effects on sea turtles is available in the SFWF BA (BOEM 2020) and the NMFS biological opinion for the Vineyard Wind Energy Project (NOAA 2020a).

<u>Light</u>: Nighttime lighting associated with offshore structures and vessels could represent a source of attraction, avoidance, or other behavioral responses in sea turtles. Although responses to light have been studied in various species and life stages of sea turtles, the effects remain uncertain. Shoreline development is the predominant existing artificial lighting source in the nearshore component of the geographic analysis area while vessels, mainly fishing vessels, are the predominant artificial lighting source offshore. Future wind energy development would contribute additional light sources to the offshore component of the geographic analysis area, including a short-term increase in light from vessels used during construction, and the long-term use of navigational lighting on new WTGs and OSSs. An estimated 2,050 structures are forecasted for construction. Each structure would have minimal yellow flashing navigational lighting as well as red flashing FAA hazard lights in accordance with BOEM's (2019) lighting and marking guidelines.

<u>New cable emplacement/maintenance:</u> Future offshore wind projects could disturb up to 7,951 acres of seabed during the installation of associated undersea cables, causing an increase in suspended sediment. This disturbance would be both localized and temporary in duration. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be limited in extent, short term in duration, and likely too small to be detected (NOAA 2020b). Seafloor disturbance during construction of future offshore wind projects may affect foraging success or some prey species; however, given that impacts would be temporary, and generally localized to the cable corridor, no population-level effects on sea turtles would be expected.

<u>Noise</u>: 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, 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 3.4.4.2.2 (No Action Alternative), 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 significant underwater noise effects.

Existing and potential future anthropogenic noise sources generally fall into two categories: impulsive noise, defined as the instantaneous change in sound pressure over a short period of time; and intermittent non-impulsive noise, which remains constant and stable over a given time period. Impulsive and intermittent 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 geographic analysis area include impact pile driving used in nearshore and offshore construction activities and G&G surveys.

G&G 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 generates less intense noise than other G&G survey methods. Short-term noise effects from HRG equipment could include behavioral disturbance, avoidance, increased stress, and, potentially, TTS. Noise levels produced by this type of equipment is not likely to result in permanent hearing injury (i.e., PTS). 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 non-biologically significant physiological consequences (NMFS 2020), no injury or mortality would occur, and impacts on sea turtles would be negligible and not result in stock or population-level effects.

Impulsive underwater noise from impact pile driving during planned offshore wind development, due to the anticipated frequency and spatial extent of effect, represents the highest likelihood for exposure of adverse effects to individual sea turtles. While these potential effects are acknowledged, their potential significance is unclear because sea turtle sensitivity and behavioral responses to underwater noise is a subject of ongoing study (see Section 3.4.6.2.3). Potential behavioral effects may include altered submergence patterns, short-term disturbance, startle response (diving or swimming away), and short-term 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 effects 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 (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 potentially 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 remains poorly understood (Lavender et al. 2014). Assuming that mitigation measures described in Appendix G, Table G-2 would likely be required in all offshore wind development projects, impacts to sea turtles from construction-related noise would be likely be limited to minimal or moderate short-term effects on a small number of individuals. Short-term effects on individuals would not be significant at the population level and therefore minor overall.

Intermittent Non-Impulsive Noise: Intermittent non-impulsive underwater noise sources in the geographic analysis area include baseline noise levels from 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, vibratory pile driving during Project construction, and operational noise from WTGs.

Helicopters and fixed-wing aircraft may be used during initial site surveys, marine mammal monitoring prior to and during construction, and facility monitoring. Sea turtle sensitivity to airborne nose and disturbance is not well studied, but available information indicates that it is minimal. 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. NOAA (2020b) determined that noise and disturbance effects on sea turtles from aircraft used for construction and O&M of the Vineyard Wind offshore wind facility would be insignificant. Based on this information, cumulative effects on sea turtles from aircraft used for wind energy development on the OCS would be negligible.

Vibratory pile driving used during submarine cable and port facility construction is the most intensive source of intermittent non-impulsive underwater noise expected to result from planned offshore wind energy development. As discussed in Section 3.4.4.2.3 (Proposed Action Alternative), the typical noise levels generated by vibratory pile driving used for facility development and port improvements are below thresholds associated with potential hearing injury in sea turtles. 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, short term in duration, and widely separated, vibratory pile-driving noise effects on sea turtles would be negligible at the individual and population levels.

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 incrementally increase as a result of planned offshore wind projects, especially during construction periods (Jacobs 2020). 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 207 vessels involved in the construction of reasonably foreseeable projects (see Section 3.4.4.2.2 No Action Alternative for details). However, this increase must be considered relative to the baseline level of vessel traffic in the geographic analysis area. Sea turtles are relatively insensitive to sound and, as discussed in Section 3.4.6.2.3 (Proposed Action Alternative), no injury or behavioral effects from vessel noise are anticipated for the Proposed Action. 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 short-term behavioral impacts on sea turtles could occur. 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 geographic analysis area, the effects of vessel noise from future activities on sea turtles would be negligible. No stock or population-level effects would occur.

No significant effects on sea turtles are anticipated from intermittent non-impulsive noise resulting from WTG operation. Noise associated with operational WTGs would be expected to attenuate below ambient levels at a relatively short distance from WTG foundations (Kraus et al. 2016; Miller and Potty 2017; Thomsen et al. 2015; Tougaard et al. 2009). The maximum anticipated noise levels produced by operational WTGs are below recommended thresholds for sea turtle injury and behavioral effects. Current generation WTGs use direct drive motors, which produce even lower noise levels than the earlier generation technologies considered in prior studies (BOEM 2019a). Sea turtles appear to habituate to repetitive underwater noise not accompanied by an overt threat (Bartol and Bartol 2011; Hazel et al. 2007; Navy 2018). This suggests that even if WTGs generate noise detectable to sea turtles in the immediate proximity, the exposed individuals are not expected to experience measurable adverse effects. Therefore, the effects of operational noise from future wind farm development on sea turtles would be negligible at both individual and population levels.

Port utilization: Any port expansions could increase the total amount of disturbed benthic habitat (see Section 3.5.5.2.2 No Action Alternative) and result in impacts on some sea turtle prey species. However, given that port expansions would likely occur in subprime areas for foraging, and the disturbance would be relatively small in comparison to the overall sea turtle foraging areas in the geographic analysis area, port expansions are not expected to impact sea turtles. Dredging for port facility improvement could lead to additional impacts on turtles from incidental entrainment, impingement, or capture. Dredging impacts on sea turtles are relatively rare, with most observed injury and mortality events in the United States associated with hopper dredging in and around core habitat areas in the southern portion of the geographic analysis area and along the Gulf Coast (Michel et al. 2013; USACE 2020). Ongoing maintenance dredging of these facilities may incrementally increase related risks to individual turtles over the lifetime of the facilities; however, typical mitigation measures such as timing restrictions should minimize this potential. Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging associated with the projects considered here is low and population level effects are unlikely to occur. Therefore, associated effects of port expansions on sea turtles would be minor.

Presence of structures: The addition of up to 2,050 new offshore structures in the geographic analysis area could increase sea turtle prey availability through creating new hard-bottom habitat, increasing pelagic productivity in local areas, or promoting fish aggregations at foundations (Bailey et al. 2014 cited in English et al. 2017). Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) discusses reef creation and altered water flow in detail. The significance of this reef effect is unknown but is expected to result in negligible or minor beneficial impacts to sea turtles given the broad geographic range of species during their annual foraging migrations. However, the presence of structures may indirectly concentrate recreational fishing around foundations, which could indirectly increase the potential for sea turtle entanglement in both lines and nets (Nelms et al. 2016; Gall and Thompson 2015; Shigenaka et al. 2010).

Human-made structures, especially tall, vertical structures like WTG and OSS foundations, 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), within 300 to 400 feet of each monopile foundation. Altered hydraulics can increase seabed scour and sediment suspension around foundations, but this effect would be minimized by scour protection around the foundations; therefore, sediment plumes, if any, would return to baseline conditions within a short distance.

The changes in fluid flow caused by the presence of an estimated 2,050 structures could also 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 many WTG structures could affect oceanographic and atmospheric conditions in ways that alter these dynamics, potentially increasing primary productivity in the vicinity of the structures (Carpenter et al. 2016; Schultze et al. 2020). However, this 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).

The ultimate 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. For example, the presence of new, hard surfaces could increase the abundance of associated organisms like mussels and crustaceans on and around the structures, providing a prey resource for loggerhead sea turtles. Increased primary and secondary productivity in proximity to structures could increase the abundance of prey species like jellyfish (English et al. 2017). Additionally, hard-bottom (scour control and rock mattresses used to bury required offshore export cables) and vertical structures (i.e., WTG and OSS foundations) in a soft-bottom habitat can create artificial reef effects; thus inducing the "reef effect" associated with higher densities and biomass of fish and decapod crustaceans (Causon and Gill 2018; Taormina et al. 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, sea turtles, and birds as well (Raoux et al. 2017; Pezy et al. 2018; Wang et al. 2019), indicating that offshore wind facilities can generate beneficial long term impacts on local ecosystems, translating to increased foraging opportunities for sea turtle species. In contrast, increased fish biomass around the structures could attract commercial and recreational fishing activity, creating an increased risk of injury or death from gear entanglement and ingestion of debris (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014).

Some level of displacement of sea turtles out of the Lease Area and into areas with a higher potential for interactions with ships or fishing gear could occur, particularly during construction phases. However, the addition of structures could locally increase pelagic productivity and prey availability for sea turtles. Thus, the overall impact to sea turtles is not expected to be biologically significant. Potential long-term, intermittent impacts would persist until conceptual decommissioning is complete and structures are removed. These impacts would be negligible to minor.

Traffic: Vessel strike is an increasing concern for sea turtles. The percentage of loggerhead sea turtles stranded due to vessel strikes increased from approximately 10% in the 1980s to 20.5% in 2004 (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 geographic analysis area may exceed 10 knots. Up to 207 vessels associated with offshore wind development may be operating in the geographic analysis area during the peak construction period in 2025. Increased vessel traffic could result in sea turtle injury or mortality. However, despite the potential for individual fatalities, no population-level impacts on sea turtles are expected. Assuming other offshore wind projects employ the same minimizing measures included in the Project, impacts would be further reduced and would be moderate.

Climate change: 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. Possible impacts to sea turtles due to climate change include increased storm severity and frequency; increased erosion and sediment deposition; disease frequency; ocean acidification; and altered habitat, altered prey availability, ecology, and migration patterns. Over time, climate change, in combination with coastal development, would alter existing habitats, rendering some areas unsuitable for some species and more suitable for others.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual 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 construction-related lighting, noise, habitat alternation, collision risk, and artificial reef effect.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **negligible** to **moderate**. As described in Attachment 3 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts because the overall effect would be notable but the resource would be expected to recover completely.

3.4.6.2.3 PROPOSED ACTION ALTERNATIVE

Table 3.4.6-3 summarizes potential short-term and long-term benthic habitat disturbance by Project components (CH2M HILL 2018).

Table 3.4.6-3. Short-Term and Long-Term Benthic Habitat Disturbance by Project Component

Project Component	Short-Term Disturbance (Acres)	Long-Term Disturbance (Acres)
SFWF	814.8*	126.8
SFEC	618.7	179.3
O&M facility	0.9	0.007
Total	**1,731.2**	**306.1**

Construction and Installation

Construction impacts to sea turtles could occur from seabed disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. Unless noted otherwise, construction-related impacts would be temporary and short term. The potential for these impacts to occur are discussed in detail in the following sections.

Seabed disturbance: Sea turtles near the Project would likely be foraging, and prey items could include benthic species. Seabed disturbance would be associated with seabed preparation, foundation installation, vessel anchoring, and cable installation during Project construction. This disturbance would be short term; however, some benthic habitat conversion would also occur as described in in Section 3.4.2.2 (Environmental Consequences). As discussed in Section 3.4.2.1 (Affected Environment), the affected seabed is composed primarily of unconsolidated sand and gravel deposits subject to regular disturbance from currents. Project construction and installation would temporarily affect a small percentage (i.e., 0.9%) of the available foraging habitat in the Lease Area until pre-construction species assemblages are recolonized and recovered. Benthic communities that inhabit dynamic bed environments typically recover rapidly from construction-related disturbance, usually within 1 year (Dernie et al. 2003; UKBERR 2007). The affected area is also subject to periodic bed disturbance by commercial fishing (CH2M HILL 2018), indicating that construction-related bed disturbance is unexpected to measurably alter environmental baseline conditions in the area of direct effects. Because impacts to foraging habitat are mostly temporary and localized, the impact of Project activities associated with seabed disturbance on sea turtles would be negligible.

Port utilization: Construction of the Montauk O&M facility, if selected as the final site, poses a theoretical risk to sea turtles from dredge entrainment and impingement, similar to those described in Section 3.4.6.2.2 (No Action Alternative). However, the likelihood of sea turtle exposure to construction-related dredging impacts is minimal. The USACE monitors incidental take of sea turtles associated with navigation channel dredging projects. There is only one recorded incident of an individual sea turtle being injured or killed in the available data record for 34 federal dredging projects conducted in the New York and New England districts between 1994 and 2012 (USACE 2020). Further, current permitting restrictions limit the timing of dredging activities in Lake Montauk Harbor to the period from September 30 through January 15 (USACE 2019). Most sea turtles occurring in the vicinity would have migrated south to overwintering habitats and would not be present when dredging occurs. Therefore, dredging-related risks to sea turtles from Project construction are negligible.

Noise: A short-term 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 SFWF and offshore SFEC construction. The noise associated with offshore Project construction and operation generally falls into two categories: impulsive noise, defined as the instantaneous change in sound pressure over a short period of time; and intermittent non-impulsive noise, which generates constant high-intensity noise over a limited time period.

Table 3.4.6-4 summarizes thresholds for underwater noise effects and the maximum distances to injurious and behavioral effects from both impulsive and intermittent non-impulsive construction-related underwater noise levels (Denes et al. 2020). The distances shown for a difficult installation scenario represent a worst case, as most installations are expected to require only 2 hours and would produce comparatively smaller areas of cumulative effect. These effects are described in greater detail below.

Table 3.4.6-4. Distances to Effect Thresholds for Elevated Underwater Noise

Noise Source	Injurious Effects		Behavioral Effects
	Distance to 207 dB_{peak} Threshold (feet)	Distance to 210 dB_{SEL} Threshold (feet)	Distance to 175 dB_{RMS} Threshold (feet)
Monopile foundation installation (impulsive)	115	725	1,716
Temporary cofferdam installation, vibratory sheet pile (intermittent non-impulsive noise)	0	0	175
Vibratory sheet pile driving for O&M facility upgrades (intermittent non-impulsive noise)	0	0	175
Dynamically positioned construction vessels (intermittent non-impulsive noise)	0	0	0

Source: Denes et al. (2020). Monopile foundation values reflect the maximum possible effect area from a difficult installation of an 11-meter-diameter pile with 10 dB broadband attenuation.

Popper et al. (2014) reviewed available data and suggested the threshold levels of 207 dB_{PEAK} and 210 dB_{SEL} 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 beginning at 232 dB_{PEAK} and 204 dB_{SEL} and TTS beginning at 226 dB_{PEAK} and 189 dB_{SEL} (Navy 2017). Denes (2020) modeled the extent of injurious effects from impulsive underwater noise using only the Popper et al. (2014) thresholds. Note that use of these thresholds could result in predictions of mortality or mortal injury when the actual expected response would be auditory injury; therefore, the predicted responses of sea turtles to pile-driving noise based on the Popper et al. (2014) thresholds would result in overestimates of the severity of effects. NMFS has considered behavioral response beginning at 175 dB_{RMS} (Navy 2017). These thresholds apply to juvenile, subadult, and adult life stages.

Little is known about the role of sound perception in the sea turtle’s typical activities. 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). Sea turtles migrating through the area when pile driving occurs are expected to adjust their course to avoid the area where noise is elevated above 175 dB re 1uPa RMS. Depending on how close the individual is to the pile being driven, this could involve swimming up to 1.04 miles (1.67 km). 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 turtle may experience physiological stress during this avoidance behavior, but this stressed state would be anticipated to dissipate once the sea turtle is outside the ensonified area over time. Individuals may become habituated to repeated exposures over time that were not accompanied by an overt threat (Hazel et al. 2007); individuals have been shown to retain this habituation even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018). There have been no documented sea turtle mortalities associated with pile driving. Either a temporary or permanent reduction in hearing sensitivity could be harmful for sea turtles, but the potential significance 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 observers, exclusion and monitoring zones, and pile-driving soft start measures (Appendix G, Table G-1) would minimize the risk of sea turtle exposure to elevated underwater noise levels.

Impulsive noise: Impact pile driving during construction is the loudest potential impulsive underwater noise source associated with the Project and would produce the most extensive effects. Based on the combination of minimization measures discussed above (e.g., sound reduction technology, soft starts, PSOs) and the low numbers of sea turtles expected in the area of direct effects, only minor impacts to sea turtles from impact pile driving are expected.

HRG surveys use a combination of sonar-based methods to map shallow geophysical features. The equipment is towed behind a moving survey vessel attached by an umbilical cable. These sonars generate a short-duration pulse in the 1.1 to 200 kHz range, with the interval between pulses ranging from 0.2 to 1 second, depending on the specific type of equipment used. The equipment only operates when the vessel is moving along a survey transect, meaning that the ensonified area is intermittent and constantly moving. BOEM (2018) and NOAA (2020b) evaluated potential underwater noise effects on sea turtles from HRG surveys and concluded that an individual sea turtle would have to be within 20 to 40 feet of the loudest possible type of HRG equipment to experience PTS, depending on the species. HRG survey noise would exceed the behavioral effects threshold up to 300 feet from the source, depending on the type of equipment used. Given the limited extent of potential noise effects and the EPMs and other mitigation measures used in this Project, injury-level exposures are unlikely to occur. BOEM (2018) concluded that planned HRG survey activities across the entire Mid-Atlantic OCS are unlikely to cause PTS injury to sea turtles. While low-level behavioral exposures could potentially occur, these would be limited in extent and short term in duration. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

Intermittent Non-Impulsive Noise: Vibratory pile driving would be used to install cofferdams for SFEC sea-to-shore transitions and may also be used for the construction of upgrades to the Montauk O&M. Similar to 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 area of direct effects. Noise from vibratory pile driving at the Montauk O&M would be within the embayment of Lake Montauk, and noise would be constrained within the embayment by human-made jetties and natural geography.

As shown in Table 3.4.6-4, vibratory pile-driving noise would not exceed recommended sea turtle injury thresholds and would only exceed behavioral thresholds within 175 feet of the source. 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.

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). However, Hazel et al. (2007) suggested that turtles could habituate to vessel sounds in marine areas that experience regular vessel traffic. 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, 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, but these effects would be caused by the visual presence of the vessel itself rather than the noise produced. 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.

Fixed-wing aircraft may be used during construction for marine mammal monitoring, and helicopters may be used for crew transport to and from construction vessels. Monitoring aircraft would operate at an altitude of 1,000 feet consistent with established guidance (BOEM 2019b). Noise levels generated by helicopters and propeller-driven aircraft at this altitude range from 65to 85 dBA (Behr and Reindel 2008; Brown and Sutherland 1980), below the 90-dBA airborne noise thresholds for seals (NOAA 2019). 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 may cause some short-term and 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.

Vessel traffic: 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 that were not accompanied by an overt threat. Project construction vessels could collide with sea turtles, posing a short-term increase in the risk of injury or death to individual sea turtles. However, as stated in Section 3.5.6 (Navigation and Vessel Traffic), the MARIPARS study area supports high volumes of vessel traffic (13,000 to 46,900 annual vessel transits), and the Proposed Action would be expected to result in only a small incremental increase in vessel traffic, with a peak during Project construction. Based on information provided by DWSF, Project construction would require an estimated total of 50 vessel trips between the Port of New London, Connecticut, and the SFWF over the 2-year construction period, with an estimated maximum of six trips in any given month from U.S. ports outside of the RI/MA WEA. Port traffic within the RI/MA WEA would add an additional 127 one-way trips during WTG installation and 146 one-way trips during cable installation to the SFWF. Depending on the contractor selected, up to eight construction vessels could travel to the Lease Area from unspecified ports in Europe or elsewhere in the world.

Fishing vessels may be displaced during construction of WTGs and installation of the SFEC. Up to 300 fishing vessels use the SFWF annually (see Section 3.5.1 [Commercial Fisheries and For-Hire Recreation]) and might decide to avoid the SFWF once it is fully constructed. This reduction in commercial fishing within the SFWF could lead to a reduced risk of turtle collisions within the SFWF, but collision risk could increase in those areas where fishing vessels relocate. Conversely, recreational fishing vessel traffic in and around the SFWF could increase as a result of the reef effect generated by the monopile foundations. This assumes similar densities of sea turtles occur in both areas; however, the future distribution of commercial and recreational fishing vessels in response to the SFWF cannot be predicted. The increased collision risk in some areas is anticipated to be commensurate with the decreased risk within the SFWF, so changes in collision risk from relocated commercial and for-hire fishing vessels during construction of the SFWF would not be measurable from baseline. At most, relocation of fishing vessel would be considered minor to sea turtles.

Sea turtles are likely to be most susceptible to vessel collision in coastal foraging areas crossed by construction vessels traveling between the SFWF and offshore SFEC 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. The behaviors observed suggested 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 incremental increase in collision risk relative to baseline levels of vessel traffic in and around the area of direct effects. 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 very slowly, on the order of 1 mile per day. Project EPMs include the implementation of NOAA guidelines (COP Table 4.7-2) to minimize turtle risk by reducing vessel speed and maintaining a separation distance from sighted individuals. Nevertheless, collisions with individual turtles may 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 also low, the number of sea turtles injured or killed by vessel strikes as a result of Project construction would be low and would not result in significant effects at the population level. NOAA (2020b) evaluated sea turtle collision risk for the much larger Vineyard Wind project and concluded that anticipated mortalities, which would be considerably less for the SFWF and offshore SFEC project construction, would not represent population-level effects on ESA-listed turtles. Therefore, the potential effects of construction vessel collisions on sea turtles would be minor.

<u>Water quality degradation</u>: Construction of the SFWF and offshore SFEC is expected to result in elevated levels of suspended sediment in the immediate proximity of bed-disturbing activities like pile driving, placement of scour protection, and trenching and burial of the SFEC and inter-array cable, as discussed in Section 3.3.2.2.3 Proposed Action Alternative. Vinhateiro et al. (2018) modeled anticipated TSS levels and the time required to dissipate those levels to ambient conditions. Within the SFWF, they predicted that TSS concentrations greater than 10 mg/liter (L) would not extend more than 10 feet (3 m) from the disturbance source based on the coarser sediment conditions present in the area of direct effects. TSS levels along the SFEC would remain below 30 mg/L within 330 feet (100 m) of the cable route. These effects would be short term because TSS levels are predicted to return to normal within 1.4 hours of activity completion (Vinhateiro et al. 2018). TSS levels associated with dredging for the construction of the Montauk O&M facility is anticipated to reach up to 100 mg/L (Vinhateiro et al. 2018). This work would take approximately 2 days and suspended sediments would return to background levels after two tide cycles due to the course composition of the sediment.

Direct, physical effects from TSS exposure are unlikely because sea turtles breathe air and do not share the physiological sensitivities of susceptible organisms like fish and invertebrates. Turtles could alter their behavior in response to elevated suspended sediment levels (e.g., moving away from an affected area). They could also experience behavioral stressors (e.g., reduced ability to forage and avoid predators). However, turtles are highly mobile and can avoid short-term suspended sediment impacts that are limited in severity and range. Given the limited extent of potential suspended sediment impacts expected to result from the Project and low sea turtle sensitivity to this stressor, effects to sea turtles from elevated suspended sediment levels would be negligible. Many sea turtle species routinely inhabit nearshore and estuarine environments with periodically high natural turbidity levels; therefore, short-term exposure to elevated suspended sediment is unlikely to measurably inhibit foraging (Michel et al. 2013 as cited in Johnson 2018). Because of the relatively small area impacted by habitat disturbance and resettled sediment, impacts on prey and foraging success for sea turtles would also be negligible.

Artificial lighting: Lights would be required on vessels and heavy equipment during construction. Most scientific studies on lighting effects on sea turtles were conducted at nesting sites, which do not occur in the area of direct effects. Gless et al. (2008) reported that previous studies showed that loggerhead turtles were attracted to lights from longline fishing vessels. Gless et al. (2008) conducted a laboratory study to see if juvenile leatherbacks responded to lights in the same way as loggerheads. Their study showed that leatherbacks either failed to orient or oriented at an angle away from the lights and concluded that there is no convincing evidence that marine turtles are attracted to vessel lights. Limpus (2006) indicates that navigation/anchor lights on top of vessel masts are not impactful but that bright deck lights should be shielded if possible to reduce impacts to sea turtles. Project EPMs (see Table G-1 in Appendix G) include construction vessel light shielding and operational restrictions to limit light use to required periods and minimize artificial lighting effects on the environment. Considering the proposed EPMs and the fact that construction vessel activity is unlikely to measurably alter baseline vessel light levels in the area of direct effects, construction lighting effects on sea turtles would be negligible.

Potential discharges, spills, and trash: During construction of the SFWF, 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 significantly impact exposed individuals (Vargo et al. 1986). Any non-routine 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 G-1 in Appendix G). Impacts on sea turtles from accidental spills or releases of pollutants are considered minor 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 like plastic bags are often mistaken for food such as jellyfish and ingested, which can block intestinal tracts, causing injury or mortality. Personnel working offshore would receive training on sea turtle awareness and marine debris awareness (see COP Table 4.7-2). Impacts on sea turtles from accidental deposits of trash or debris are considered minor because implementation of proposed EPMs (see Table G-1 in Appendix G) would lower the probability of such risk.

Operations and Maintenance and Conceptual Decommissioning

Vessel traffic: DWSF has estimated that Project O&M would involve up to seven vessel trips per month, or between 2,500 and 2,600 vessel trips over the lifetime of the Project. The majority of vessel trips (2,500) would originate from the Montauk O&M facilities, with rare vessel trips (< one per month) originating from New London, Connecticut, or unspecified ports in Europe on an as-needed basis. The negligible increase in vessel traffic due to unplanned maintenance is not expected to lead to a large increase in risk of collision with sea turtles due to the low number of vessel transits and the low density of sea turtles in the Project.

Fishing vessels may be displaced during operation of WTGs. Up to 300 fishing vessels (see Section 3.5.1 [Commercial Fisheries and For-Hire Recreation]) could choose not to operate within the SFWF annually during operation, assuming all fishing vessels avoid the Lease Area. This would lead to a reduced potential for turtle collisions within the SFWF, but the risk could increase in areas where fishing vessels relocate their fishing activities outside the SFWF. In contrast, recreational fishing vessel use of the SFWF area may increase in response to the anticipated reef effect created by the monopile foundations. The degree to which these effects offset cannot be fully evaluated because turtle densities in the area of direct effects are low overall and likely not uniform, and future changes in the distribution of commercial and recreational fishing vessel activity are difficult to predict. However, increases in collision risk in some areas is anticipated to be commensurate with the decreased risk within the SFWF, so changes in collision risk from relocated commercial and recreational vessels during operation of the SFWF would not be measurable from baseline.

As with construction, a similar increase in vessel round trips during conceptual decommissioning is expected to increase the relative risk of vessel strike for sea turtles. The implementation of NOAA guidelines (see Table G-1 in Appendix G) 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 area of direct effects is anticipated to be generally low with patchy distribution, and the proportional increase in vessel traffic also low, the number of sea turtles injured or killed by vessel strikes as a result of Project construction would be low and would not result in significant effects at the population level. Therefore, potential effects of vessel strikes on sea turtles from vessels supporting the Project conceptual decommissioning would be minor.

Port utilization: Maintenance dredging of the O&M facility poses a theoretical risk to sea turtles from entrainment and impingement. As discussed for Project construction, the likelihood of sea turtle exposure to maintenance dredging is negligible based on monitoring data from other federal dredging projects in the region and anticipated permitting restrictions (USACE 2019). Moreover, the O&M facility location is periodically dredged to maintain access and navigation so ongoing maintenance dredging would not appreciably change existing conditions in the affected environment. Therefore, the effects of O&M facility maintenance dredging on sea turtles would be negligible.

Seabed disturbance and alteration: The WTG foundations and associated scour protection in the form of boulders and concrete mats would displace or alter approximately 278 acres of seabed over the life of the Project. The WTG foundations and associated scour protection would displace 14.6 acres of seabed and would require an additional 7.5 acres of cable protection. Approximately 12.5 acres of scour protection would be required where boulder substrates prevent burial of the inter-array cable. An estimated 15.4 acres of scour protection would be required for portions of the offshore SFEC where cable burial is not possible. This would only occur in areas where boulders or other hard substrates are present on or immediately below the bed surface. Approximately 255 acres of boulder relocation may occur to prepare the seabed for the cable. Maintenance dredging at the Montauk O&M facility would disturb 0.86 acres in Lake Montauk.

Three benthic habitat types were documented in the area of direct effects (Fugro 2019a, 2019b; Guida et al. 2017; Inspire Environmental 2019; MARCO 2019). These habitats support benthic fauna that provide potential prey items for sea turtles. Refer to Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) for a detailed discussion on benthic habitat.

The WTG and OSS foundations, exposed portions of offshore SFEC, 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 other species that are typically attracted to hard-bottom habitat (Causon and Gill 2018; Langhamer 2012). Refer to Section 3.4.2 (Benthic Habitat, Essential Fish Habitat, Invertebrates, and Finfish) for a detailed discussion of potential reef effects on food web dynamics. Over time, this reef effect would increase the amount of forage and shelter available for sea turtles, but this effect would be limited to low use areas within the SFWF. Overall, in the context of the OCS and Montauk O&M facility, the seabed and water column biotic community alterations would have a negligible effect on sea turtles.

Water column alteration: The WTG foundations constitute potential obstacles in the water column for the life of the Project until conceptual decommissioning. These obstacles could alter the normal behavior of aquatic organisms in the area of direct effects. No data were found to suggest whether the presence of WTG foundations would affect turtle behavior. Given that sea turtles are highly mobile and the structures are only 36 feet in diameter and would be separated by approximately 1 mile, the structural alterations of the water column are unlikely to pose a barrier to foraging, migration, or other behaviors. Therefore, the presence of the SFWF would have a negligible impact on sea turtle movement. The WTG foundations and associated scour protection would produce an artificial reef effect that could alter the foraging behavior of turtles that encounter the structures. The significance of the reef effect is expected to be negligible or minor given the limited area affected and the broad geographic range of sea turtle species during their annual foraging migrations.

Intermittent Non-Impulsive Noise: Operational WTGs are capable of producing underwater sound levels of 90 to 115 dB at a distance of 351 feet in moderate winds and frequencies of 20 to 1,200 Hz, with peak levels at 50 Hz, 160 Hz, and 200 Hz (Thomsen et al. 2006). The literature on operational noise has focused primarily on older WTG models. Newer generation WTGs use direct drive motors that produce less noise and vibration, suggesting that these values likely overestimate actual noise levels expected to result from the Project. The Project would generate operational noise throughout the life of the facility. 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.

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, intermittent 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 be cause injury to sea turtles but could alter the behavior of individuals close to the structure. Localized behavioral effects would be negligible.

Project decommissioning would require the use of construction vessels of similar number and class as used during construction. Underwater noise and disturbance levels generated during conceptual 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 effects of Project decommissioning on sea turtles would therefore range from negligible to minor.

EMF and heat: The Project would length of the inter-array cables and offshore SFEC for the life of the Project until conceptual decommissioning. These effects would be most intense at locations where the SFEC cannot be buried and is laid on the bed surface covered by a stone or concrete armoring blanket. Approximately 2.97 miles of the SFEC cable and 2.1 miles of the inter-array cable could be unburied and would require surface armoring. Exponent Engineering, P.C. (2018) modeled anticipated EMF levels generated by the SFEC and inter-array cable. It estimated induced magnetic field levels ranging from 13.7 to 76.6 mG on the bed surface above the buried and exposed SFEC cable and 9.1 to 65.3 mG above the inter-array cable. Induced field strength would decrease effectively to 0 mG within 25 feet of each cable. By comparison, the earth's natural magnetic field in the area of direct effects is more than five times the maximum potential EMF effect from the Project (see Figure F-7 in Appendix F).

BOEM has conducted literature reviews and analyses of potential EMF effects from offshore renewable energy projects conducted (CSA Ocean Sciences Inc. 2019; Inspire Environmental 2019; Normandeau et al. 2011). These and other available reviews and studies (Gill et al. 2005; Kilfoyle et al. 2018) suggest that most marine species cannot sense very low-intensity electric or magnetic fields at the typical AC power transmission frequencies associated with offshore renewable energy projects. Normandeau et al. (2011) indicate that sea turtles are magnetosensitive and orient to the Earth’s magnetic field for navigation, but they are unlikely to detect magnetic fields below 50 mG. The majority of the SFEC and inter-array cable would be buried 6 feet below the bed surface, reducing the magnetic field in the water column below levels detectable to turtles. The transmission cables could produce magnetic field effects above the 50-mG threshold at selected locations where full burial is not possible; these areas would be localized and limited in extent. Magnetic field strength at these locations would decrease rapidly with distance from the cable and drop to 0 mG within 25 feet. This indicates that turtles would only be able to detect induced magnetic fields within 25 feet of cable segments lying on the bed surface. These cable segments would be relatively short (less than 100 feet) and widely dispersed. Exponent Engineering, P.C. (2018) concluded that the shielding provided by burial and the grounded metallic sheaths around the cables would effectively eliminate any induced electrical field effects. Given the lack of sensitive life stages present in the SFWF and/or offshore SFEC, the limited extent of measurable magnetic field levels, and limited potential for mobile species like sea turtles to encounter field levels above detectable thresholds, the effects of Project-related EMF exposure on sea turtles would be negligible.

Heat from the buried SFEC and inter-array cables could affect some benthic organisms that represent forage for turtles, but little is known about the potential change to substrate temperatures that transmission cables might have on the benthos (Taormina et al. 2018). Benthic effects would not impact leatherback turtles as benthic prey are not typically included in their diet. Effects to algal cover (green sea turtle forage) and crustaceans, gastropods, crabs, and bivalves (loggerhead sea turtle forage) could conceivably affect sea turtle foraging opportunities, but because cables would be buried to a depth of 6 feet and/or covered with concrete protection, changes in temperature of the substrate at the surface of the seabed is not anticipated to increase markedly. Since the effects of habitat alteration from cable installation were already considered in Section 3.4.2.2.3 (Proposed Action Alternative), it is expected that any recolonization would laterally or vertically avoid any temperatures that invertebrate species may be sensitive to. Since the cable would be buried at an average of 6 feet in most locations, the potential effects of cable heat to the availability of turtle forage would be negligible.

<u>Artificial lighting</u>: The SFWF would include a variety of operational lighting, including navigational lighting for mariners, obstruction lighting for aviators, and vessel/work lighting for maintenance and operations (Orr et al. 2013). This review indicates that lights on wind generators flash intermittently for navigation or safety purposes and do not present a continuous light source. Limpus (2006) suggests that intermittent flashing lights with a very short on pulse and long off interval are non-disruptive to marine turtle behavior, irrespective of the color. Limpus (2006) also indicates that navigation/anchor lights on top of vessel masts are unlikely to adversely affect sea turtles, but that bright deck lights should be shielded if possible to reduce impacts to sea turtles.

Sea turtles’ typical behavior of remaining predominantly submerged would limit the exposure of individuals to operational lighting. Operational lighting would be limited to the minimum required by regulation and for safety (see Table G-1 in Appendix G), minimizing the potential for exposure. Based on the available information, it is expected that the impact of operation lighting on sea turtles would be negligible.

<u>Spills</u>: The SFWF would undergo maintenance as needed, which would necessitate vessels and other equipment at the facility for the life of the Project during operation. This presents an opportunity for accidental discharge or spills of fuels and/or fluids during maintenance activities. Spill response EPMs

(see Table G-1 in Appendix G) 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 construction. Impacts on sea turtles from accidental spills or releases of pollutants are considered minor because of the low probability of the risk and EPMs (refer to Section 3.3.2 [Water Quality] for additional detail).

Cumulative Impacts

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 2% incremental increase in total chemical usage in the geographic analysis area relative to the No Action alternative. When combined with other offshore wind projects, up to approximately 850,000 gallons of coolants and 10.5 million gallons of oils and lubricants that could cumulatively be stored within WTG foundations and the OSS within the geographic analysis area (see Section 3.4.6.2.2 [No Action Alternative] for quantities and details). 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 3.4.6.2.2 (No Action Alternative), 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.

New cable emplacement/maintenance: Cable installation associated with the Proposed Action would result in localized, temporary, negligible incremental impacts to sea turtles through an estimated 913 acres of temporary seabed disturbance and associated increased suspended sedimentation within the geographic analysis area. BOEM estimates a cumulative total of 8,864 acres of seabed disturbance for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. While increases in foraging effort or displacement due to turbidity may occur to individual sea turtles, these temporary effects are not anticipated to lead to population-level effects on sea turtle populations. Therefore, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in negligible impacts to sea turtles.

EMF: The Proposed Action would result in negligible incremental impacts to sea turtles from EMF exposure via the addition of 82.5 to 86.9 miles of cable (1%) to conditions under the No Action alternative. Submarine power cables would be installed with appropriate shielding and burial depth to reduce potential EMF at the substrate surface. The SFEC and inter-array cable would maintain a minimum separation of at least 330 feet from other known cables to avoid inadvertent damage during installation. This separation distance ensures that there are no additive EMF effects from adjacent cables. Additionally, exposure to detectable levels of EMF would be limited to the small number of areas where cable segments cannot be buried to the regular depth. This represents an extremely small percentage of the geographic analysis area for sea turtles and is unlikely to lead to biologically significant effects on sea turtle movement, migration, or foraging patterns.

BOEM estimates a cumulative total of 5,866 miles of cable for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. 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 represent a long-term negligible impact on sea turtles.

Light: The Proposed Action would result in negligible incremental impacts to sea turtles through the installation of 16 lighted structures (15 WTGs and one OSS). This represents less than a 1% increase to conditions under the No Action alternative. BOEM estimates a cumulative total of 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. Nighttime lighting associated with offshore structures and vessels could represent a source of attraction, avoidance, or other behavioral responses in sea turtles. However, BOEM assumes that all offshore wind projects would be sited offshore, away from nesting beaches and would not disorient nesting females or hatchling sea turtles.

For the same reasons, the Proposed Action when combined with past, present, and reasonably foreseeable activities would also represent a negligible impact on sea turtles.

Noise: The Proposed Action would result in localized, temporary, negligible to minor incremental impacts to sea turtles through the generation of impulsive and intermittent non-impulsive underwater noise associated with offshore wind construction activities. Sea turtles are anticipated to occur at generally low densities (see Section 3.4.6.1 [Affected Environment]) near wind farms in the region, reducing the probability of individual exposure to noise effects. These noise sources could incrementally 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. However, that effect mechanism would cease once pile driving stops and the behavior of sea turtles would be anticipated to return to normal over time (NOAA 2020). Although permanent hearing impairment could occur to some individuals, science has not determined whether hearing ability is critical to sea turtles completing essential life history requirements. 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. Short, low-level stress responses could be adaptive and beneficial should it result in sea turtles exhibiting avoidance behavior, thereby minimizing their exposure duration and risk from more adverse sound levels.

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 increase to injurious levels. Additionally, the implementation of monitoring zones and clearance zones associated with wind farm construction projects would further reduce the likelihood of injury from the potential moderate cumulative impacts associated with pile driving. With regard to intermittent 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 may cause some short-term 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 moderate impacts to sea turtles, depending upon the noise source.

Port utilization: Although dredging or in-water work for the Port of Montauk could be required for the Proposed Action, these actions would occur within heavily modified habitats. BOEM expect impacts to sea turtles due to the incremental increase in port expansion resulting from the Proposed Action to be negligible. 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 represent a minor impact to sea turtles.

Presence of structures: The Proposed Action would result in long-term negligible and minor beneficial incremental impacts to sea turtles through the installation of 16 structures (15 WTGs and one OSS) 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 3.4.6.2.2 (No Action Alternative), structures associated with offshore wind farms are expected to provide some level of reef effect and may 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 fishing gear could occur, particularly during construction phases, when elevated underwater noise levels occur. These intermittent impacts would persist until conceptual 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 2,066 offshore WTGs and OSS foundations for the Proposed Action plus all other future offshore wind projects in the geographic analysis area. For similar reasons as described above, the Proposed Action when combined with past, present, and reasonably foreseeable projects would result in negligible to minor impacts and potential minor beneficial impacts to sea turtles.

Traffic: The Proposed Action would result in minor impacts to sea turtles through the addition of construction and maintenance vessels within the geographic analysis area. 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 G-1 in Appendix G) to minimize vessel strikes.

BOEM estimates a peak of 207 construction vessels due to offshore wind project construction over a 10-year time frame, of which 13 would result from the Proposed Action alone. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be moderate; however, BOEM does not expect the viability of sea turtle populations to be affected.

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. This difference may not be measurable but would be expected to help reduce climate change impacts, resulting in negligible to moderate incremental impacts. When combined with other past, present, and reasonably foreseeable actions, the Proposed Action would result in moderate impacts.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **minor**. Therefore, BOEM expects the overall impact on air sea turtles from the Proposed Action alone to be **minor**, as the overall effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate** and **minor 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 **moderate** impacts and **minor beneficial** impacts to sea turtles. BOEM made this decision because the overall effect would be notable and resource impacts would be expected to recover completely.

3.4.6.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, the Transit alternative would result in a smaller area of seabed and water column disturbance and include a shorter duration of associated water quality degradation due to fewer WTGs constructed. Fewer structures in the water could also reduce the reef effect, indirectly reducing recreational fishing and the subsequent risk to sea turtles from entanglement. Fewer vessels and/or vessel trips would be expected, which would reduce the risk of discharges, fuel spills, and trash in the area and decrease the risk of collision with sea turtles. The duration of noise associated with pile driving would decrease. However, the sound levels resulting from construction activities would remain unchanged: sea turtle injury and behavioral-level effects thresholds described in the Proposed Action would similarly apply to this alternative.

Operational impacts of the Transit alternative on sea turtles would be minimally decreased compared to the Proposed Action due to the fewer number of WTGs and subsequent smaller area of impact. Less habitat would be altered and impacted by WTG operational noise, artificial lighting, and EMF from the inter-array cable. However, within the vicinity of the SFWF, effects would not be measurably different than the Proposed Action. Annual maintenance dredging and resulting water quality impacts at the O&M facility would not be measurably different than the Proposed Action.

Based on the above findings, the Transit alternative would be expected to have negligible to minor, temporary, and long-term adverse impacts to sea turtles as the Proposed Action.

Cumulative Impacts

If the Transit alternative is implemented, proposed WTGs could need to be eliminated within offshore wind lease areas to accommodate the proposed transit lanes. If the Transit alternative reduced the number of WTGs, associated risks to sea turtles, particularly related to pile-driving noise, would subsequently decrease. However, noise associated with additional vessel traffic and the risk of vessel collision or disturbance would be elevated due to increased use of the transit lane. Therefore, BOEM expects that reductions in WTGs and establishing transit lanes in their place would result still result in negligible to moderate adverse and minor beneficial cumulative impacts to sea turtles, when combined with past, present, and reasonably foreseeable activities.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

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

3.4.6.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. However, the total number of monopiles and associated scour protection may be reduced, and additional micrositing would be used to preferentially avoid gravel, cobble, or boulder substrates that provide complex fisheries habitat. The duration of noise-producing pile driving during construction would be shorter due to the reduced number of monopiles, but the extent of noise and the overall impact to sea turtles from construction of the SFWF would be the same as the Proposed Action. Therefore, the Habitat alternative would result in negligible to minor adverse impacts to sea turtles.

Cumulative Impacts

The Habitat alternative is similar to the Proposed Action except that it may have a slightly smaller construction and operational footprint and duration of construction impacts. Therefore, the overall cumulative impacts of this alternative to sea turtles when combined with past, present, and reasonably foreseeable activities are anticipated to be negligible to moderate and minor beneficial.

Conclusions

Although the Habitat alternative could reduce the number of WTGs and the associated length of inter-array cables, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

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

3.4.6.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, BOEM expects that sea turtle impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate** and **minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate** and **moderate beneficial.**

3.4.6.4 Mitigation

Time of day visibility, exclusion zones, weather restrictions, daily pre-construction surveys, and vessel strike avoidance measures would further reduce the expected negligible to minor impacts to sea turtles by allowing observers to visually establish required exclusion zones and identify/avoid impacts to any individuals that could be affected by Project actions or vessel interactions. Crew training and educational awareness would also reduce impacts by increasing the effectiveness of mitigation and monitoring measures. Pile -driving sound source verification, data collection and reporting efforts, and monitoring plans would not reduce pile-driving or other Project-related impacts, but would ensure that the deployed noise reduction technologies and other employed mitigations are effective. Likewise, injury reporting would ensure that the amount of take that potentially occurs does not exceed the exempted take under the ESA and MMPA. Additionally, the data gathered could be used to evaluate impacts and potentially lead to additional mitigation measures, if required (30 CFR § 585.633(b)). See Table G-2 in Appendix G for details.

3.4.7 Wetlands and Other Waters of the United States

3.4.7.1 Affected Environment

The onshore portions of the Project are located within the Shinnecock Bay-Atlantic Ocean watershed (HUC-0203020206), Shelter Island Sound-Gardiners Bay watershed (HUC-0203020207), and Long Island-Atlantic Ocean watershed (HUC-0203020209), which are part of the Southern Long Island Subbasin (HUC-02030202). Three subwatersheds overlap the Project: Moriches Bay-Atlantic Ocean (HUC-020302020902), Acabonack Harbor-Gardiners Bay (HUC-020302020704), and Georgica Pond-Frontal Atlantic Ocean (HUC-020302020606) (USGS 2019). A variety of freshwater and tidal wetlands were observed during the field surveys for the Project, including marine subtidal waters, intertidal beaches, intertidal marshes, mudflats, tidal creeks, and vegetated high marshes, as well as freshwater wetlands such as ponds, deepwater and emergent marshes, forested swamps, shrub swamps, bogs, wet meadows and various groundwater-influenced depressional features, including vegetated ditches and swales (VHB 2018). In all, 93 wetlands (83 freshwater wetlands and 10 tidal wetlands) were delineated during field surveys (VHB 2018:Section 3.0 [Table 2]). Table 3.4.7-1 provides a quantitative summary of delineated wetlands by Project component (VHB 2018:Section 3.0 [Table 3]).

The onshore O&M facility is 100 feet east of the inlet that connects Lake Montauk to Block Island Sound and the Atlantic Ocean. Based on a desktop review, no jurisdictional wetlands or other water resources are within the upland portion of the proposed facility site. The portion of Lake Montauk within the proposed O&M facility is a federal water under jurisdiction of USACE and a state tidal wetland (SM code: coastal shoal, bar, or mudflat) under jurisdiction of the NYSDEC (Stantec 2020).

Table 3.4.7-1. Delineated Wetlands by Project Component

Project Component	Freshwater Wetlands		Tidal Wetlands	
	Wetlands Within Project Component (number/acres)	Wetland Adjacent Areas Within Project Component (number/acres)*	Wetlands Within Project Component (number/acres)	Wetland Adjacent Areas Within Project Component (number/acres)*
Beach Lane landing site	0/0	0/0	0/0[c]	0/0[c]
Beach Lane cable route†	0/0	0/0	0/0	0/0
Hither Hills Landing site	0/0	0/0	0/0	0/0
Hither Hills cable route†	22/2.02	7/13.21	0/0	5/4.73
Interconnection facility	0/0	0/0	0/0	0/0

* The NYSDEC-regulated adjacent areas for freshwater wetlands and tidal wetlands are 100 feet and 300 feet, respectively.

† The area surveyed during wetland delineations is greater than the actual Project footprint, therefore the number/area of delineated wetlands within the construction footprint for each cable route would be less than those shown in this table.

Source: VHB (2018).

3.4.7.2 Environmental Consequences

3.4.7.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.4.7-2 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS.

Table 3.4.7-2. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Wetlands and other Waters of the United States

<table>
<tr><th>Issue</th><th>Impact Indicator</th><th>Significance Criteria</th></tr>
<tr><td>Land disturbance/loss of wetlands</td><td>Acres of wetlands impacted</td><td rowspan="3">Negligible: No measurable loss or modification of wetlands would occur; no measurable change in wetland quality or function would occur.
Minor: Most impacts to wetlands could be avoided with mitigation; if impacts occur, the wetland would recover completely.
Moderate: impacts to wetlands are unavoidable, but the overall wetland function would not be threatened.
Major: impacts to wetlands could be severe and long lasting.</td></tr>
<tr><td>Soil erosion and sedimentation</td><td>Qualitative assessment of potential Increased sedimentation into wetlands</td></tr>
<tr><td>Discharges/releases</td><td>Qualitative assessment of potential changes in water quality from HDD activity and spills</td></tr>
</table>

3.4.7.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing wetland and other wetlands and other waters of the United States (WOTUS) trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated wetland and other WOTUS impacts. Future non-Project actions include residential, commercial, and industrial developments, as described in Appendix E, as well as the FIMP Project, LIRR improvements, dredging and port improvement projects, and existing and proposed WTGs and communications towers. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated wetland and other WOTUS impacts. These impacts are also described below.

Future Activities (without the Proposed Action)

Future onshore projects could temporarily disturb wetlands or areas near wetlands. All projects would be required to comply with federal, state, and local regulations related to the protection of wetlands and other WOTUS, thereby avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated for projects that would allow wetlands to recover to the extent possible. BOEM is not aware of any future offshore wind activities other than the Proposed Action that would overlap the geographic analysis area. However, this DEIS assumes that any onshore impacts associated with these future projects would be similar to the Proposed Action. As a result, adverse impacts from future activities on wetlands and other WOTUS under the No Action alternative would be short term and minor.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on wetlands and other WOTUS associated with the Project would not occur. However, ongoing and future activities would have continuing short-term impacts on wetlands and other WOTUS, primarily due to land disturbance.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities and onshore activities would be negligible to **minor**. As described in Attachment 3 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable offshore activities other than offshore wind would be **minor**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts because the effect would be small and the resource would be expected to recover completely.

3.4.7.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

During construction of the onshore SFEC cable, there could be up to 2.02 acres of impacts to freshwater wetlands and wetland adjacent areas from dredging and/or filling if the Hither Hills route is selected (see Table 3.4.7-1). These impacts would be long term, localized, and minor. The Project would comply with the federal Clean Water Act of 1972, NYDEC, and local regulations to prevent degradation to wetlands (VHB 2018:Section 3.0). There would be no direct impacts to freshwater wetlands or wetland adjacent areas if the Beach Lane route is selected. No impacts to tidal wetlands would occur for Beach Lane; however, impacts of up to 4.73 acres of tidal wetland adjacent areas could occur if the Hither Hills route is selected. No wetlands were delineated within the proposed interconnection facility. Additionally, no impacts in the intertidal areas from construction at the landing sites are anticipated due to subsurface installation techniques proposed (i.e., HDD). The transition vault and HDD work area would be protected by erosion and sedimentation controls outlined in the Project SWPPP required for construction. The underground transition vault located at the selected onshore cable landing site would also be installed above mean high water, outside of wetlands and waterbodies, within paved roadway or a parking lot, and would have a manhole cover at the ground surface. Therefore, potential adverse impacts to wetland adjacent areas from construction activities would be long term, localized, and minor.

Temporary, localized decreases in water quality to tidal and freshwater wetlands from increased sedimentation during construction of the onshore SFEC route, the O&M facility, and interconnection facility could occur, but they are considered negligible. All earth disturbances from construction activities would be conducted in compliance with the New York State Pollutant Discharge Elimination System General Permit for Stormwater Discharges associated with Construction Activities and the approved SWPPP for the Project. The in-water work for construction of the Montauk O&M facility would be in compliance with NYSDEC permits for Excavation and Fill in Navigable Waters and Tidal Wetlands (dredging permits) and DWSF would be required to apply for a CWA Section 404 Individual Permit from USACE and a Section 401 Water Quality Certification (Stantec 2020). DWSF would comply with all requirements of any issued permits. Any non-routine spills or accidental releases 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.

Operations and Maintenance and Conceptual Decommissioning

The onshore underground transition vault, cable route, and interconnection facility have no maintenance needs unless a fault or failure occurs; therefore, O&M is not expected to impact wetlands or WOTUS. In the event of a fault or failure, impacts would be expected to be short term and negligible. Conceptual decommissioning of the onshore Project components would have similar impacts as construction; long term, localized, and minor.

Cumulative Impacts

Onshore construction and installation could incrementally add up to 2.02 acres of wetlands impacts to the No Action alternative, depending on the onshore cable route selected. Project developers would comply with all local, state, and federal wetland regulations and permit requirements. Therefore, the incremental impact for the Proposed Action would be short term to long term and negligible to minor. The cumulative impact of the Proposed Action when combined with past, present, and reasonably foreseeable projects to wetlands and WOTUS would be short term to long term and negligible to minor.

Conclusions

Project construction and installation and conceptual decommissioning would result in wetland dredging or fill if the Hither Hills route is selected. Sedimentation could also occur during construction of the onshore SFEC route, the O&M facility, and interconnection facility. No O&M impacts are anticipated. BOEM anticipates the impacts resulting from the Proposed Action alone would be short term to long term and **negligible to minor**. Therefore, BOEM expects the overall impact on wetlands or other WOTUS from the Proposed Action alone to be **minor** because the effect would be small and the resource would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would be **negligible** to **minor**. 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** impacts to wetlands or other WOTUS. BOEM made this call as the effect would be small and the resource would be expected to recover completely.

3.4.7.2.4 VESSEL TRANSIT LANE ALTERNATIVE

Changes in offshore transit routes under the Transit alternative would not increase or decrease proposed impacts to onshore or nearshore freshwater and tidal wetlands when compared to the Proposed Action. All onshore Project components and activities, including construction and installation, O&M, and conceptual decommissioning, would be the same as the Proposed Action. Therefore, the impact of this alternative would be the same as the Proposed Action: short term to long term and negligible to minor.

Cumulative Impacts

For the same reasons described above, the cumulative impacts of this alternative when combined with other past, present, and reasonably foreseeable activities would be the same as the Proposed Action: short-term and negligible to minor.

Conclusions

Since reductions to the number of WTGs and their associated inter-array cables considered under this alternative would not impact wetlands and other WOTUS, BOEM expects that the impacts resulting from the alternative alone would be the same as the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Transit alternative’s incremental impacts would be similar to the Proposed Action (with individual IPFs leading to minor impacts). The overall impacts of the Transit alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor**.

3.4.7.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

Changes in offshore transit routes under the Habitat alternative would not increase or decrease proposed impacts to onshore or nearshore freshwater and tidal wetlands when compared to the Proposed Action. All onshore Project components and activities, including construction and installation, O&M, and conceptual decommissioning, would be the same as the Proposed Action. Therefore, the impacts of this alternative would be the same as the Proposed Action: short to long term and negligible to minor.

Cumulative Impacts

For the same reasons described above, the cumulative impacts of this alternative when combined with other past, present, and reasonably foreseeable activities would be the same as the Proposed Action: short to long term and negligible to minor.

Conclusions

Since reductions to the number of WTGs and their associated inter-array cables considered under this alternative would not impact wetlands and other WOTUS, BOEM expects that the impacts resulting from the alternative alone would be similar to the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Habitat alternative’s incremental impacts would be similar to the Proposed Action (with individual IPFs leading to **minor** impacts). The overall impacts of the Habitat alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor**.

3.4.7.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change across evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, these alterations would not impact wetlands and other WOTUS. Therefore, BOEM expects that terrestrial and coastal fauna and habitats impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives’ incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts as **negligible** to **minor**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor.**

3.4.7.4 Mitigation

If impacts to wetlands and WOTUS occur, the Project would be subject to mitigation measures imposed by the USACE in compliance with the CWA. Currently, no potential additional mitigation measures for wetlands and WOTUS are identified in Appendix G.

3.5 SOCIOECONOMIC AND CULTURAL RESOURCES

3.5.1 Commercial Fisheries and For-Hire Recreational Fishing (*see section in main DEIS*)

3.5.2 Cultural Resources (*see section in main DEIS*)

3.5.3 Demographics, Employment, and Economics (*see section in main DEIS*)

3.5.4 Environmental Justice (*see section in main DEIS*)

3.5.5 Land Use and Coastal Infrastructure (*see section in main DEIS*)

3.5.6 Navigation and Vessel Traffic

3.5.6.1 Affected Environment

This section discusses navigation and vessel traffic characteristics and potential impacts on the waterways and water approaches adjacent to the Lease Area. It primarily draws upon the navigational safety risk assessment (DNV-GL 2018) prepared to comply with the guidelines in USCG *Navigation and Vessel Inspection Circular (NVIC) 02-07* (USCG 2007), which has since been canceled and replaced with *NVIC 01-19* (USCG 2019). This section groups vessel types into deep draft vessels (cargo and tanker vessels) and tug and towing vessels that would generally avoid the Lease Area, and vessels that travel within and through the Lease Area (commercial fishing, passenger, and other vessels).

The navigational safety risk assessment analyzed all vessels with AIS data,[2] using data with a timestamp of 12:00 a.m. July 18, 2016, through 1:00 p.m. July 18, 2017 (DNV-GL 2018). It used a 5-mile radius around the Project to determine the vessel types transiting in the area during this time period and evaluation incidents; AIS data suggest that only fishing, other and unidentified, and pleasure vessels currently transit within the SFWF. No military vessels operated in the Lease Area during this period. Most vessels sail between 8 and 12 knots.

USCG's (2020) *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study* (MARIPARS) analyzed AIS data in the eight BOEM OCS lease areas in the Rhode Island and Massachusetts region (study area).[3] (USCG 2020:Figure 3). The MARIPARS study found 13,000 to 46,900 annual vessel transits through the study area. Activity during the summer months was quadruple that of January and February. The study concluded that vessel activity in the study area was largely commercial fishing. Fishing vessels primarily originated from several ports in Rhode Island, Massachusetts, or New York and transited the study area to reach fishing ground and other areas southeast of the study area. Recreational vessels were more expected to transit within the turbine arrays and less expected to use USCG designated routes. Passenger vessels largely did not transit the study area.

[2] AIS data cover those vessels that are required to carry a transponder—or that choose to carry one—according to AIS requirements at 33 CFR 164.01, 164.02, 164.46, and 164.53. Most smaller vessels are not covered in the data. AIS data underestimate the scale of commercial fishing vessel activities, as transponders are only required for vessels over 65 feet and can be turned off after 12 nm.

[3] The MARIPARS includes the following BOEM lease areas: OCS-A 486 (now subdivided as OSC-A 0517 and OCS-A 0486), OCS-A 0487, OCS-A 0500, OCS-A 0501, OCS-A 0520, OCS-A 0521, and OCS-A 0522.

Deep draft and towing vessels transited the study area, mostly on the west side, and tug and towing vessels had a low frequency of transit in the study area. MARIPARS did not evaluate other and unidentified vessels, though many appeared to be misclassified fishing vessels.

AIS data for 2018 (Office for Coastal Management [OCM] 2019) were further analyzed to measure the time and distance that vessels spent within the Lease Area. In 2018, vessels traveled 5,521 miles and spent 25,880 hours within the Lease Area and nearby lease areas. The majority of miles and time are attributed to vessels that could not be identified. Fishing vessels accounted for 23% of all vessel miles traveled and 23% of hours spent in the area. Pleasure craft accounted for 13% of miles and 20% of time (Table 3.5.6-1). Table 3.5.6-2 summarizes activity in bays in the geographic analysis area, as measured by miles traveled. Passenger vessels and pleasure craft account for the majority of activity in Buzzards Bay, Massachusetts Bay, and New York Harbor, while deep draft vessels account for most of the activity in Chesapeake Bay and Delaware Bay.

Table 3.5.6-1. Existing Vessel Traffic in Lease Area Groups, 2018 (AIS data)

Vessel Type	SFWF	Block Island	Other RI/MA and MA WEAs
Time Vessels Spent inside Lease Area Groups (hours)			
Cargo	2,023	0	34,306
Fishing	5,961	334	239,112
Not available	6,519	8	36,506
Other	4,696	42,031	129,080
Passenger	479	534	7,272
Pleasure craft/Sailing	5,281	1,957	58,639
Tanker	901	0	17,279
Tug/Tow	20	0	6,749
Total	**25,880**	**44,863**	**528,943**
Distance Vessels Traveled inside Lease Area (miles)			
Cargo	132	0	4,956
Fishing	1,259	21	68,373
Not available	2,654	1	3,786
Other	260	790	22,095
Passenger	422	118	3,152
Pleasure craft/Sailing	722	26	11,230
Tanker	71	0	3,139
Tug/Tow	1	0	468
Total	**5,521**	**956**	**117,199**

Source: OCM (2019).

Table 3.5.6-2. Existing Vessel Traffic in Bays, 2018

Vessel Type	Distance Vessels Traveled inside Bays (thousands of miles and percentage of totals)									
	Buzzards Bay		Chesapeake Bay		Delaware Bay		Massachusetts Bay		New York Harbor	
Cargo	31,582	(2%)	663,095	(16%)	276,308	(18%)	26,153	(2%)	125,120	(3%)
Fishing	302,085	(17%)	111,658	(3%)	15,360	(1%)	72,835	(6%)	5,223	(0%)
Not available	81,330	(5%)	232,338	(6%)	81,930	(5%)	150,056	(12%)	296,171	(7%)
Other	79,626	(4%)	339,487	(8%)	88,305	(6%)	86,837	(7%)	143,048	(3%)
Passenger	392,097	(22%)	388,190	(10%)	191,493	(12%)	456,082	(35%)	2,198,312	(52%)
Pleasure craft/Sailing	576,292	(32%)	1,078,695	(27%)	99,874	(6%)	223,474	(17%)	151,634	(4%)
Tanker	18,695	(1%)	47,466	(1%)	136,507	(9%)	21,639	(2%)	62,033	(1%)
Tug/Tow	302,406	(17%)	1,188,461	(29%)	667,005	(43%)	247,764	(19%)	1,226,713	(29%)
Total	**1,784,112**		**4,049,389**		**1,556,782**		**1,284,840**		**4,208,253**	

Source: Developed using OCM (2019).

Figure C-29 shows close-up views of the Project with vessel traffic (based on AIS data). Tankers cargo vessels, and tug and towing vessels generally travel in the internationally designated Traffic Separation Schemes to the north and west of the Lease Area. These vessels can approach or exit the Narragansett Bay Traffic Separation Scheme in a northwest–southeast orientation leading some to transit through the Lease Area. East of and at the approximate latitude of Old Harbor, cargo vessels diverge from the north–south traffic lanes, and some transit through the Lease Area. Passenger vessels, typically ferries or cruise ships, generally avoid the Lease Area and would often follow a similar route. The Lease Area is located outside of the designated lanes used by most commercial vessel traffic. Fishing vessels operate all over the region, sometimes fishing and often transiting, with their vessel movements recorded through AIS, VMS, or not at all (see Section 3.5.1.1 [Affected Environment] in Section 3.5.1 Commercial Fisheries and For-Hire Recreational Fishing). Relative to the larger geographic area, there is less vessel traffic near the Lease Area.

The Navigational Safety Risk Assessment analyzed vessel incident data and found a total of 0.053 collision per year and no allisions (DNV-GL 2018). Note that the assessment encompassed a much larger area (DNV-GL 2018:xii). Unidentified vessels, for which vessel type information was not available but which are expected to be fishing vessels, experienced the most frequent rate of incidents and accounted for nearly all of the collisions, at 0.050 per year. All other vessel types had frequencies of 0.002 collision or fewer per year (DNV-GL 2018).[4]

3.5.6.2 Environmental Consequences

3.5.6.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.6-3 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS. Construction and conceptual decommissioning activities would have short-term impacts of 1 to 2 years, and long-term impacts during operations would last for the duration of the Project (25 years, plus up to an additional 2 years for conceptual decommissioning) until conceptual decommissioning.

[4] The USCG is beginning a new study of routes used by ships to access ports on the Atlantic Coast, Atlantic Coast Port Access Route Study: Port Approaches and International Entry and Departure Transit Areas (USCG 2019).

Table 3.5.6-3. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Navigation and Vessel Traffic

Issue	Impact Indicator	Significance Criteria
Vessel or structural damage due to incident	Increased frequency of strikes/allisions, collisions, and groundings	Negligible: No measurable impacts would occur. Minor: Impacts to vessels and turbines could be avoided with EPMs. Impacts would not disrupt the normal or routine functions or navigation of the vessel or turbine. Moderate: Impacts are unavoidable, although EPMs would reduce impacts substantially during the life of the Project. The vessel would have to adjust somewhat to account for disruptions due to impacts of the Project Major. Vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable.
Vessel traffic	Increased vessel traffic or congestion	
Navigation	Changes to navigational patterns and increased risk of navigational hazards	

3.5.6.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing navigation and vessel traffic trends from past and present activities. Table 3.13-1 in Appendix E, Attachment 3 provides additional information regarding past and present activities and associated navigation and vessel traffic impacts. Future non-Project actions include offshore wind development activities, tidal energy projects, dredging and port improvement projects, [see Appendix E]) and future marine transportation and fisheries use. Attachment 3 in Appendix E discloses future non-offshore wind activities and associated navigation and vessel traffic impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Traffic: 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), if construction of the Project does not occur, vessel activity could peak in 2025 with as many as 207 vessels involved in the construction of reasonably foreseeable projects (Table 3.5.6-4).

Table 3.5.6-4. Cumulative Construction and Operations Vessels from Future Activities

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Average construction vessels	0	20	79	98	59	113	102	28	19	0	0
Maximum construction vessels	0	37	145	180	109	207	188	51	34	0	0
Average operation vessels	1	1	1	3	10	14	17	28	29	31	31
Maximum operation vessels	0	20	79	98	59	113	102	28	19	0	0
Average daily vessels, total	0	20	79	100	65	123	113	47	38	21	21
Maximum daily vessels, total	1	38	146	183	119	221	205	79	63	31	31

Sources: Developed using OCM (2019).

Construction activities would result in increased vessel traffic near the lease areas and ports used as well as obstructions to navigation and changes to navigation patterns. Additional impacts would include delays within or approaching ports; increased navigational complexity; detours to offshore travel or port approaches; or increased risk of incidents such as collision, strikes or allisions, and groundings. Other reasonably foreseeable future offshore projects would produce additional vessel traffic during construction, but because of their timing, they are not anticipated to use the same traffic routes. Construction of other offshore wind projects would be scheduled to minimize overlapping construction periods and reduce the number of construction vessels in operation at any given time, effectively reducing the cumulative impact on port congestion and construction vessel rerouting. As a whole, this level of traffic activity would represent a minor to moderate adverse cumulative impact to navigation under the No Action alternative because the construction would be located outside of major shipping lanes and the number of vessels would be small compared to the overall level of traffic near each of the potential developments.

Cumulative impacts during O&M of reasonably foreseeable offshore wind projects (see Table 3.5.6-4) would also represent a negligible to minor adverse impact to navigation due to the smaller number of vessels and lower frequency of activities (growing to an average of 31 vessel trips per day by 2030). Conceptual decommissioning of each of the projects is anticipated to have cumulative impacts similar to those experienced during construction. All reasonably foreseeable offshore wind projects would be required to prepare a navigational safety risk assessment in compliance with the guidelines in USCG *NVIC 01-19* (USCG 2019), which would minimize impacts to marine navigation.

New cable emplacement/maintenance: Under the No Action alternative, up to 2,623 miles of cable could be installed in the RI/MA WEA to support future offshore wind projects. Offshore cable emplacement would have temporary, localized adverse impacts on boating because vessels would need to navigate around work areas, and some boaters would prefer to avoid the noise and disruption caused by installation.

Presence of structures: The placement of 959 WTGs and OSS in the RI/MA WEA would have long-term adverse impacts on vessels through the risk of allision, navigation hazards, space use conflicts, the presence of cable infrastructure, and visual impacts. While lease areas are generally located in low vessel traffic areas, they do receive some use. Table 3.5.6-2 summarizes the time spent and miles traveled by vessels within the SFWF and other lease areas in 2018.

The presence of offshore wind structures would increase the geographic analysis area's navigational complexity, thereby increasing the risk of allision or collision. Deep draft and tug and towing vessels would need to minimally divert to avoid traveling near structures. Vessels that generally travel within and through lease areas could require adjustment of navigation practices. The attraction of the artificial reef effects would incrementally increase vessel congestion and the risk of allision, collision, and spills near WTGs. BOEM assumes that all offshore wind developments in the geographic analysis area would use 1 × 1–nm spacing in fixed east–west rows and north–south columns. Because this layout supports the traditional east–west active fishing operations, this arrangement would reduce, but not eliminate, navigational complexity and space-use conflicts during the operation phases of the projects.

Port utilization: Construction and operation of improvements at various ports in support of reasonably foreseeable offshore wind projects could coincide with forecasted port improvements listed in Appendix E, some of which are intended to directly support offshore wind energy development. Port improvements could increase vessel congestion and stress port capacity during construction. However, state and local agencies would be responsible for minimizing the potential adverse impacts of additional port utilization by managing traffic to ensure continued access to ports.

Anchoring: In total, BOEM estimates approximately 112 acres of seabed would be disturbed by anchoring associated with offshore wind activities in the RI/MA WEA. Future offshore wind developers are expected to coordinate with the maritime community and the USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas, meaning that any risk for deep-draft vessels would come from anchoring in an emergency scenario, specifically in or near the Buzzards Bay and Narragansett Bay traffic separation schemes. Generally, larger vessels accidently dropping anchor on top of an export cable (buried or mattress protected) to prevent drifting in the event of vessel power failure would result in damage to the export cable, risks to the vessel associated with an anchor contacting an electrified cable, and impacts to the vessel operator's liability and insurance. Impacts on navigation and vessel traffic would be temporary and localized, and navigation and vessel traffic would fully recover following the disturbance.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and potential impacts on navigation associated with the Project would not occur. However, ongoing and future activities would have continuing temporary to long-term impacts on navigation, primarily through existing traffic activity, port use, and the presence of structures.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **minor** to **moderate**. As described in Attachment 3 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would also be **minor** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **moderate** adverse impacts because the overall effect would be notable but vessels would be able to adjust to account for disruptions and EPMs would reduce impacts.

3.5.6.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Project construction could impact navigation and vessel traffic. Project effects on navigation and vessel traffic would include increased vessel traffic near the SFWF, offshore SFEC, and ports used by the Project; obstructions to navigation; delays within or approaching ports; increased navigational complexity; changes to navigation patterns; detours to offshore travel or port approaches; or increased risk of incidents such as collision, strikes or allisions, and groundings.

Monopile turbine construction would require approximately 5,000–10,000 vessel work days[5] over 1 to 2 years, and offshore SFEC construction would require approximately 4,000–4,500 vessel work days[6] over 1 year (Jacobs 2020). The Navigational Safety Risk Assessment indicates the highest risk would be from smaller, non-Project vessels operating close to construction and work vessels. Because of the small number of vessels used for construction and the location of the Project outside of shipping lanes (as shown in Figure C-29), there would be a negligible to minor adverse impact on deep draft and tug and towing vessels, which would need to reroute around the Project for a slightly longer route, and smaller passenger vessels, (which may reroute closer to shore, increasing grounding potential). As noted in Section 3.5.1.2.3, during construction and installation, commercial fishing vessels would need to avoid work areas and could be adversely impacted, depending on the location of the exploitable biomass and whether there are suitable alternative locations; with respect to navigation, commercial fishing vessels

[5] Monopile construction vessels would include a floating/jack-up crane barge, two towing tugs, two material barges, an anchor handling barge, a rock dumping vessel, two crew transport vessels, an inflatable support vessel, a helicopter, and two Monco 335 feeder barges. A bunkering vessel would support the construction fleet. These 13 vessels would operate 24 hours per day during construction.

[6] Offshore SFEC construction vessels would include a transportation barge, a fuel bunkering vessel, two towing tugs, a material barge, an anchor handling barge, a cable laying vessel, a work vessel, a work vessel support tug, two crew transport vessels, and an inflatable support vessel. A bunkering vessel would support the construction fleet. These 13 vessels would operate 24 hours per day during construction.

would experience temporary, minor to moderate adverse impacts. Because of the small number of vessels involved in construction, there would be a negligible impact on port congestion (see Table 3.1-5 in the COP for list of potential ports). Cable laying would have a temporary, negligible to minor adverse impact on vessels entering or exiting commercial shipping lanes and the precautionary area. Project construction would have a negligible impact on commercial traffic.

DWSF would implement temporary safety zones around the locations with active construction, develop a mariner communication plan, and limit construction activities to periods of good weather conditions would minimize impacts from offshore SFEC construction and result in a negligible adverse impact (see Table G-1 in Appendix G).

Because of the small number of vessels involved with Project construction, any ports potentially used by these vessels would be able to accommodate their needs at existing facilities without significant modifications or upgrades; therefore, the impact to port operations would be negligible. See Table 3.1-5 in COP for a list of potential port facilities the Project could use and how they would be used.

Operations and Maintenance and Conceptual Decommissioning

During operations, planned maintenance and unplanned maintenance are each expected to require 1 week of work each year (DWSF 2019) and would include three crew transport vessels, a floating/jack-up crane barge, and two feeder barges (Jacobs 2020). This limited operation activity would have a negligible adverse impact on navigation and vessel traffic. Any ports used by these vessels would likewise have a negligible impact because ports potentially used by these vessels would be able to accommodate their needs at existing facilities without significant modifications or upgrades.

Under the Proposed Action, there would be an increase of 0.03 incidents per year (0.4%) over baseline conditions as a result of changes to travel patterns to certain vessel types (DNV-GL 2018:Table 4-7); more than 99% of total incidents would be groundings. Collisions are expected to increase 0.3% and allisions are not expected to increase. Other vessels and unidentified vessels are expected to see 6.81 incidents per year (6.76 groundings, 0.005 collisions, and 0.004 allisions), but the effect of the Project on their rate of incidents is an increase of only 0.1%. Similarly, pleasure vessels are expected to have an incident every 2 years but with only a 0.1% increase from the Project.

Because of the low frequency of incidents (less than 1% of which would be collisions or allisions) and Project EPMs (see Table G-1 in Appendix G), the expected risks to navigation would be negligible. Most deep draft vessel traffic already avoids the area and would not need to meaningfully reroute, as shown in Figure C-29. For cargo vessels that travel through the Project, only slight reroutes would be necessary to avoid Project components (DNV-GL 2018:Section 6).

According to the NSRA, the Project would not have an impact on the USCG's missions, primarily because of the low frequency of missions in the area, ranging from zero to five missions per year and averaging 2.4 (DNV-GL 2018). However, the USCG has not formally evaluated the NSRA.

For vessels that generally travel within and through the Lease Area, the NSRA mapped out the placement of the turbines and evaluated the time of potential visual obstruction each would present based on a vessel's speed (DNV-GL 2018:Section 5.2). At a speed of 5 knots, a vessel's view could be obstructed for as much as 7.8 seconds. The Navigational Safety Risk Assessment notes that this is a conservative estimate because it reflects the view of a single moving vessel and not multiple moving vessels that would enhance each vessel's ability to see the others. Because of the 1 × 1–nm spacing of the turbines, the impact on visibility would be further reduced. The turbines would not impact a mariner's ability to use navigation aids or the coastline as a reference for navigation. Overall, spacing and placement of the turbines would result in a negligible impact to visibility. NOAA also would identify and chart the WTGs and offshore SFEC.

As noted in Section 3.5.1.2.3, commercial fishing vessels that are unable to adapt to the presence of structures or find suitable alternative fishing locations may experience moderate adverse impacts because of reduced fishing opportunity. For those vessels that can adapt to the presence of structures or relocate to other fishing locations, the adverse impacts would be temporary and minor.

The nearest anchorage area is 12 nm away from the Project (DNV-GL 2018), although the southern portion of the precautionary area, consisting of vessels operating between Narragansett Bay or Buzzards Bay and an established traffic lane (NOAA 2020), is located within 1 to 2 nm of the Lease Area. As a result, the Project would have no impact to ordinary vessel anchorage operations, though risks would still exist for emergency anchoring and for vessels transiting the area. The Project would use USCG-approved lighting to make nearby vessels aware of turbine locations (see Table G-1 in Appendix G for EPMs). Impacts of navigational lighting on deep draft vessels during operations would be long term and negligible.

Impacts to traffic from the offshore SFEC maintenance would be negligible because of the infrequent nature of monitoring and inspection. Conceptual decommissioning of the Project would have similar negligible to minor adverse impacts as construction because conceptual decommissioning would use similar numbers of vessels and implement the same EPMs. After the facility is decommissioned, the navigation conditions in the area would return to pre-Project conditions.

Cumulative Impacts

Traffic: The Proposed Action would incrementally add 13 construction vessels per construction day in 2021 and 2022 to conditions under the No Action alternative (see Table 3.5.6-4). This additional vessel activity would increase the risks of collisions, allisions, and spills. Vessel traffic in ports may become congested with limited maneuvering space, causing delays. However, the Proposed Action represents a small proportion (2%) of the total maximum vessels potentially present. Non-Project traffic would be able to adjust routes and avoid the work area and transiting construction vessels. Project O&M vessel traffic would be substantially less, representing no more than 12% of the 50 to 78 vessels active each day by 2030 under the No Action alternative. Therefore, the Proposed Action would result in a negligible incremental impact to vessel traffic. BOEM estimates a peak of 207 vessels due to offshore wind project construction over a 10-year time frame. Although the number of construction vessels (reaching a maximum of 207 in 2025) would represent a large portion of the traffic in the region, most vessels would remain in the 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 sufficient capacity exists at each port and in each waterway. Therefore, cumulative impacts associated with the Project when combined with past, present, and reasonably foreseeable future activities would be short-term and minor.

New cable emplacement/maintenance and anchoring: The Proposed Action would add up to 913 acres of seafloor disturbance from SFEC and inter-array cable installation, or 25% of seafloor cable-related disturbance estimated under the No Action alternative. The Proposed Action would also add an additional 821 acres of seabed disturbance from anchoring/mooring activity. This would result in localized, temporary, negligible to minor incremental impacts on navigation and vessel traffic due to increased collision and spill risk during construction. BOEM estimates a total of 933 acres of anchoring and mooring-related disturbance and 4,528 acres of sea floor disturbance for the Proposed Action plus all other future offshore wind projects in the RI/MA WEA. During installation and maintenance, other vessels could also be forced to reroute to avoid installation and maintenance vessels. Based on the location of other offshore wind projects and proposed construction schedules (see Appendix E), however, it is unexpected that Project cable installation would overlap with other project cable routes. Therefore, when considered in combination with past, present, and other reasonably foreseeable projects, the Project would have short-term, minor impacts on navigation and vessel traffic.

Presence of structures: The Proposed Action would add up to 15 additional WTGs and one OSS to the 959 structures present under the No Action alternative, which would increase navigational complexity and therefore the risk of collision, allision, and potential spills. Additional structures could also interfere with marine radars and aircraft engaging in search and rescue efforts. See Table 3.5.6-1 for a summary of time spent and miles traveled by vessels carrying AIS within SFWF and grouped lease areas in 2018. Section 3.5.1.1.1 Commercial Fisheries presents VMS numbers for commercial fishing vessels. However, the Proposed Action would account for less than 2% of the total future structures on the OCS and would implement 1 × 1–nm with uniform north–south and east–west grid spacing, consistent with other surrounding lease areas. Therefore, the Project would only contribute a negligible incremental impact to navigation and vessel traffic. 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 represent a long-term, moderate impact on navigation and vessel traffic.

Port utilization: Port upgrades and vessel activity associated with the Proposed Action could result in negligible incremental impacts to navigation and vessel traffic. The Proposed Action is expected to require 13 construction vessels per construction day in 2021 and 2022. This additional vessel traffic could cause delays or changes in berthing patterns at primary ports. It could lead to operators being redirected to use alternate ports or facilities on a temporary basis. To some extent, individual ports may independently undertake facility improvement projects in anticipation of this demand to relieve some of the potential congestion. The Project’s impact would also be limited due to the small number of additional vessels and impact on port capacity.

Project port activity and upgrades (via dredging and in-water work) could coincide with other forecasted projects, as shown in Table 3.5.6-4. Port activities could be delayed or experience port congestion or changes in utilization as result of the overlap in construction activities. Therefore, the cumulative impacts of the Proposed Action when combined with past, present, and reasonably foreseeable future projects would have short-term, moderate impacts on navigation and vessel traffic.

Conclusions

Project construction and installation, O&M, and conceptual decommissioning would impact navigation and vessel traffic, primarily through increased traffic, obstructions to navigation; delays within or approaching ports; increased navigational complexity; changes to navigation patterns; detours to offshore travel or port approaches; or increased risk of incidents such as collision, strikes or allisions, and groundings. BOEM anticipates the impacts resulting from the Proposed Action alone would be **negligible to minor**. Therefore, BOEM expects the overall impact on navigation from the Proposed Action alone to be **minor**, as the change would be small**.**

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **minor**. 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 **moderate** impacts to navigation. As the overall effect would be notable but the resource would be expected to recover completely.

3.5.6.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The transit lane direction is oriented to assist common commercial fishing transit routes, though its orientation would not necessarily provide a useful route for all recreational vessels. Use of the transit lane by both recreational and commercial fishing could result in a simultaneous mixture of transiting and fishing activities, which could increase the potential for allision, collision, and other navigation conflicts.

The Transit alternative would eliminate WTGs located within the transit lane; remaining Project WTGs would be arranged in accordance with MARIPARS recommendations for commercial fishing and with USCG First District and Sector Southeast, which call for uniform north–south and east–west grid spacing and separation of 1 nm. Therefore, this alternative would result in a minor, long-term adverse impact on both recreational and commercial vessels.

All other impacts would be similar to the Proposed Action. Therefore, this alternative would have similar temporary, negligible to minor adverse impacts to navigation as those described above under the Proposed Action.

Cumulative Impacts

The Transit alternative would incrementally add sources of navigation impacts (e.g., structures, port utilization, and traffic) to the cumulative, No Action scenario at a similar duration but to a lesser extent than the Proposed Action. Therefore, the overall cumulative impacts of the Transit alternative on navigation and vessel traffic when combined with past, present, and reasonably foreseeable activities would be localized, long term, intermittent, and moderate.

Implementation of the Transit alternative could reduce cumulative impacts related to allision and collision risk throughout the geographic analysis area. However, there would be no formal designation of the transit lanes prohibiting other activities from occurring within them, possibly increasing risks of collisions and allisions in these areas.

Conclusions

Although the Transit alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel activity, this alternative would maintain uniform north–south and east–west grid spacing and separation of 1 nm. Therefore, BOEM expects that the impacts resulting from the alternative alone would be similar to but slightly less than the Proposed Action and would range from **negligible** to **minor**.

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

3.5.6.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would reduce the number of WTGs while still maintaining a 1 × 1–nm uniform east–west/north–south grid. All other impacts would be similar to the Proposed Action. Therefore, this alternative would have similar temporary, negligible to minor adverse impacts to navigation as those described above under the Proposed Action.

Cumulative Impacts

This alternative would incrementally add sources of navigation impacts (e.g., structures, noise, port utilization) to the No Action alternative at quantities and durations similar to the Proposed Action. Therefore, the overall cumulative impacts of the Habitat alternative on navigation and vessel traffic when combined with past, present, and reasonably foreseeable activities would be localized, long term, intermittent, and moderate.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and their associated inter-array cables, which would have an associated reduction in associated vessel activity, this alternative would maintain uniform north–south and east–west grid spacing and separation of 1 nm. Therefore, BOEM expects that the impacts resulting from the alternative alone would be similar to but slightly less than the Proposed Action and range from **negligible** to **minor**.

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

3.5.6.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives. Although the amount of number of WTGs and their associated inter-array cables varies slightly, all action alternatives would maintain uniform north–south and east–west grid spacing and separation of 1 nm. Therefore, BOEM expects that navigation impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible to minor**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **moderate**.

3.5.6.4 Mitigation

Documenting locations of relocated boulders would further reduce the expected negligible to minor impacts on navigation by better understanding seafloor elements that can potentially affect navigation and vessel traffic. WTG and OSS marking would also reduce impacts by making Project elements more clearly identifiable to mariners. Compliance with USCG and SOLAS standards, development of an O&M plan, USCG monthly reporting, and the USCG's review and BOEM's approval of the submarine cable system burial and WTG/OSS installation plans would provide an added layer of coordination to aid in reducing impacts on navigation and vessel traffic. WTG shutdown mechanisms, USCG training exercises, mooring attachments/ladders, provision of helicopter landing platforms on OSSs, and web-based cameras would also aid in the USCG's ability to respond if an emergency situation were to occur.

3.5.7 Other Uses (marine, military use, aviation, offshore energy) (*see section in main DEIS*)

3.5.8 Recreation and Tourism

3.5.8.1 Affected Environment

Recreation and tourism as a resource refers to an area or activity that combines the natural qualities of land and water areas with the ability and desire to use this combination for personal satisfaction and enjoyment. Recreation and tourism could be undertaken individually or with others. Recreation can be passive or active and may or may not require specialized skills, e.g., boating or walking, respectively. The environment and landscape of the Project offer settings for a range of high-quality recreation opportunities and experiences. The primary recreation and tourism concerns, as they relate to the Project, are coastal and nearshore/offshore activities. Inland and open ocean recreation and tourism are also discussed.

Recreation and tourism play a major role in the coastal economies of the states affected by the Project as well as surrounding states (see Section 3.5.1 Commercial Fisheries and For-Hire Recreational Fishing and Section 3.5.3 Demographics, Employment, and Economics), and is present on and off the coasts of New York's Long Island and in the Lease Area (approximately 19 miles southeast of Block Island, Rhode Island, and 35 miles east of Montauk Point, New York). 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. National Ocean Watch tourism and recreation statistics 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 would be directly or indirectly affected by the Project, as identified in Section 3.5.3, is aggregated in Table 3.5.8-1 and revised to include only those data that fall within the 40-mile visual radius of the SFWF. As of 2016, ocean economy sectors accounted for 2% to 21% of the total economy for affected counties and states. Tourism and recreation were the predominant sources of economic activity for most locations.

Table 3.5.8-1. 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 GDP for Tourism and Recreation (% of total GDP generated by ocean economy)
New York	4	347,001 (92%)	$11.1 billion (83%)	$23.2 billion (84%)
Suffolk County, NY	5	8,017 (93%)	$156.5 million (76%)	$310.4 million (77%)
Connecticut	3	39,122 (70%)	$930.4 million (42%)	$2.1 billion (46%)
New London County, CT	16	7,314 (39%)	$165.8 million (14%)	$388.7 million (19%)
Massachusetts	3	75,788 (79%)	$1.9 billion (56%)	$4.0 billion (55%)
Bristol County, MA	2	2,975 (66%)	$52.9 million (28%)	$102.2 million (18%)
Rhode Island	9	36,366 (82%)	$775.1 million (62%)	$1.7 billion (61%)
Washington County, RI	19	5,991 (59%)	$132.7 million (35%)	$300.8 million (33%)
Newport County, RI	21	6,719 (82%)	$164.1 million (54%)	$401.0 million (58%)

Source: NOAA (2020).

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

Recreation and tourism in the analysis area are noticeably higher in the spring, summer, and fall, when the ambient air and water temperatures are comfortable, whereas winter recreation and tourism uses occur at a much reduced scale (Parsons and Firestone 2018).

The analysis area supports inland, shoreline or beach, and ocean-based recreation and tourist activities. Recreational activities revolve mostly around 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. Based on one survey in the Northeast, the five most popular activities were beach going (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). 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 were identified as the three areas in the WEA that support the highest level of recreational fishing for HMS. Recreation is generally concentrated along the eastern tip of Long Island and along dunes, inlets, harbors/marinas, or barrier islands that provide cover or shelter from the open ocean (Figure C-30). Recreation and tourism are promoted both locally (towns, private clubs) as well as regionally (county or state parks), and users could drive from local or distant locations. Several long-distance sailboat races may pass through the offshore portions of analysis area, depending upon the route selected for a particular year; these races include the Transatlantic Race, Marion to Bermuda Race, and Newport Bermuda Race. Larger sightseeing boats also travel to offshore locations where sightings of whales are more likely.

Most publicly available recreation and tourism activities are free (equipment requirements notwithstanding). Local businesses offer boat rentals, private boat/cruise charters, canoe, kayak, and stand-up-paddleboard touring. There are multiple targeted recreation (e.g., whale watching, deep-sea fishing charters, and scuba diving) opportunities in the analysis area that have a direct link to local businesses, including non-ocean-related leisure, hotels, and restaurants (Figure C-30). Section 3.5.1 provides additional detail on for-hire recreational fishing.

In the analysis area, Suffolk County Department of Parks manages dozens of parks and recreation sites, and the Division of Historic Services manages more than 200 local historic sites. Two state parks exist within the analysis area: Hither Hills State Park and Napeague State Park. Hither Hills offers scenic picnic areas, sport fishing and beach access, playing fields, and a public campground. One of the two optional cable landing sites is located at Hither Hills. Napeague State Park, located west of Hither Hills, is mostly undeveloped, with few specifically permitted uses and no camping allowed at the park.

The Towns of East Hampton and Montauk, New York, are the two nearest communities to the onshore Project components, west and east of the analysis area, respectively. Many of the local recreation users would be based out of these locations. Many local residents have private beach-front access within the analysis area along the coastline of Long Island. Where local roads terminate at an access beach, limited public parking is typically provided, such as at Beach Lane and Napeague Lane in East Hampton. The second of the landing sites is located at Beach Lane.

An O&M facility would be established at an existing port in either at Quonset Point, Rhode Island, or Montauk Harbor, New York. North Kingston, Rhode Island is located on the eastern side of Narragansett Bay, and offers similar recreation experiences as East Hampton, New York (offshore recreation notwithstanding) on a much smaller and less-crowded scale.

The State of New York administers recreational boating in the nearshore coastal portions of the analysis area. The USCG administers all boating activities in offshore areas, including the proposed locations for the export cable and SFWF. The offshore SFEC would cross nearshore areas and offshore areas popular for recreational fishing and boating, whale watching, birdwatching, and scuba diving. Scuba diving is pursued in this area because of the sea life and shipwrecks that can be accessed at relatively shallow depths. Recreational boating within the SFWF is sparse, but does occur, as shown on Figure C-30.

3.5.8.2 Environmental Consequences

3.5.8.2.1 ISSUES, INDICATORS, AND SIGNIFICANCE CRITERIA

Table 3.5.8-2 lists the issues identified for this resource and the indicators and significance criteria used to assess impacts for this DEIS. EDR (2019) and BOEM-funded studies were used to guide this analysis. Additionally, the analysis for recreation and tourism has a strong relationship to Section 3.5.9 Visual Resources because the recreation setting is heavily dependent upon the viewscape.

Table 3.5.8-2. Issues, Indicators, and Significance Criteria Used to Assess Impacts to Recreation and Tourism

Issue	Impact Indicator	Significance Criteria
Changes to recreation access and opportunity	Qualitative assessment of changes to the following: Vehicle/vessel traffic volume Viewshed Navigation hazards Access restrictions	Negligible: No measurable impacts to the recreation setting, recreation opportunities, or recreation experiences would occur. Minor: Most impacts could be avoided with EPMs. Moderate: EPMs would minimize, but not fully resolve impacts. Major: Impacts would be unavoidable even with EPMs; additional mitigation could be required.

3.5.8.2.2 NO ACTION ALTERNATIVE

The Affected Environment section provides information on existing recreation and tourism trends from past and present activities. Attachment 3 in Appendix E provides additional information regarding past and present activities and associated recreation and tourism impacts. Future non-Project actions include offshore wind energy development; undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; marine minerals use and ocean-dredged material disposal; military uses; marine transportation; fisheries use and management; global climate change; oil and gas activities; and onshore development activities. Attachment 3 in Appendix E also discloses future non-offshore wind activities and associated recreation and tourism impacts. Impacts associated with future offshore wind activities are described below.

Future Activities (without the Proposed Action)

Onshore

Future projects would generate increased onshore vehicle traffic or alter traffic patterns that could inconvenience recreational users, primarily during construction in localized areas near port facilities and on existing roadways frequented by recreational users. 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 incrementally 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 incrementally add to the existing onshore traffic and therefore present minor, localized, long-term impacts on recreational users.

Existing ports that would be used for staging and construction of planned future projects may provide opportunities or facilities for some recreational vessels, or may be on waterways shared with recreational marinas. Increased onshore traffic from future projects could affect some recreational travelers on local roadways. However, these ports are primarily industrial in character and are not intended to service recreational activity. Impacts to onshore recreation and tourism related to current marine industrial activities at existing ports would not experience significant changes, regardless of offshore wind industry development (BOEM 2016), and therefore would not contribute to cumulative impacts on recreation and tourism.

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. The O&M of some onshore projects would include permanent nighttime lighting on some of the taller communications towers and port improvements. Construction noise from planned future projects onshore would be variable based on project type, but many projects would also include one or more noise-generating activities such as earth moving, pile driving, trenching, jack hammering, and other similar large equipment operation. 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). However, most of these onshore project components are anticipated to be in previously developed and lighted areas. Therefore, adverse effects of onshore noise and lighting from construction would be short term and localized to discrete construction sites. Onshore visual impacts, O&M noise, and lighting from future projects would be variable based on project type (i.e., increased rail and road infrastructure use, increased port operational noise), which would be adverse and long term with variable minor to moderate impacts experienced based on the observed distance.

Offshore

<u>Traffic and anchoring</u>: Future projects would generate increased nearshore and offshore vessel traffic, primarily during construction, along routes between ports and the offshore wind construction areas. Construction of future projects would also increase the number of anchored vessels and work platforms used for survey and construction purposes. 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 207 vessels involved in the construction of reasonably foreseeable projects (see Table 3.5.6-4). Most of the anchored and moving construction-related vessels would be located within temporary safety zones (anticipated to be established and monitored by offshore wind developers), and onshore work areas would follow established safety guidelines that would prevent most conflicts for recreational uses. These activities would also be temporary and localized; therefore, construction impacts from future projects would not incrementally add to adverse impacts on recreational users. Anchoring impacts to fish species used for recreational fishing are addressed in Section 3.4.2.2.2. Although long-term increased traffic volumes from O&M of future projects would be low, they would incrementally add to the existing in-water vessel traffic and therefore present minor, localized, long-term impacts on recreational users.

<u>Presence of structures</u>: In-water structures (WTGs and the OSS) associated with future offshore wind projects could affect recreation and tourism. These structures would represent the most visible components of planned future projects in the area from onshore and offshore locations. The placement and operation of up to 857 structures (see Table E-3 in Appendix E) are proposed within the recreation and tourism geographic analysis area. Recreational impacts would include the risk of recreational vessel allision with in-water structures, fishing gear entanglement, vessel damage or loss, increased navigation hazards, vessel traffic congestion, space use conflicts, presence of cables and infrastructure, and visual impacts.

A 2012 survey of recreational boaters along the northeastern United States coast found that the highest density of recreational vessels routes in the 2012 survey's "study area" was within Nantucket Sound and within 1 nm of the coastline (Starbuck and Lipsky 2013). More than half (52%) of recreational boating occurred within 1 nm of the coastline (Starbuck and Lipsky 2013). A 2015 study of coastal and marine recreational activity in the Northeast noted that human-made features were attractive for scuba divers, although poor water clarity and pollution, low visibility, and limited shore access represent obstacles to diving (Bloeser et al. 2015). The same study noted that surfing, stand-up paddleboarding, and triathlon typically occurred in nearshore, bay-protected waters. Sailing events occur along the entire Long Island coastline, but are generally small (averaging less than 50 participants). In 2011, NOAA estimated that 97% of the 2011 recreational boating from Massachusetts occurred within 3 nm of shore (BOEM 2012). Based on these findings, under the No Action alternative, most recreational vessels would continue to navigate within 3 nm of shore and therefore would not interact with proposed WTGs and the OSS. The closest WTG in the geographic analysis area could be approximately 12 miles from shore (a potential WTG position within Lease Area OCS-A-6 0486). However, some smaller vessels could navigate to and through future in-water Lease Areas. WTGs could also attract additional recreational boaters and sightseeing vessels. These conditions could increase the number of congregating vessels and further increase collision risks.

Offshore routes for recreational boaters, anglers, sailboat races, and sightseeing boats could require adjustment to avoid allision risks with in-water structures. Additional in-water structures would force smaller vessels traveling in or around them to pass at potentially shorter distances, which would increase the risk of vessel collisions. 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 altogether.

Conversely, the new in-water structures could result in several beneficial impacts including increased recreational fishing by introducing new aquatic habitats and increased tourism by people interested in viewing the structures. New in-water structures could also create foraging opportunities for seals, small odontocetes, and sea turtles (see Section 3.4 Biological Resources), which could offer recreational sightseeing opportunities. Recreational users that approach these offshore structures could be doing so intentionally, suggesting a minor beneficial impact instead of an adverse impact.

Visual impacts from 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. A viewer engaged in onshore recreation and tourism activities would experience changing views of multiple projects as they turn their heads and/or move along a shoreline or other area with views toward the lease areas. Towers closer to shore may block other more distant towers from view and could produce a visual anomaly of the closer turbine appearing to have more than three blades. The white to light grey color of the turbines would also contrast at certain sun angles during the day. The motion of the WTGs would also draw an onshore viewer's attention. The contrast would vary in visual dominance, depending on the distance between the viewer and the WTGs, and would be influenced by sun angle, atmospheric conditions and the viewers' visual acuity. The visual dominance created by the contrasting elements (form, line, color) would be static as viewed from a given stationary point along the shoreline but would vary with changes in sun angle and atmospheric conditions.

For offshore recreation/ tourism viewers, visual dominance created by contrasting elements will vary from offshore locations as floating vessels navigate toward or away from the WTGs. If the purpose of the viewer's sightseeing excursion is to observe the mass and scale of the WTGs' offshore presence, then the increasing visual dominance would benefit the recreation/tourism experience as the viewer navigates toward the WTGs. However, if experiencing a vast pristine ocean condition is the purpose of the viewer's sightseeing excursion, then the increasing visual dominance may detract from the viewer's recreation/tourism experience.

New cable emplacement/maintenance: Up to 3,301 acres of seabed disturbance could occur from cable installation to support future offshore wind projects within the recreation and tourism geographic analysis area (see Attachment 4 in Appendix E). Offshore cables would create temporary, localized adverse impacts on recreational boating because vessels would need to navigate around work areas, and recreational boaters would prefer to avoid the noise and disruption caused by installation. Cable installation could also have temporary impacts on fish and invertebrates of interest for recreational fishing resulting from the required dredging, turbulence, and disturbance; however, species would recover upon completion. Once installed, cables would impact recreational boating only during maintenance operations. Buried offshore cables would not pose a risk for most recreational vessels because smaller vessel anchors would not penetrate to the typical target burial depth (4 to 6 feet) for most cables. Scour protection for cables and foundations could hinder anchoring and result in gear entanglement or loss. Offshore wind scour protection would also present a hazard for anchoring because anchors could have difficulty holding or become snagged and lost. If the hazards are not noted on charts, operators may lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. However, recreational vessel anchoring is uncommon in water depths where offshore structures would be installed.

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 by offshore boaters recreating at night or in low-light conditions. O&M of the estimated 857 WTGs would require permanent aviation warning lights that would be visible from many beaches and coastlines, and could cumulatively impact recreation and tourism in certain locations if the decisions made by users in selecting locations to visit is influenced by lighting. Field observations made from the mainland shoreline during WTG operation 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 mi (23.2 nm) (HDR 2019). Aviation obstruction lights would be visible from shore (see COP Figure 4.5-6 through 4.5-8) low on the horizon and would vary in appearance and intensity as the lights rotate and become intermittently blocked by passing turbine blades. Cumulative visual impacts on recreation and tourism from increased offshore lighting would be short term during construction with variable minor to moderate impacts experienced based on the observed distance. Long-term cumulative impacts from O&M of future planned Project lighting would be adverse and long term but variable and discontinuous.

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, which is estimated to be approximately 60 dB on the A-weighted scale at a distance of 2,400 feet from its source (CH2M HILL 2018a), comparable to the noise level of a normal conversation (OSHA 2011).

Most pile driving would occur far enough offshore that that work would be inaudible from onshore locations. 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 safety zones anticipated to be established for each project by offshore wind developers that would exclude recreational and tourism vessel access.

Most recreational fishing occurs close to shore, whereas most pile driving for future projects would be well offshore; therefore, only a small percentage of recreational users would be in the areas of loudest sound levels where pile driving would occur. However, because some fish species are sensitive to underwater sound, construction activities such as vessel traffic and especially pile driving are expected to temporarily cause fish to relocate to other habitats farther from the noise source, which could then adversely affect recreational fishing opportunities near in-water work areas (CH2M HILL 2018b). Most of the anticipated offshore O&M noise from future projects would be from the continuous noise generated by WTG operation. 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 BIWF minimally exceeded ambient levels at 164 feet (35.4 meters) from the WTG base. These field observations also concluded that WTG operational noise from the BIWF 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).

Port utilization: Existing ports that would be used for staging and construction of planned future projects may provide opportunities or facilities for some recreational vessels, or may be on waterways shared with recreational marinas. However, these ports are primarily industrial in character and are not intended to service recreational activity. Impacts to offshore recreation and tourism related to current marine industrial activities at existing ports would not experience significant changes, regardless of offshore wind industry development (BOEM 2016), and therefore would contribute only minor adverse cumulative impacts on recreation and tourism.

Conclusions

Under the No Action alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual 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 interruption of access and introduction of new offshore hazards, as well as new aquatic habitat and curiosity tourism.

BOEM anticipates that the range of impacts for reasonably foreseeable offshore wind activities would be **minor** to **moderate** adverse, and **minor** beneficial. As described in Attachment 3 in Appendix E, BOEM anticipates that the range of impacts for ongoing activities and reasonably foreseeable activities other than offshore wind would be **minor** to **moderate**.

Considering all the IPFs together, BOEM anticipates that the impacts associated with future offshore wind activities in the geographic analysis area combined with ongoing activities, reasonably foreseeable environmental trends, and reasonably foreseeable activities other than offshore wind would result in **minor** adverse impacts on recreation and tourism because the overall effect would be small and the resource would be expected to recover completely.

3.5.8.2.3 PROPOSED ACTION ALTERNATIVE

Construction and Installation

Onshore

Noise from construction activities and views of workers, equipment, vehicles, or debris and cleared areas could temporarily adversely impact the recreation experience of users near the landing site (i.e., junction manhole) at either Beach Lane (650 feet from the beach) or Hither Hills parking lot (800 feet from the beach). Similar construction activities could temporarily impact the recreation experience for users travelling in the vicinity because of the construction of the onshore SFEC route and interconnection facility (i.e., onshore substation) within and adjacent to the LIRR ROW. Recreation and tourism users driving on Montauk Highway could experience 10-minute delays (or less) from onshore SFEC construction activities along the highway.

All construction activities would be conducted such that public recreation would not be precluded from use. In coordination with local communities, groups, and Hither Hills State Park, DWSF's communication planning would announce all construction plans via public outreach programs to minimize potential impacts to recreation and tourism. DWSF would establish a construction schedule to minimize impacts to the local community during the summer tourist season. Additionally, construction activities at the manhole (e.g., earthworks, drilling, use of heavy machinery, and implementation of safety exclusion areas) would be planned for the non-tourist season to minimize the impacts (see Table G-1 in Appendix G). For most locals and tourists, adverse impacts would be temporary, minor and inconvenient but not cause a loss to their overall experience.

Construction staging areas would be located such that public parking, beach access, and access to campsites would be maintained (Appendix G). Surface disturbances related to construction of the manhole at either Hither Hills or Beach Lane would be rehabilitated to return the recreation setting to pre-construction conditions.

Construction of offshore Project components could elicit both temporary beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. It is anticipated that ocean beaches could experience an increase in curiosity visits, as well as a decrease in visits from users who do not appreciate seeing the WTGs when visiting a beach (Parsons and Firestone 2018).

The proposed O&M facilities (located in either Quonset Point, Rhode Island, or Montauk Harbor, New York) would be located within existing industrial ports. The Montauk Harbor location may require dredging. However, dredging would occur outside the main navigational route and therefore no impact to recreational navigation is expected. The interconnection facility in East Hampton is proposed to be located adjacent to an existing substation in an area zoned for utility use and so impacts to recreational uses are not anticipated. Construction traffic detours would be temporary if required. A BOEM study suggests that impacts on recreation and tourism related to current marine industrial activities at existing ports would not experience significant long-term changes, regardless of offshore wind industry development (BOEM 2016). The study notes that although the Atlantic coast already possesses the necessary infrastructure to support offshore wind, the industry is still evolving (BOEM 2016), and communication, flexibility, and scalability are needed to ensure port selection would not impact tourism or recreation. Therefore, construction activities for the O&M facility and interconnection facility would result in negligible temporary adverse impacts to transportation related to recreation or tourism activities.

Offshore

During construction, recreational offshore fishing could experience minor conflicts with construction boating traffic, increased construction noise, and increased public safety clearance requirements (i.e., during offshore SFEC construction, all recreational boaters would be directed to maintain minimum safe distance from construction activity, as established and monitored by DWSF) (see also Section 3.5.1.2.3. and Section 3.5.6.2.3). Construction EPMs would be implemented to minimize adverse impacts to recreators (see Table G-1 in Appendix G), including communication with vessel operators and scheduling onshore construction in the non-busy season. These temporary, minor adverse impacts would extend from the shore to the OCS (as shown on Figure C-30, where most recreational boating and fishing occurs) and would be short term. However, recreation and tourism use could increase slightly during construction, as interested onlookers attempt to view Project progress and thus impede other recreation and tourism users (Parsons and Firestone 2018). Noise from construction could lead to the displacement of fish in and around construction sites. This could lead to spatial competition, depending on migrating patterns, which could adversely impact recreational trips.

A survey-based study of 1,725 participants who typically visit the coast suggested that (based on visual simulations for prospective offshore wind facilities) at 2.5 miles from shore, approximately 53% of participants would experience adverse impacts, with the results diminishing to 10% of respondents experiencing adverse impacts at 10 miles from shore (Parsons and Firestone 2018). The study was carried out only to a distance of 20 miles, but the resulting trend suggests that coastal visitors could experience adverse reactions approaching 0% from WTG at about 25-30 miles offshore.

Operations and Maintenance and Conceptual Decommissioning

Onshore

Operations of onshore Project components (SFEC landing site manhole, onshore SFEC cable route, and interconnection facility) would have negligible, intermittent adverse impacts over the life of the Project to onshore recreation and tourism because these components would only require periodic routine maintenance. O&M and conceptual decommissioning of onshore Project activities could elicit both beneficial and adverse impacts to recreational use of resources within the viewshed of the WTGs. It is anticipated that ocean beaches could experience a temporary increase in curiosity visits, as well as a decrease in visits from users who do not appreciate seeing the WTGs while recreating. Conceptual decommissioning of onshore Project components would have similar temporary, minor adverse impacts to onshore recreation and tourism users as described above under construction.

Offshore

Operations of offshore Project components (offshore SFEC, OSS, WTGs, and inter-array cables) would have negligible long-term adverse impacts to recreation and tourism because of their distance from nearshore recreators and the infrequency of maintenance activities. The Project could improve habitat for popular recreational fish species via fish aggregating by the structures, which would provide a minor, long-term beneficial impact to recreation and tourism (see Section 3.5.1.2.3). The WTGs and offshore SFEC are not anticipated to conflict with recreational fishing gear (lines, hooks, nets), and the distance between WTGs and their grid-like placement would prevent adverse effects to recreational boats operating within the boundaries of SFWF (DNV-GL 2018). The presence of WTGs could affect some recreational fishing operations and limit the ability of anglers targeting highly migratory species to conduct certain fishing activities among WTGs. Charter cruises could also choose to market the operational WTGs as a tourist destination, though distance from shore may limit interest. However, SCUBA divers are known to be willing to travel greater distances. 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. 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. These surveys suggest that SFWF could attract recreational fishing and diving activity, providing a long-term minor benefit. The Project could also potentially increase tourism activity during peak tourism months (Carr-Harris and Lang 2019). Operation of WTGs is not expected to exceed 35 dBA (CH2M HILL 2018a); therefore, operational noise from the WTGs would not be readily audible over ambient ocean noise such as wind and wave action.

Conceptual decommissioning of offshore Project components would have similar temporary, minor adverse impacts to recreational boaters as those described above under construction. DWSF would implement the same EPMs for conceptual decommissioning (see Table G-1 in Appendix G), including communication with vessel operators and scheduling onshore construction in the non-busy season.

Cumulative Impacts

Onshore

Onshore construction and installation would incrementally add an O&M facility, an interconnection facility, and distribution cable to the No Action alternative. These new onshore structures would not result in visual impacts experienced by recreational users due to the existing settings at these locations (see Sections 3.5.2 and 3.5.9 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.

Construction vehicles associated with the Proposed Action would incrementally add short-term traffic delays (10-minute delays or less) experienced by recreational travelers on local roadways, as well as temporary, minor adverse noise and light impacts experienced by onshore recreational users near the cable landing site at either Hither Hills or Beach Lane, or from the aviation hazard lighting on the new WTGs. Long-term increases in operational traffic, lighting, and noise from the Proposed Action would be negligible. 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.

Construction activities would incrementally add noise from 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, and minor to moderate, depending on the distance of the receptor from the source.

Offshore

Offshore impacts would predominately be associated with the following offshore wind IPFs.

<u>Traffic and anchoring</u>: Offshore construction would incrementally add 13 construction vessels and approximately 821 acres of temporary mooring (see DEIS Table 2.1-1) to the 106 acres of mooring estimated under the No Action alternative. Project-related construction anchorages and vessels would incrementally 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. 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 related to vessel traffic and anchoring.

<u>Presence of structures and new cable emplacement/maintenance</u>: The Proposed Action would incrementally add up to 15 WTGs; one OSS; and 82.5–86.9 miles of cable the No Action alternative. This represents a 2% to 4% increase, respectively, over the No Action alternative. The buried cabling would present only short-term traffic and navigational hazards; however, new structures related to the Proposed Action would add to the long-term impacts on recreation and tourism throughout the life of the Project (25 years, plus up to an additional 2 years for conceptual decommissioning) by incrementally increasing navigational complexity; by risks of structure allision; by route adjustments for races, sightseeing, and fishing; by loss and damage of fishing gear to scour and cable protection; and by difficulty anchoring over scour and cable protection. However, new in-water structures from the Proposed Action could incrementally 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 incrementally increase the visual impacts on recreational and tourism users by adding up to 15 new WTGs and one OSS to the No Action alternative. Based on visual simulations (see Section 3.5.9) from onshore locations, some offshore WTGs would be visible from various key observation points on clear days. However, atmospheric conditions would limit the number of these large structures discernable during daylight hours for a significant portion of the year (EDR 2019). 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 unexpected to impact shore-based recreation and tourism as a whole. Established offshore wind facilities in Europe did not result in decreased onshore tourist numbers, tourist experience, or tourist revenue (Smythe et al. 2018), and Block Island's WTGs provide recreational fishing and shellfishing opportunities (Smythe et al. 2018). Recreational users would also observe a relatively small onshore construction area used for HDD at either the Hither Hills State Park or the Beach Lane landing site. 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 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 for offshore recreational users and would increase as users approach the WTGs. Impacts to viewers at sensitive viewing locations are address in Section 3.5.9 Visual Resources.

Light: Offshore construction activities would incrementally add 13 construction related vessels, and up to 15 new WTGs and one OSS 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 the Proposed Action would negligibly contribute to no more than a 2% increase in in-water lighting sources from past, present, and reasonably foreseeable future projects by introducing built visual elements to views previously characterized by dark, open ocean. 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 cumulative impacts on recreation and tourism from construction and O&M related lighting.

Noise: Construction activities would incrementally add noise from 13 construction vessels, pile-driving activities for all 15 WTGs and one OSS, 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, the Proposed Action when combined with past, present, and reasonably foreseeable activities would result in localized, short-term, minor to moderate cumulative impacts on recreation and tourism due to construction activities, whereas noise from O&M activities would result in long-term, negligible cumulative impacts.

Port utilization: Port activity and upgrades (dredging and in-water work) would result increased short-term construction traffic, and long-term operational traffic to the No Action alternative, which could coincide with recreational activity in the vicinity, depending on transportation type (vessels, rail, or road vehicle). However, activities related to the Proposed Action at port facilities would occur within the boundaries of existing ports or other re-purposed industrial facilities where recreational users would not be expected to occur. Project activities at ports would be similar to those already taking place at these facilities, and would be consistent with state and local agency guidelines regarding land use, access, land use, noise and air quality, and other impacts on nearby neighborhoods. Therefore, Proposed Action when combined with past, present, and reasonably foreseeable activities would result in would have negligible adverse cumulative impacts on recreation and tourism.

Conclusions

Project construction and installation and conceptual decommissioning would introduce noise, lighting, human activity, vehicles and vessels (increasing potential collision risk), and interruption to access points in the geographic analysis area. Noise, lighting, and human activity impacts from Project O&M would occur, although at lower levels than those produced during construction and conceptual decommissioning. BOEM anticipates the impacts resulting from the Proposed Action alone would range from **negligible** to **minor** and short term to long term. Therefore, BOEM expects the overall impact on recreation and tourism from the Proposed Action alone to be **minor**, as the overall effect would be small and would be expected to recover completely without remedial or mitigating action.

In the context of other reasonably foreseeable environmental trends and planned actions, the incremental impacts under the Proposed Action resulting from individual IPFs would range from **negligible** to **moderate adverse** and **minor 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 adverse** impacts and **minor beneficial** impacts to recreation and tourism. BOEM made this call because the overall effect would be small and the resource would be expected to recover completely after conceptual decommissioning.

3.5.8.2.4 VESSEL TRANSIT LANE ALTERNATIVE

The Transit alternative would not affect the Project's onshore activities; therefore, direct and indirect effects to onshore recreation and tourism would be the same as the Proposed Action: negligible to minor.

Offshore, this alternative could provide for improved safety for all vessels, including those used for recreational and tourism purposes. This alternative could benefit some recreational vessels by designating a specific route that allows a safer transit around the Lease Area. However, the transit lane direction is oriented to assist common commercial fishing transit routes, and its orientation might not provide a useful route for all recreational vessels. Additionally, use of the designated transit lane by both recreational and commercial fishing could reduce distances between vessels, which could increase the potential for collision and introduce navigational conflicts for recreational and other vessels. Likewise, flanking of structure foundations (that attract fish and recreational fishing) could also lead to increased congestion, space conflicts, and navigation risks. The reduced number of WTGs could also negligibly improve or diminish recreational experiences, depending on individuals' perception of offshore wind farms.

All other impacts are anticipated to be similar to those detailed under the Proposed Action: negligible to minor.

Cumulative Impacts

The Transit alternative would not affect onshore Project activities; therefore, cumulative onshore effects to recreation and tourism would be the same as previously discussed under the Proposed Action: negligible to minor.

Planned future offshore projects near the Lease Area, specifically wind projects, would result in increased short-term construction vessel traffic, long-term maintenance vessel traffic, and long-term recreation and tourism traffic. Ostensibly, some of the increased vessel traffic from planned future projects would use the new corridor as proposed under the Transit alternative.

Should the Transit alternative be implemented, the WTGs for other reasonably foreseeable offshore wind projects may need to be relocated or eliminated within those affected lease areas to avoid the transit lanes. If these shifts result in WTG reductions that further reduce views of structures and/or nighttime lighting, these effects could decrease recreational impacts relative to the Proposed Action. Conversely, if these lanes further exacerbate congestion, space conflicts, and navigation risks identified under the Transit alternative, then cumulative impacts could be increased relative to the Proposed Action.

Therefore, the overall cumulative impacts of the Transit alternative on recreation and tourism when combined with past, present, and reasonably foreseeable activities would be long term, minor, and beneficial from increased fishing and tourism opportunities, and negligible to moderate adverse if vessel navigation or recreational opportunities are reduced.

Conclusions

Although the Transit alternative would reduce the number of WTGs and introduce a designated transit lane, the designated transit lane would be used by recreational and commercial vessels which could increase the potential for collision. Additionally, flanking of structure foundations by recreational fishing vessels could also contribute to increased congestion, space conflicts, and navigation risks. The reduced number of WTGs could also negligibly improve or diminish recreational experiences, depending on individuals' perception of offshore wind farms. As a result, BOEM expects that the impacts from the Transit alternative alone would be similar to but less than the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Transit alternative's incremental 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 the Transit alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse and **minor beneficial**.

3.5.8.2.5 FISHERIES HABITAT IMPACT MINIMIZATION ALTERNATIVE

The Habitat alternative would not affect the Project's onshore activities; therefore, effects to onshore recreation and tourism would be the same as the Proposed Action: negligible to minor.

Offshore, this alternative would avoid sensitive benthic habitats that may support recreational fishing tourism. The reduced number of WTGs could also negligibly improve or diminish recreational experiences, depending on individuals' perception of offshore wind farms. All other impacts are anticipated to be similar to those detailed under the Proposed Action: negligible to minor.

Cumulative Impacts

The Habitat alternative would not affect onshore Project activities; therefore, cumulative onshore effects to recreation and tourism would be the same as previously discussed under the Proposed Action: negligible to minor.

Offshore, this alternative would incrementally add sources of impact (e.g., structures, noise, vessel activity) at quantities and durations similar to, or less than, the Proposed Action. Therefore, the overall offshore cumulative impacts on recreation and tourism when combined with past, present, and reasonably foreseeable activities would be long term and beneficial from increased fishing and tourism opportunities, and negligible to moderate adverse impacts if vessel navigation or recreational opportunities are reduced.

Conclusions

Although the Habitat alternative would reduce the number of WTGs and introduce a designated transit lane, the transit lane would be used by both recreational and commercial vessels which could increase congestion, space conflicts, navigation risks, and the potential for collision. The reduced number of WTGs under this alternative could provide a long-term beneficial impact on recreational viewers and a minor, long-term adverse impact on recreational fishing and tourism. Therefore, BOEM expects that the impacts resulting from the alternative alone would be similar to but less than the Proposed Action and range from **negligible** to **minor**.

In context of other reasonably foreseeable environmental trends and planned actions, BOEM also expects that the Habitat alternative's incremental 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 the Habitat alternative when combined with past, present, and reasonably foreseeable activities would therefore be the same level as under the Proposed Action: **minor** adverse and **minor beneficial**.

3.5.8.3 Action Alternative Comparison

As discussed above, the impacts associated with Proposed Action alone do not change substantially under other evaluated action alternatives, although some variation in impacts is acknowledged due to fewer WTGs being constructed. Although the number of WTGs varies slightly, BOEM expects that recreation and tourism impacts would range from **negligible** to **minor** for all action alternatives.

In context of reasonably foreseeable environmental trends and planned actions, all action alternatives would occur within the same overall environment (e.g., ongoing and future activities). Therefore, impacts would only vary if the alternatives' incremental contributions differ, as they do here. However, as noted above, BOEM expects that the incremental impact from any action alternative would be similar, with the level of individual impacts ranging from **negligible** to **moderate** adverse and **minor beneficial**. Therefore, the overall impact of any action alternative when combined with past, present, and reasonably foreseeable activities would be **minor** adverse and **minor beneficial**.

3.5.8.4 Mitigation

If BOEM requires potential additional mitigation measures identified in Appendix G, such as requiring complete avoidance of construction activities from Memorial Day through Labor Day that would impede traffic or access to recreational areas, minor and short-term adverse impacts for local residents who recreate during non-summer months would be further reduced.

BOEM could require installation of an ADLS as a mitigation measure. If an ADLS is used on offshore structures, aviation hazard lighting would only activate when aircraft approach within 3 nm or within 1,000 feet above a structure. ADLS would reduce the amount of time WTGs would be visible at night. and further reduce negligible, long-term visual impacts on recreation and tourism.

3.5.9 Visual Resources (*see section in main DEIS*)

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.

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