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BOEM 2016-042

Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York

Environmental Assessment

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TABLE OF CONTENTS

Appendices

Appendix A	Announcement of Area Identification for Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore New York
Appendix B	Standard Operating Conditions
Appendix C	Vessel Trip Calculations
Appendix D	Air Quality Emissions and Calculations
Appendix E	Sightings Information for Marine Mammals and Sea Turtles: Data Handling Procedures and Maps of Raw Sightings Data and Sightings per Unit Effort
Appendix F	Key Observation Points and Photosimulations

Figures

Tables

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
μPa	micropascal
μPa^2-s	micropascal squared second
μs	microsecond
ac	acres
ACHP	Advisory Council on Historic Preservation
ADCP	Acoustic Doppler Current Profiler
AIS	automatic identification systems
AOI	Area of Interest
APPS	Act to Prevent Pollution from Ships
Area ID	Area Identification
ASMFC	Atlantic States Marine Fisheries Commission
Atlantic OCS WEAs Biological Opinion	Endangered Species Act Section 7 Consultation Biological Opinion for *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas*
BOEM	Bureau of Ocean Energy Management
B.P.	before present
BSEE	Bureau of Safety and Environmental Enforcement
Call	Call for Information and Nominations
CD	Consistency Determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CHIRP	Compressed High Intensity Radar Pulse
cm	centimeters
CO	carbon monoxide
CODAR	Coastal Ocean Dynamic Applications Radar
COLOS	Coastal Oceanographic Line-of-Sight
ConEd	Consolidated Edison
COP	construction and operation plan
CPT	cone penetrometer test
dB	decibels
dB_{peak}	peak sound pressure
DOD	U.S. Department of Defense
DP	ducted propeller
DPS	distinct population segments
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

FAA	Federal Aviation Administration
FIIS	Fire Island National Seashore
FAO	Food and Agriculture Organization of the United Nations
FLiDAR	floating LiDAR [light detection and ranging]
FR	*Federal Register*
ft	feet
ft^2	square feet
G&G	geological and geophysical
G&G Final PEIS	*Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas: Final Programmatic Environmental Impact Statement*
GAP	General Activities Plan
GHG	greenhouse gas
GT	gross tonnage
ha	hectares
HAPC	Habitat Areas of Particular Concern
HRG	high-resolution geophysical
Hz	hertz
IPaC	Information for Planning and Consultation
in.	inch/inches
kg	kilograms
kHz	kilohertz
kJ	kilojoules
km	kilometers
km^2	square kilometers
km/hr	kilometers per hour
KOP	Key Observation Point
lb	pound
LiDAR	light detection and ranging
LIPA	Long Island Power Authority
L_{rms}	mammal hearing weighted (M-weighted) sound levels
m	meters
m^2	square meters
M-weighted	mammal hearing weighted
MARAD	U.S. Maritime Administration
MARPOL	International Convention for the Prevention of Pollution from Ships
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
mi	miles
mi^2	square miles
Mid-Atlantic EA	*Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment*
mm	millimeters
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service

MOU	Memorandum of Understanding
MPG	Marine Planning Guidelines
ms	milliseconds
MW	megawatts
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
n.d.	no date
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NH_3	ammonia
NHPA	National Historic Preservation Act
NCCOS	National Centers for Coastal Ocean Science
nm	nautical miles
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOMAD	Naval Oceanographic and Meteorological Automated Device
NOS	National Ocean Service
NO_x	nitrogen oxides
NPS	National Park Service
NRHP	National Register of Historic Places
NWP	Nationwide Permit
NYPA	New York Power Authority
NYSDEC	New York State Department of Environmental Conservation
O_3	ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPAREA	Military Operating Area
PATON	private aids to navigation
Pb	lead
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
$PM_{2.5}$	particulate matter with aerodynamic diameters of 2.5 microns or less
PM_{10}	particulate matter with aerodynamic diameters of 10 microns or less
ppt	parts per thousand
PSO	protected species observer
PTS	Permanent Threshold Shift
RFI	Request for Interest
RMS	root mean square
ROV	remotely operated underwater vehicle
SAP	Site Assessment Plan
SEL	sound exposure level
SEL_{cum}	cumulative sound exposure level
SHPO	State Historic Preservation Office

SMA	Seasonal Management Area
SMAST	School for Marine Science and Technology
SMB	squid, mackerel, butterfish (fisheries)
SO_2	sulfur dioxide
SOC	Standard Operating Condition
SODAR	Sonic Detection and Ranging
SO_x	sulphur oxides
SPL	sound pressure level
SPUE	sightings per unit effort
Task Force	BOEM’s New York Intergovernmental Renewable Energy Task Force
TIMS	Transportation Injury Mapping System
TNC	The Nature Conservancy
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
USACE	U.S. Army Corps of Engineers
U.S.C.	U.S. Code
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WEA	Wind Energy Area

1 INTRODUCTION

The U.S. Department of the Interior (USDOI), Bureau of Ocean Energy Management (BOEM) has prepared this Environmental Assessment (EA) to determine whether the issuance of a lease and approval of a Site Assessment Plan (SAP) within the Wind Energy Area (WEA) offshore New York would lead to reasonably foreseeable significant impacts on the environment and, thus, whether an Environmental Impact Statement (EIS) should be prepared before a lease is issued. BOEM identified the WEA (see Section 1.6 *Development of the New York Wind Energy Area* below) for the purposes of conducting this environmental analysis and considering the area for leasing.

1.1 Background

1.1.1 BOEM Authority and Regulatory Process

The Energy Policy Act of 2005, Public Law 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which authorized the Secretary of the Interior to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of wind energy development (see 43 U.S.C. § 1337[p][1][C]). The Secretary of the Interior delegated this authority to the former Minerals Management Service (MMS), now BOEM. Final regulations implementing this authority at Title 30 CFR Part 585 were promulgated on April 22, 2009.

In 2010, the creation of BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) focused on dividing regulatory responsibility for the offshore mineral development program and left regulatory responsibility for renewable energy entirely with BOEM. However, the Secretarial Order that created the two bureaus always envisioned that there would be a future division of administrative responsibility for renewable energy.

This division of responsibility for renewable energy would have BOEM continue to oversee the identification and leasing of offshore areas for renewable energy development and evaluation of proposed development plans; while BSEE's mission is to enforce safety, environmental, and conservation compliance with any associated legal and regulatory requirements during project construction and future operations. The bureaus are working together to implement these changes. Though the division of responsibility will require regulatory changes to 30 CFR Part 585, these changes will not substantially alter the process described in this EA. BOEM will retain authority to approve, approve with modification, or disapprove any SAPs, while BSEE will be in charge of the review of Facility Design and Fabrication and Installation Reports, oversee inspections/enforcement actions as appropriate, oversee closeout verification efforts, oversee facility removal inspections/monitoring, and oversee bottom clearance confirmation. Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision-making process.

BOEM's wind energy program occurs in four distinct phases, as shown in Figure 1-1 below.

1 Planning and Analysis

Identify suitable areas to be considered for wind energy project leases through collaborative, consultative, and analytical processes, including using the BOEM Intergovernmental Renewable Energy Task Force, public information meetings, and input from State and Federal agencies, Federally Recognized Tribes, and other stakeholders.

2 Lease Issuance

- BOEM issues a commercial wind energy lease.
- Gives lessee exclusive right to seek BOEM approval for the development of the leasehold.
- Lease does not grant the lessee the right to construct any facilities; the lease grants the right to use the lease area to develop its plans, which must be approved by BOEM before the lessee can move on to the next stage of the process (see 30 CFR 585.600 and 585.601).

3 Approval of a Site Assessment Plan (SAP)

- Lessee has one year after lease execution to submit a SAP, which contains a lessee's detailed proposal for the construction and/or installation of meteorological towers and/or buoys.
- Allows lessee to install and operate site assessment facilities for a specified term.
- BOEM must approve a SAP before lessee conducts site assessment activities on the leasehold.
- BOEM may approve, approve with modification, or disapprove a lessee's SAP (see 30 CFR 585.605-585.618).
- Once BOEM approves a SAP, a lessee has five years to complete site characterization and site assessment activities. A lessee would conduct surveys to support COP submittal during the site assessment term.

4 Approval of a Construction & Operation Plan (COP)

- Six months prior to the end of the five year site assessment term, a lessee submits a COP, which contains a detailed plan for the construction and operation of a wind energy project on the lease.
- Allows lessee to construct and operate wind turbine generators and associated facilities for a term of 25 years.
- BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS.
- BOEM may approve, approve with modification, or disapprove a lessee's COP (see 30 CFR 585.620-585.638).

Figure 1-1 Phases of BOEM's Wind Energy Planning/Authorization Process

The regulations also require that a lessee provide the results of shallow hazard, geological, geotechnical, biological, and archaeological surveys with its SAP or construction and operation plan (COP). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits for these site characterization activities, BOEM regulations require that a lessee include the results of these surveys in its application for SAP or COP approval (see 30 CFR 585.610[b] and 30 CFR 626 [a]). The flow chart below (Figure 1-2) outlines BOEM's evaluation of a SAP pursuant to the National Environmental Policy Act (NEPA).

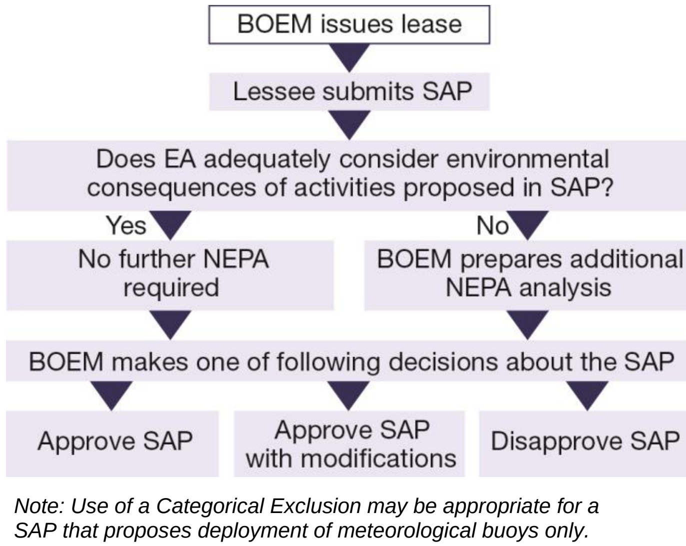

Figure 1-2 BOEM Evaluation of a SAP

Figure 1-3 outlines BOEM's evaluation of a COP pursuant to NEPA. Preparation of an EIS to evaluate the reasonably foreseeable environmental consequences associated with proposed COP activities would provide additional opportunities for public involvement pursuant to NEPA and the Council on Environmental Quality (CEQ) regulations at 40 CFR Parts 1500–1508. BOEM will use the EIS to decide whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR Part 585.638. Depending on the potential impacts and the effectiveness of mitigation measures associated with the activities proposed in the COP, BOEM has the discretion to limit activities, the area, and/or the time in which activities are performed in the WEA. These decisions will be informed by the project-specific NEPA analysis associated with the COP.

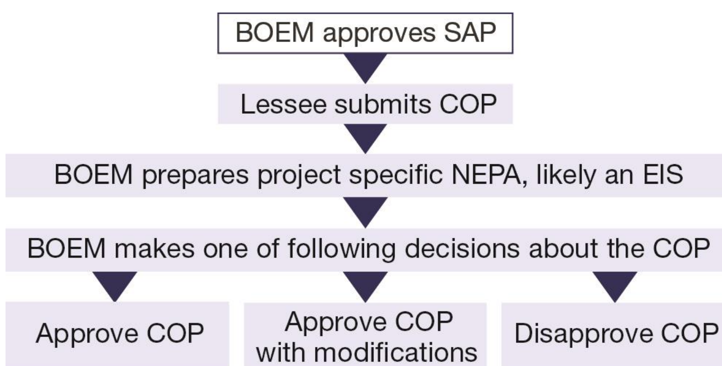

Figure 1-3 BOEM Evaluation of a COP

1.2 Purpose and Need

The purpose of the proposed action is to issue a lease and approve a SAP that would allow the lessee to assess the wind energy resources within the WEA offshore New York. BOEM's issuance of a lease is needed to ensure that survey activities carried out in support of a SAP and COP are conducted in a safe and environmentally responsible manner. BOEM approval of a SAP is needed to adequately assess wind and environmental resources of the WEA to determine if some or all areas within the WEA are suitable for, and could support, commercial-scale wind energy production.

1.3 Description of the Proposed Action

The proposed action is the issuance of a commercial wind energy lease for the WEA offshore New York and approval of site assessment activities on that lease. Of the alternatives considered in this EA, Alternative A, the proposed action, would result in site assessment activities over the largest geographic area. One other action alternative and a No Action alternative are also being considered in this EA. The alternatives are described in Section 2.

1.4 Objective of the Environmental Assessment

Pursuant to NEPA, 42 U.S.C. §§ 4321–4370f, as well as the CEQ regulations at 40 CFR 1501.3, this EA was prepared to assist BOEM in determining which OCS areas offshore New York should be the focus of BOEM's wind energy leasing efforts. This EA considers whether issuing leases and approving site assessment activities in the WEA offshore of New York would lead to reasonably foreseeable significant impacts on the human environment and, thus, whether an EIS should be prepared before leases are issued.

1.4.1 Information Considered

Information considered in scoping this EA includes:

- Comments received in response to the January 4, 2013 Request for Interest (RFI) and the May 28, 2014 Call for Information and Nominations (Call) associated with wind energy planning offshore New York;
- Public response to the May 28, 2014 Notice of Intent (NOI) to prepare this EA;
- Ongoing consultation and coordination with the members of BOEM's New York Intergovernmental Renewable Energy Task Force (Task Force);
- Ongoing or completed consultations with other federal agencies, including the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the U.S. Department of Defense (DOD), and the U.S. Coast Guard (USCG);
- Research and review of current relevant scientific and socioeconomic literature;
- *Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas: Final Programmatic Environmental Impact Statement*, February 2014 (G&G Final PEIS) (BOEM, 2014a);
- *Programmatic Environmental Impact Statement (PEIS) for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (MMS, 2007a);
- Relevant material from the *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina* (BOEM, 2015a);

- *Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development, Impacts of Offshore Wind on Tourism and Recreation Economics* (BOEM, 2012a);
- Relevant material from the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment* (Mid-Atlantic EA) (BOEM, 2012b);
- *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts* (BOEM, 2013a);
- *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts* (BOEM, 2014b);
- *Revised Environmental Assessment for Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia* (BOEM, 2015b);
- Biological Assessment for *Commercial Wind Lease Issuance, Associated Site Characterization Activities, and Subsequent Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia*, (BOEM, 2012e);
- Relevant material from the Endangered Species Act Section 7 Consultation Biological Opinion for *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas* (Atlantic OCS WEAs Biological Opinion) (NMFS, 2013a);
- *Development of Mitigation Measures to Address Potential Use Conflicts between Commercial Wind Energy Lessees/Grantees and Commercial Fishers on the Atlantic Outer Continental Shelf* (BOEM, 2014c);
- New York Department of State *Offshore Atlantic Ocean Study* (NYDOS, 2013);
- *Final Environmental Impact Statement for the Port Ambrose Project Deepwater Port Application* (USCG, 2015a);
- *Evaluation of Visual Impact on Cultural Resources/Historic Properties: North Atlantic, Mid-Atlantic, South Atlantic, and Florida Straits* (BOEM, 2012c);
- Relevant material from the *Project Plan for the Installation, Operation, and Maintenance of Buoy Based Environmental Monitoring Systems OCS Block 6931, New Jersey* (Fishermen's Energy of New Jersey, LLC, 2011); and
- Relevant material from the *Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf Offshore Delaware and New Jersey* (MMS, 2009a).

The G&G Final PEIS (BOEM, 2014a) includes a programmatic analysis of some of the same activities that are also part of the commercial wind lease issuance and site assessment activities considered in this EA.[1] Geological and geophysical (G&G) survey activities for three program areas (oil and gas, renewable energy, and marine minerals) during the 2012–2020 time period were evaluated in the G&G Final PEIS. Alternative C (which was the No Action alternative and assumed that alternative energy development would continue on a project-by-project basis) in the G&G Final PEIS included the same site characterization activities undertaken as part of renewable energy development that are evaluated in this EA for areas offshore New York. These activities include:

- High-resolution geophysical (HRG) surveys;
- Geotechnical/sub-bottom sampling; and
- Biological resource surveys using vessel and/or aerial surveys to characterize the WEA for (1) benthic habitats, (2) avian resources, and (3) marine fauna.

Although the geographic area evaluated in the G&G Final PEIS does not cover the area proposed for the New York WEA (it covered BOEM's Mid-Atlantic and South Atlantic Planning Areas), the PEIS proposed action included G&G survey activities identical to the types of survey activities evaluated in this EA. Consequently, the G&G Final PEIS *scenario* of impact-producing factors and the *types* of impacts that may result from G&G surveys is applicable to the New York WEA and surrounding areas. Additionally, although the Atlantic OCS varies regionally, the resources evaluated in the G&G Final PEIS would generally be affected in similar ways on the OCS in the vicinity of the New York WEA. Therefore, to avoid redundancy, BOEM has incorporated by reference the relevant portions of the G&G Final PEIS into this EA.

1.4.2 Scope of Analysis

This analysis is limited to the effects of lease issuance, conducting site characterization activities (i.e., surveys of the lease area), and approval of site assessment activities (i.e., construction and operation of a meteorological tower and/or two buoys) within the WEA. This analysis does not consider construction and operation of any commercial wind power facilities, which would be evaluated later in the process during the review of a COP. BOEM takes this approach based on several factors.

First, BOEM does not consider the issuance of a lease to constitute an irreversible and irretrievable commitment of agency resources toward the authorization of a commercial wind power facility. Section 1.1.1 of this EA describes BOEM's phased planning and authorization process for offshore wind development. Under this process, the issuance of a lease only grants the lessee the exclusive right to use the leasehold to (1) gather resource and site characterization information, (2) develop its plans, and (3) subsequently seek BOEM approval of its plans for the development of the leasehold.[2] The purpose of conducting the surveys and installing meteorological measurement devices is to assess the wind resources in the lease area and to characterize the environmental and socioeconomic resources and conditions. A lessee must collect this information to determine whether the site is suitable for commercial development and, if so, submit a COP with its project-specific design parameters, for BOEM's review.

[1] More information about the G&G Final PEIS is located at http://www.boem.gov/Atlantic-G-G-PEIS/.

[2] See the proposed renewable energy commercial lease form at 76 FR 55090.

Should a lessee submit a COP, BOEM would consider its merits, perform the necessary consultations with the appropriate state, federal, local, and tribal entities, solicit input from the public and the Task Force, and perform an independent, comprehensive, site- and project-specific NEPA analysis. This separate site- and project-specific NEPA analysis may take the form of an EIS and would provide additional opportunities for public involvement pursuant to NEPA and the CEQ regulations at 40 CFR Parts 1500–1508. BOEM would use this information to evaluate the potential environmental and socioeconomic consequences associated with the lessee-proposed project, when considering whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR 585.628. After lease issuance but prior to COP approval, BOEM retains the authority to prevent the environmental impacts of a commercial wind power facility from occurring.

Secondly, BOEM does not consider development of a commercial wind power facility within the WEA, and its attendant environmental impacts, to be reasonably foreseeable at this time. Based on the experiences of the offshore wind industry in northern Europe, the project design and the resulting environmental impacts are often geographically and design specific, and it would therefore be premature to analyze environmental impacts related to potential approval of any future COP at this time (Musial and Ram, 2010; Michel et al., 2007). There are a number of design parameters that would be identified in a project proposal, including foundation type, project layout, installation methods, and associated onshore facilities. However, the development of these parameters would be determined by information collected during site characterization and assessment activities conducted by the lessee after lease issuance. Each design parameter, or combination of parameters, would have varying environmental effects. Therefore, additional analyses under NEPA would be required before any future decision is made regarding construction of wind energy facilities on the OCS.

Additionally, while BOEM has issued 11 commercial wind energy leases offshore, only one lessee has submitted a COP to date. Construction of a commercial wind power facility on the OCS has yet to commence. Given the nascent nature of the offshore wind industry and market uncertainties, it is speculative at this time whether projects will actually be proposed within these areas.

Based on the above, this EA will only analyze two distinct BOEM actions in the WEA—lease issuance and SAP approval—and the reasonably foreseeable consequences associated with the following actions:

a. Conducting shallow hazard, geological, geotechnical, biological, and archaeological resource surveys in the potential lease area (site characterization).

b. Installing, operating, and decommissioning of a meteorological tower, meteorological buoys, or a combination of the two (site assessment).

1.5 Supporting NEPA Evaluations

BOEM has conducted several other environmental analyses that will be used to inform this EA, consistent with the CEQ directive at 40 CFR 1502.21 to incorporate information by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. BOEM has prepared six EAs that evaluated the same site characterization and site assessment activities considered in this EA, but in other geographic areas of the OCS.

The impacts associated with these activities were predominantly found to be negligible to minor; however, BOEM determined there would be potential for moderate impacts to threatened and endangered species from vessel strikes, and to marine mammals and sea turtles from noise associated with pile driving. These EAs have been prepared for the following states and are incorporated by reference in this EA for activities offshore New York. These documents are also referenced throughout Section 4.4 of this EA as appropriate.

1. New Jersey, Delaware, Maryland, and Virginia (BOEM, 2012b), available at http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Smart_from_the_Start/Mid-Atlantic_Final_EA_012012.pdf;
2. New Jersey and Delaware (MMS, 2009a), available at http://www.boem.gov/uploadedFiles/FinalEA_MMS2009-025_IP_DE_NJ_EA.pdf;
3. Rhode Island and Massachusetts (BOEM, 2013a), available at http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/State_Activities/BOEM%20RI_MA_Revised%20EA_22May2013.pdf;
4. Massachusetts (BOEM, 2014b), available at http://www.boem.gov/Revised-MA-EA-2014/;
5. Georgia (BOEM, 2014d), available at http://www.boem.gov/2014-017/; and
6. North Carolina (BOEM, 2015a), available at http://www.boem.gov/NC-EA-Camera-FONSI/.

1.6 Development of New York Wind Energy Area

BOEM identified the WEA through extensive collaboration and consultation with stakeholders including the Task Force, federal agencies, federally recognized tribes, the New York Department of State and other state agencies, the general public, and other relevant stakeholders beginning in November 2010. The Task Force held planning meetings in New York in November 2010, April 2012, September 2013, and April 2016.

1.6.1 Unsolicited Lease Request Submitted by the New York Power Authority

In September 2011, BOEM received an unsolicited request for a commercial lease offshore New York from the New York Power Authority (NYPA). NYPA worked together with the Long Island Power Authority (LIPA) and Consolidated Edison (ConEd) to propose a 350- to 700-megawatt offshore wind power project south of Long Island, NY, approximately 13 miles (mi) (21 kilometers [km]) off Rockaway Peninsula. The area initially proposed by NYPA is shown in Figure 1-4. In subsequent discussions, the USCG recommended a minimum of 1 nautical mile (nm) (1.9 km) separation distance from designated navigation lanes. NYPA incorporated this guidance in its lease request by an amendment filed on June 20, 2012, requesting additional lease area to compensate for the area lost by the increased setback distance.[3]

[3] NYPA's unsolicited lease request and the amendment can be viewed at http://www.boem.gov/Renewable-EnergyProgram/State-Activities/New-York.aspx.

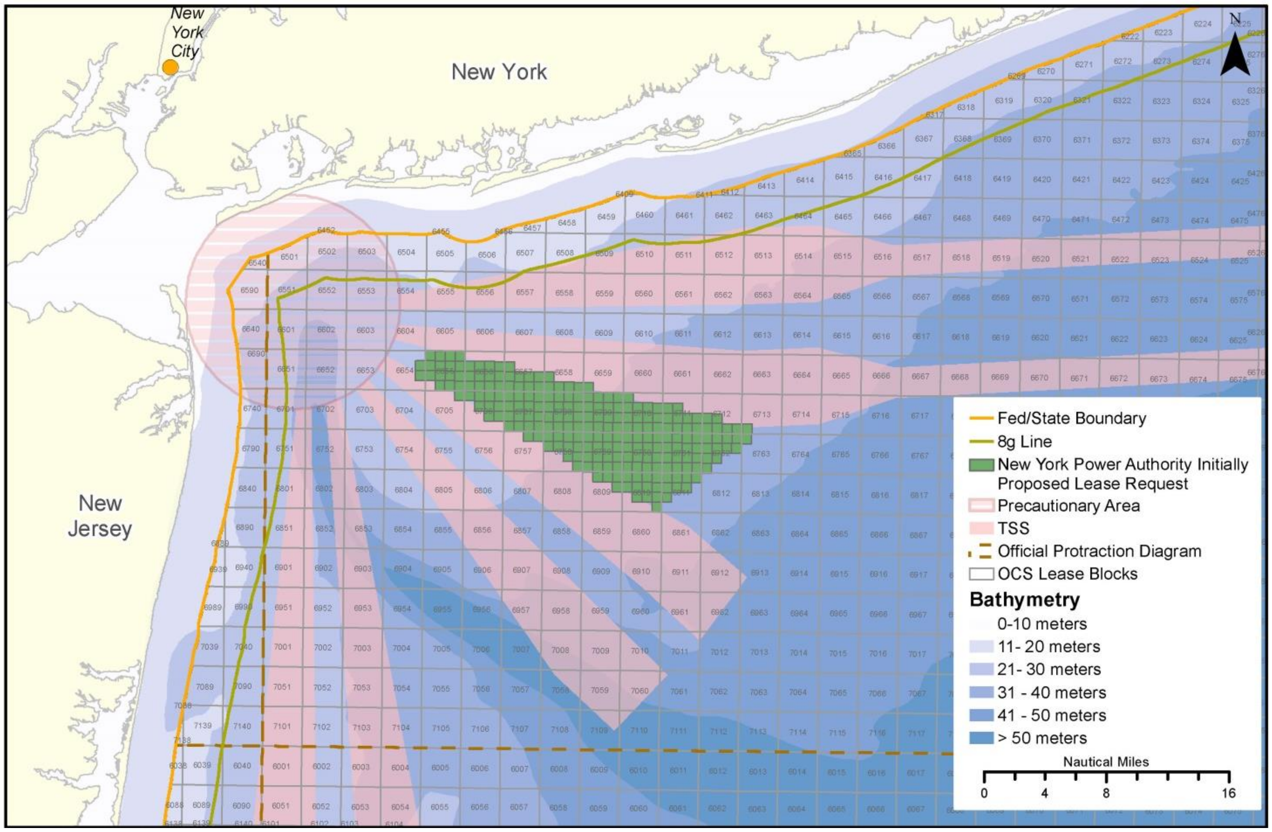

Figure 1-4 Area Initially Proposed by NYPA

1.6.2 Request for Interest

In response to the unsolicited NYPA proposal, as amended, BOEM published an RFI in the *Federal Register* on January 4, 2013 (Docket ID: BOEM-2012-0083; 78 FR 760-764) to assess whether other parties were interested in developing commercial wind facilities in the same area proposed by NYPA. In addition to inquiring about competitive interest, BOEM also sought public comment on the NYPA proposal, its potential environmental consequences, and the use of the area in which the proposed project would be located. BOEM received indications of interest from Fishermen's Energy, LLC, and Energy Management, Inc.

1.6.3 Call for Information and Nominations and NOI to Prepare an EA

BOEM reviewed the nominations received in response to the RFI and determined that competitive interest in the area proposed by NYPA exists. Therefore, BOEM stopped processing NYPA's unsolicited lease application and initiated the competitive leasing process pursuant to 30 CFR 585.211. Subsequently, on May 28, 2014, BOEM published in the *Federal Register* (Docket ID: BOEM-2013-0087; 79 FR 30645-30651) a Call for Information and Nominations offshore New York to seek additional nominations from companies interested in obtaining commercial wind energy leases within the Call Area (Figure 1-5). BOEM also sought public input on the potential for wind development in the Call Area, including comments on site conditions, resources, and existing uses of the area relevant to BOEM's wind energy development authorization process. Concurrently, BOEM published in the *Federal Register*

(Docket ID: BOEM-2014-0003; 79 FR 30643-30645) the NOI to prepare an EA for commercial wind leasing and site assessment activities offshore New York. Comments that BOEM received from stakeholders on the unsolicited commercial lease request, the RFI, the Call, the NOI, at Task Force meetings and workshops, and from BOEM studies assisted in the identification of space use conflicts within the Call Area.

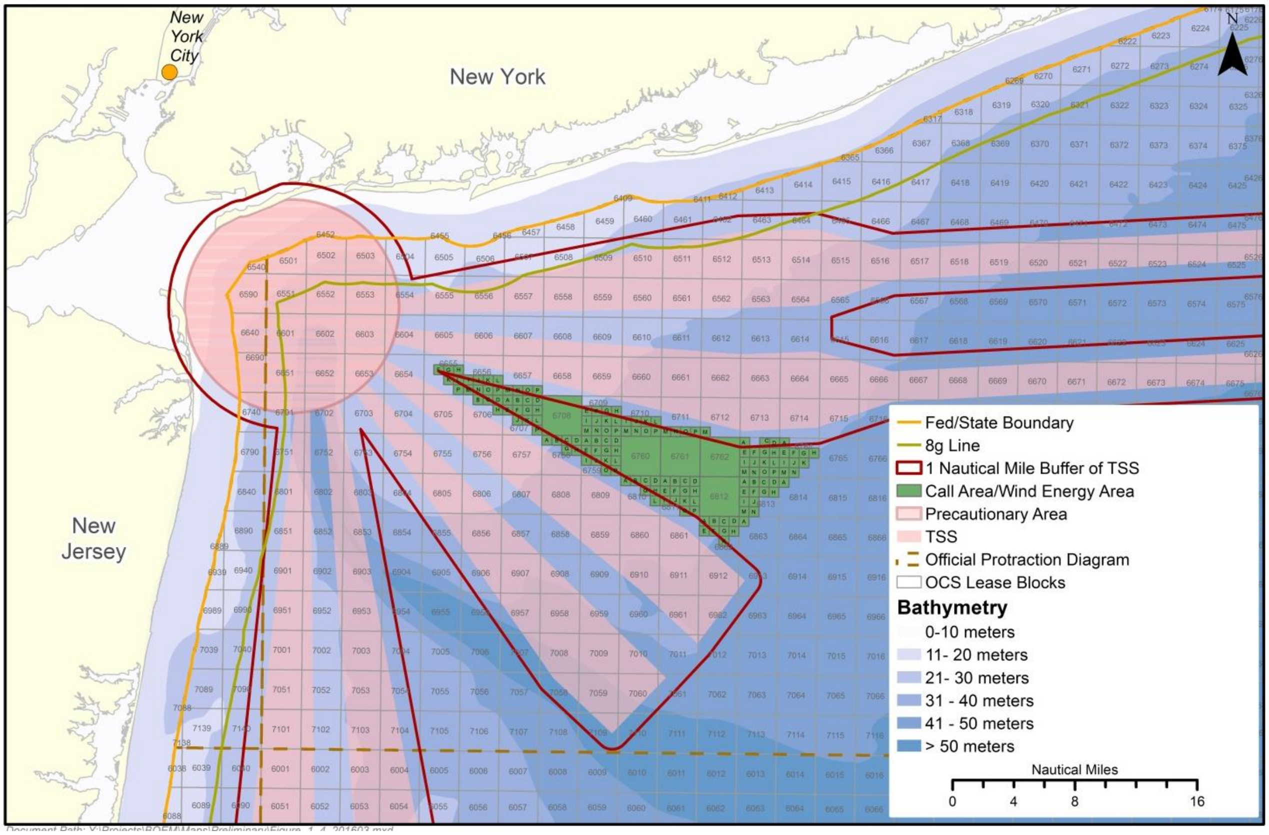

Figure 1-5 New York Call Area/Wind Energy Area

1.6.4 New York Area Identification

On March 16, 2016, BOEM released the Announcement of Area Identification (Area ID) (Appendix A). The WEA begins about 11 nm (20 km) south of Long Beach, NY, and extends approximately 26 nm (48 km) southeast along its longest portion. The WEA contains 5 whole OCS blocks and 148 sub-blocks (127 square miles [mi^2] [329 square kilometers (km^2)] or 81,130 acres [ac] [32,832 hectares (ha)]). Because the WEA is identical to the Call Area, see Figure 1-5 for a depiction of the WEA.

During the Area ID process, BOEM considered a range of information including, but not limited to, comments received on the RFI, Call, and NOI, information from the Task Force, input from federal and state agencies, comments from stakeholders, state and local renewable energy goals, and trends in global offshore wind development. Among the issues raised by stakeholders, BOEM identified the following three topics that warranted further review during the Area ID process:

1. Navigation and vessel traffic safety;
2. Commercial fisheries; and
3. Visual impacts.

BOEM initially considered one additional potential use conflict–a proposal by Liberty Natural Gas, LLC, to build the Port Ambrose Liquefied Natural Gas Deepwater Port (Port Ambrose) facilities in the New York Call Area. However, the project was vetoed by Governor Cuomo on November 12, 2015, and is no longer moving forward. Therefore, BOEM will not consider the impacts of the Port Ambrose project in this EA.

Navigation. The WEA is located between two Traffic Separation Schemes (TSSs) for vessels transiting into and out of the ports of New York and New Jersey. On January 21, 2015, First Coast Guard District and Sector New York convened a maritime stakeholder workgroup to discuss navigation concerns with representatives from the maritime industry, BOEM, the Port Authority, and other federal, state, and local partners. Following the workshop, on September 28, 2015, the USCG submitted a Risk Assessment of the New York Call Area that was based upon the USCG's Marine Planning Guidelines (MPG) (USCG, 2016). For New York, the USCG recommends that BOEM not allow the placement of permanent structures any closer than 2 nm (3.7 km) from the edge of the TSS lanes and 5 nm (9.3 km) from the entry/exit of the TSS lanes. The USCG also acknowledged the possibility that risks can be mitigated to reduce the minimum setback distance in the future, pending more detailed analysis from a project-specific Navigational Safety Risk Assessment.

Commercial fisheries. In April 2014, BOEM held a commercial fisheries workshop on Long Island in Montauk, NY to explain the offshore leasing process and discuss best management practices to reduce potential user conflicts. Area fishermen participated in the meeting, which included breakout sessions for one-on-one discussions, and their input was used to help build on the recommendations contained in the report titled *Development of Mitigation Measures to Address Potential Use Conflicts between Commercial Wind Energy Lessees/Grantees and Commercial Fishers on the Atlantic Outer Continental Shelf* (BOEM, 2014c). In November 2015, BOEM held three workshops with commercial and recreational fisherman in Point Pleasant, NJ; Long Beach, NY; and Riverhead, NY. The goal of the workshops was to obtain fishing industry input on how the Call Area is used for fishing to help BOEM determine which areas should be made available for a lease. During the workshop, fishermen stated that the New York Call Area is heavily used for commercial fishing, with Atlantic sea scallop (*Placopecten magellanicus*) and longfin squid (*Loligo pealeii*) as the primary target species caught in the Call Area.

Viewshed. The National Park Service (NPS) and New York State Historic Preservation Office (SHPO) expressed concerns regarding the potential for visual impacts to onshore areas from wind power development (primarily Fire Island National Seashore [FIIS], Gateway Recreation Area, and various National Historic Landmarks). BOEM conducted stakeholder outreach with NPS, the New York SHPO, and the New Jersey SHPO.[4] Under BOEM's commercial wind energy leasing process, full identification of historic properties and consideration of visual impacts from commercial wind development (wind turbines) does not occur until BOEM's

[4] BOEM met with the SHPOs and NPS in August and November of 2015, respectively (see Figure 1-6).

review of a lessee's COP, during which Section 106 consultations under the National Historic Preservation Act (NHPA) will be conducted.

Ultimately, BOEM decided not to expand the existing 1 nm (1.9 km) navigation buffer, nor remove additional areas for commercial fishing or viewshed concerns, at this stage. BOEM reserves the right to impose additional restrictions or mitigations if necessary, pending the outcome of project-specific plans and/or consultations.

This EA evaluates potential effects of the proposed action (site characterization and site assessment); BOEM will evaluate the potential impacts of commercial wind energy development in the WEA in the event that a lessee submits a COP.

1.6.5 Summary

At this time, BOEM is not considering, and this EA does not support, any decisions for the construction and operation of wind energy facilities on a lease that may be issued in the New York WEA. If, after a lease is issued, a lessee proposes to construct a commercial wind energy facility, the lessee would be required to submit a COP to BOEM for review and approval. BOEM would then conduct a project-specific NEPA review, which would include the lessee's proposed transmission line(s) to shore. During the NEPA review of a COP, BOEM will also analyze a no-action alternative. BOEM will use the project-specific NEPA review to decide whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR Part 585.638.

Figure 1-6 depicts the process BOEM has taken to analyze and make determinations related to the New York WEA.

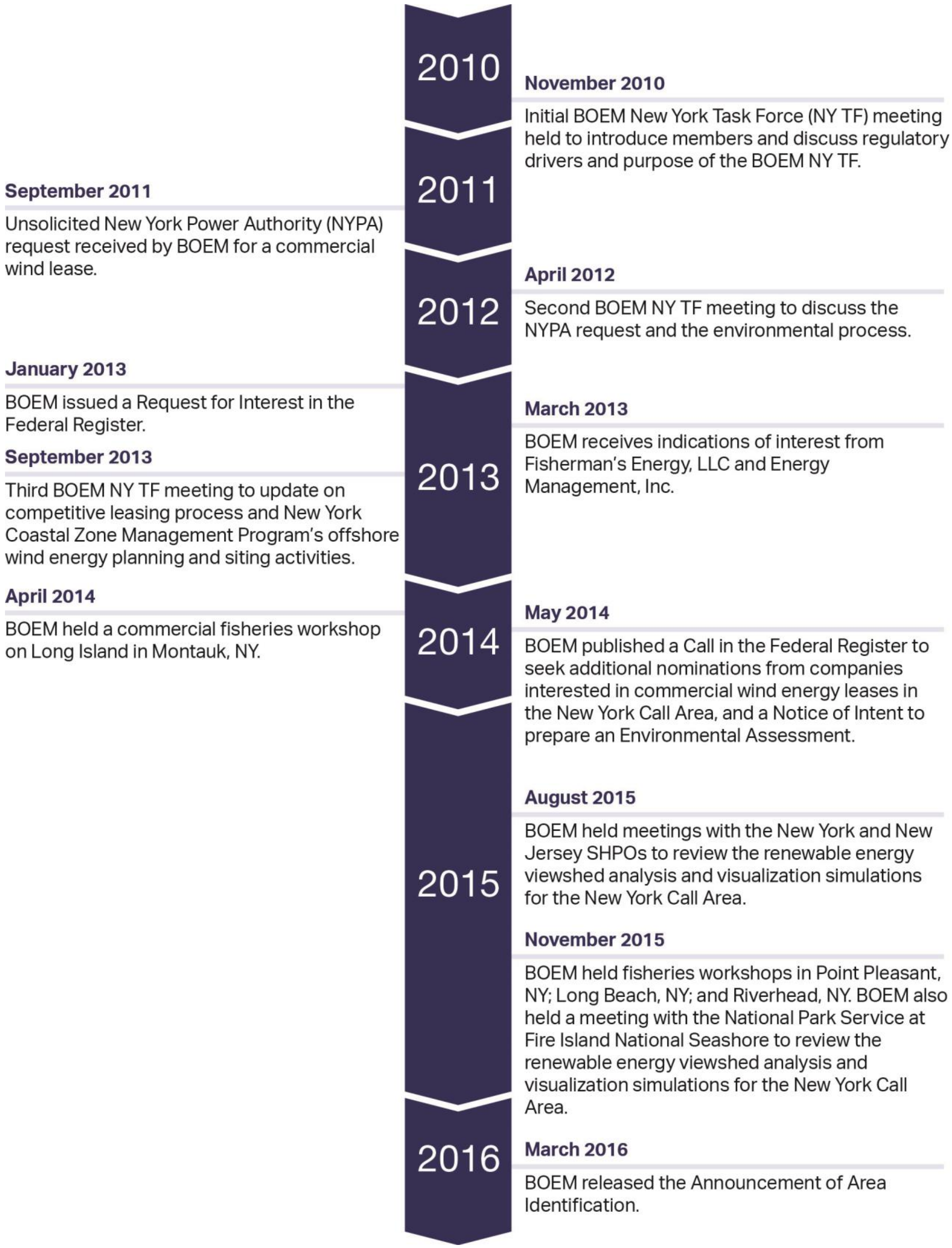

Figure 1-6 Wind Energy Area Identification Process Timeline

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2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes two action alternatives and the No Action Alternative and for lease issuance and the approval of site assessment activities within the WEA offshore New York. The alternatives are described in Table 2-1 and the following sections.

Table 2-1
Alternatives Considered

Alternative	Description
Alternative A (Preferred Alternative) – Offer for lease the entire WEA, restricting site assessment structure placement within 1 nm (1.9 km) of the TSS	Under Alternative A, lease issuance and approval of site assessment activities could occur in the entire WEA; however, no site assessment structures (i.e., meteorological tower and/or buoys) could be placed on the portion of the sub-blocks within 1 nm (1.9 km) of the TSS.
Alternative B – Offer for lease the entire WEA, restricting site assessment structure placement within 2 nm (3.7 km) of the TSSs	Under Alternative B, lease issuance and site characterization activities could occur in the entire WEA; however, no site assessment structures (i.e., meteorological tower and/or buoys) could be placed within 2 nm (3.7 km) of the TSS.
Alternative C – No Action	Under Alternative C, no lease would be issued nor site assessment activities approved in the WEA at this time.

TSS = Traffic Separation Scheme

Alternatives A and B were identified as a result of extensive coordination with the Task Force; relevant consultations with federal, state, and local agencies; and extensive input from the public and potentially affected stakeholders. Based on recommendations by the USCG, BOEM refined the action alternatives to exclude the placement of site assessment structures in certain areas of the WEA that border TSSs due to the potential for navigational use/safety conflicts. Additional alternatives considered, but not analyzed in detail are discussed in Section 2.4 below.

2.1 Alternative A (Proposed Action) – Leasing of the Whole Wind Energy Area Restricting Site Assessment Structure Placement Within 1 Nautical Mile of a TSS

Alternative A (the preferred alternative) is the issuance of a commercial wind energy lease and approval of site assessment activities on the leasehold within the whole WEA; however, BOEM has excluded from leasing those aliquots within 1 nm (1.9 km) of the two TSSs that border the WEA (Figure 2-1) (the Hudson Canyon to Ambrose TSS and the Ambrose to Nantucket TSS), except those transected by the setback line. Aliquots transected by the setback line would be offered for lease; however, the portions of those aliquots located within 1 nm (1.9 km) of the TSSs would not be available for construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys).

The WEA begins about 11 nm (20 km) south of Long Beach, NY, and extends approximately 26 nm (48 km) southeast along its longest portion (Figure 2-1). The entire WEA is approximately 81,130 ac (32,830 ha), including all OCS blocks in the 1 nm (1.9 km) TSS buffer zone, and contains 5 whole OCS blocks and 148 sub-blocks. Portions of 68 sub-blocks are in the

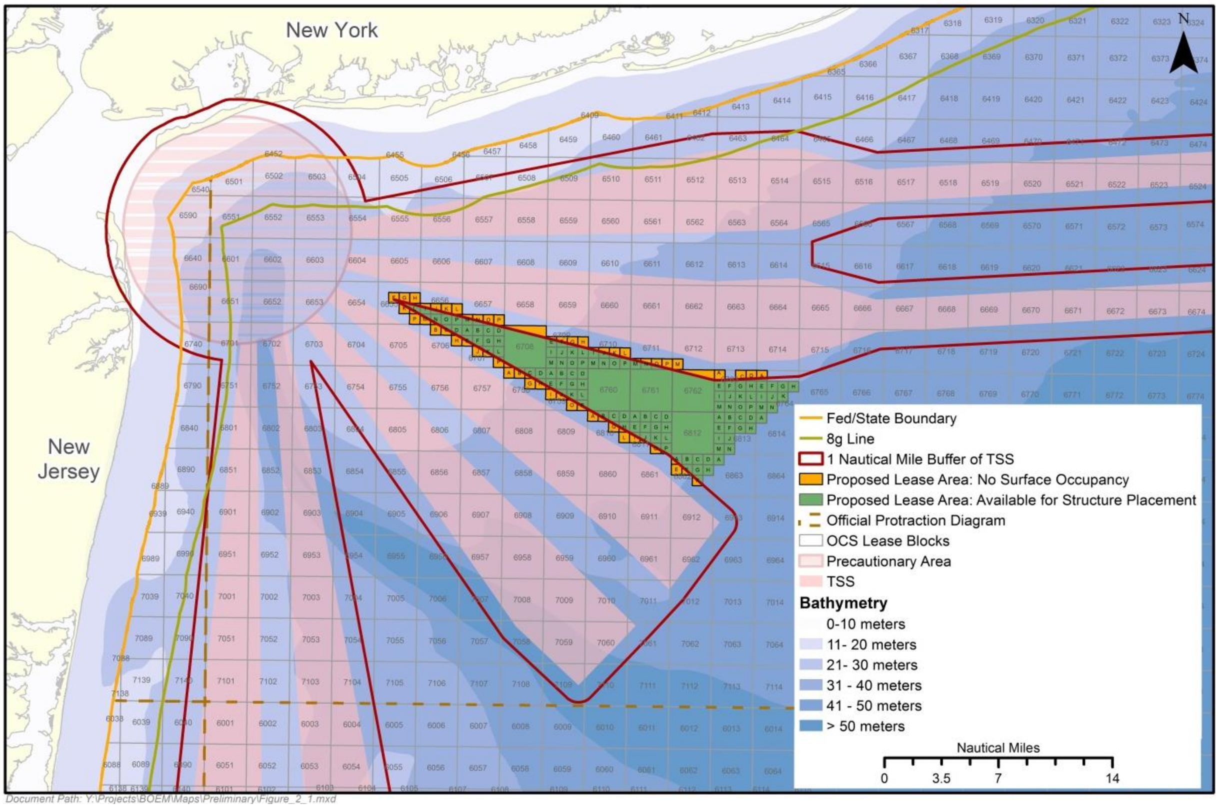

Figure 2-1 Alternative A Lease Area

1 nm (1.9 km) TSS buffer zone and therefore would not be available for placement of a meteorological tower and/or two buoys.

Table 2-2 shows the number of whole and partial OCS blocks within the Alternative A WEA as well as the blocks available for placement of site assessment structures.

Alternative A assumes that the lessee would undertake the maximum number of site characterization surveys (i.e., shallow hazards, geological, geotechnical, archaeological, and biological surveys) in their lease area. Under Alternative A, assuming that the lessee chooses to install meteorological facilities, BOEM anticipates that no more than one meteorological tower, two meteorological buoys, or some combination of a meteorological tower and buoy(s) would be installed within the WEA.

Under Alternative A, BOEM would require the lessee to avoid or minimize potential impacts on the environment by complying with various requirements. These requirements are referred to as Standard Operating Conditions (SOCs)[5] and would be implemented through lease stipulations and/or as conditions of SAP approval. The impacts of Alternative A on environmental and socioeconomic resources are described in detail in Section 4.4 *Alternative A – The Proposed Action*.

[5] SOCs are provided in Appendix B of this EA and described further in Section 2.5.

Table 2-2
Alternative A Number of Whole OCS Blocks and Sub-blocks in the WEA, in the TSS Buffer Zone, and Available for Placement of Site Assessment Structures

Description	Number
Number of Whole OCS Blocks in WEA	5
Sub-blocks in WEA Not Included in the 5 Whole OCS Blocks	148
Total Number of Sub-blocks in WEA	228[(1)]
Sub-blocks Overlapping TSS Buffer Boundary (Not Available for Site Assessment Structure Placement)[(2)]	68
Number of Sub-blocks Available for Site Assessment Structure Placement	160

[(1)] There are 16 sub-blocks in a single OCS block.
[(2)] For purposes of estimation in this EA, BOEM assumes site assessment structures would not be placed in partial sub-blocks. Note there is one sub-block fully within the TSS buffer zone that is not available for site assessment structure placement.

2.2 Alternative B – Leasing of the Whole Wind Energy Area Restricting Site Assessment Structure Placement Within 2 Nautical Miles of a TSS

Alternative B, like Alternative A, is the issuance of a commercial wind energy lease for the entire WEA; however, BOEM would not allow construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys) within 2 nm (3.7 km) of the two TSSs that border the WEA (Figure 2-2). For aliquots transected by the 2 nm (3.7 km) setback line, BOEM would not allow construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys) on the portions of those aliquots within 2 nm (3.7 km) of the TSSs.

As described in Section 1.6.4 *New York Area Identification*, USCG has developed MPG to determine appropriate separation distances for the siting of offshore structures near shipping routes. According to the USCG's evaluation of the WEA, a 2 nm (3.7 km) buffer for all permanent structures (including meteorological towers and/or buoys) around the TSSs would further reduce the risk of collision/allision. The USCG's letter also recommended a 5 nm (9.3 km) buffer from the entry/exit of the TSSs. BOEM did not consider the 5 nm (9.3 km) buffer under Alternative B, given that independent staff analysis of automatic identification systems (AIS) data found that 90 percent of the vessels traversing the TSS lanes position themselves toward the outer edges of the lanes, away from the WEA, which creates a de facto buffer that could further reduce the risk associated with construction. Further, the TSS to the north of the WEA has a Shipping Safety Fairway established, whereby vessels transiting the TSS are funneled into the Traffic Lane and are less likely to approach the entrance/exit from different directions.

BOEM strives to ensure that lessees have sufficient flexibility to microsite a project within their lease areas, especially given that data critical to siting decisions (e.g., results from geophysical and geotechnical surveys, environmental surveys, site specific resource assessment data, etc.) will not be gathered until after lease issuance. That data collection and analysis could demonstrate that a restriction on the construction of permanent structures (e.g., meteorological

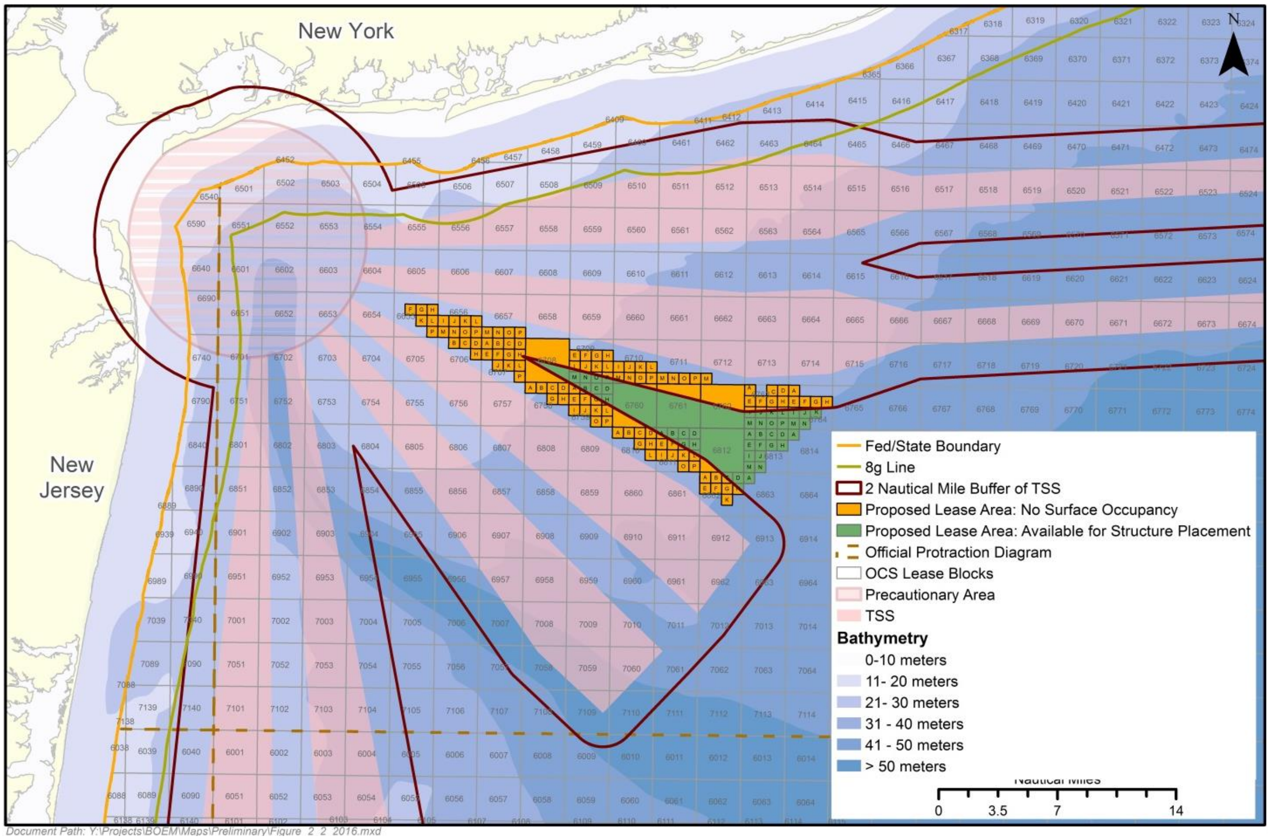

Figure 2-2 Alternative B Lease Area and No Surface Occupancy Area

towers, or future wind turbines) within 2 nm (3.7 km) of the TSS lanes is unnecessary, and/or that mitigation measures can partially or wholly resolve conflicts. Therefore, BOEM did not consider the reduction of the lease area under Alternative B.

Table 2-3 shows the number of whole and partial OCS blocks under Alternative B WEA, as well as the blocks available for placement of site assessment structures.

Table 2-3
Alternative B Number of Whole OCS Blocks and Sub-blocks Available for Leasing, the TSS Buffer Zone, and Available for Placement of Site Assessment Structures

Description	Number
Number of Whole OCS Blocks Available for Leasing	5
Total Number of Sub-blocks Available for Leasing	148
Sub-blocks Overlapping TSS Buffer Boundary (Not Available for Structure Placement)(1)	68
Number of Sub-blocks Available for Site Assessment Structure Placement	59

(1) For purposes of estimation in this EA, BOEM assumes site assessment structures would not be placed in partial sub-blocks.

Alternative B assumes that the lessee would undertake the maximum amount of site characterization surveys (i.e., shallow hazards, geological, geotechnical, archaeological, and biological surveys) in the leased area, which would be the same as Alternative A. Under Alternative B, assuming that the lessee chooses to install meteorological facilities, BOEM anticipates that no more than one meteorological tower and/or two meteorological buoys, or some combination of a meteorological tower and buoy(s) would be installed within the WEA. However, those site assessment facilities would not be installed within 2 nm (3.7 km) of a TSS. The total area under Alternative B that would be available for the placement of site assessment facilities is 37 percent of the area under Alternative A. The impacts of Alternative B on environmental and socioeconomic resources are described in Section 4.5 *Alternative B*.

2.3 Alternative C – No Action

Under the No Action Alternative, no wind energy lease would be issued, and no site assessment activities would be approved within the WEA offshore New York. Although site characterization surveys are not under BOEM's jurisdiction and could still be conducted, these activities would not be likely to occur without the possibility of a commercial lease for renewable energy development. Alternative C will serve as the baseline against which action alternatives are evaluated.

2.4 Alternatives Considered but Not Analyzed in Detail

BOEM eliminated from further consideration alternatives that did not meet the purpose and need and/or were not reasonable. In addition, BOEM strives to ensure that lessees have sufficient flexibility to microsite a project within their lease areas, especially given that data critical to siting decisions (e.g., results from geophysical and geotechnical surveys, environmental surveys, site specific resource assessment data, etc.) will not be gathered until after lease issuance. That data collection and analysis could demonstrate that conflicts either do not exist or can be resolved, in whole or in part, through mitigation measures.

The following additional alternatives were identified during the scoping process. For the reasons identified under each, they are not considered for detailed analysis in this EA.

- *Measures to protect squid from potential injurious sound*: BOEM received comments from the squid fishing industry asserting that noise produced during high resolution geophysical surveys and construction (e.g., pile driving of a meteorological tower foundation) could result in severe acoustic trauma in squid, resulting in direct mortality or disruption of spawning activity of squid in the potential lease area. BOEM assessed the study cited by industry, Andre et al. (2011), as well as Mooney et al. (2010), to evaluate if a seasonal prohibition of noise producing activities was a reasonable alternative to consider in this assessment. Mooney et al. establishes that squid are most sensitive to frequencies between 100 and 300 hertz (Hz) and that the sensitivity is from particle motion and not sound pressure levels (SPLs). Andre et al. (2011), establishes injury to squid when exposed to noise at a frequency of 50 to 400 Hz at 157 ± 5 decibels (dB) re 1 micropascal (μPa) in 20- to 200-liter tanks. The only identified sound sources that would be in the hearing range of squid are active sub-bottom profilers (i.e., boomers; see Table 3-3) and pile driving noise from construction of a meteorological tower. Both these activities are anticipated to occur primarily in the summer months when the weather is favorable to conducting these activities. In assessing the potential for impacts to the squid resource from the proposed activity it is important to understand the environmental baseline. The squid fishery occurs in the potential lease area between June and September. The squid fishery is prosecuted by between 15 and 50 vessels in each of those peak months in the New York Bight. At the same time, the traffic lanes to and from the Port of New York and New Jersey are heavily trafficked by cargo ships. Both of these activities produce low frequency noise from engine and propeller cavitation. In the case of fishing vessels, pressure fields are generated from the pulling of trawl nets through the water for the purpose of corralling squid into the nets. There is also the direct mortality caused by fishing itself. Neither of these activities appears to have resulted in spawning failure of longfin squid in the New York Bight. Given the mobile nature of the proposed HRG surveys and therefore limited period of noise exposure from this source there is no evidence to suggest that squid injury will occur. The limited spatial and temporal noise exposure from potential pile driving and the ability of squid to swim away from sound that is potentially injurious also does not support population effects to squid. Andre et al. (2011) did not record the actual sound exposure level (SEL) to better understand the energy and particle motion necessary for the onset of injury given that Mooney et al. (2010) suggests that particle motion and not sound pressure is the more appropriate measure for squid. Thus it is not reasonable to assume that the prohibition of sub-bottom surveys and pile driving during the summer months would confer any additional conservation benefit to the squid resource given the environmental baseline. Furthermore, the prohibition of noise producing activities in the summer would not support the purpose and need of the proposed action as it would effectively prohibit activity at the time when the offshore wind industry would be conducting site characterization and site assessment activities. Thus, this alternative will not be further considered in this assessment.

- *Exclusion of meteorological tower placement areas for potential impacts to the Atlantic sea scallop resource*: The scallop industry has submitted comments that scour around offshore wind facility foundations may cause near-field and far-field suspended sediment that could potentially smother valuable scallop resources in the proposed lease area. Commenters also assert the potential for direct mortality of the scallop resource due to the placement of facility foundations on a scallop bed. BOEM has evaluated whether an alternative in this assessment is justified to protect the scallop resources in the proposed lease area. Although some low to medium density scallop beds have been identified in the potential lease area, BOEM already requires in its regulations that SAPs provide a description of "benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish, plankton, sea grasses, and other plant life" that could be impacted from the proposed activities (see §585.611(b)(3)). BOEM will thus require the identification of scallop beds that could be impacted by the construction of a meteorological tower as a matter of its existing process and authority. Thus an additional alternative prohibiting meteorological tower construction on potential scallop beds is not warranted, as it is part of Alternative A and will thus not be evaluated further in this assessment.
- *Exclusion of areas from leasing due to conflicts between commercial scale wind facility and fishing*: While stakeholders expressed concerns over conflicts with fishing during scoping and preparation of this EA, those concerns focused on commercial wind power

facilities[6] (the installation and operation of wind turbines) rather than activities associated site characterization and site assessment activities (the installation and operation of a meteorological tower and/or two buoys), the subject of this EA. As discussed in Section 1.4.2 of this EA, installation, construction, and operation of a full-scale wind energy facility are outside the scope of this EA. Should a lessee submit a COP, BOEM would consider its merits, perform the necessary consultations with the appropriate state, federal, local, and tribal entities, solicit input from the public and the Task Force, and perform an independent, comprehensive, site- and project-specific NEPA analysis. Therefore, BOEM considered, but did not analyze in detail, alternatives that would eliminate areas from leasing due to concerns over conflicts with fishing that are associated with the construction of a commercial-scale offshore wind facility. Such alternatives would be evaluated by BOEM in detail later, if the New York WEA is leased and the lessee submits a COP.

- *Exclusion of areas from leasing due to visual impacts from a commercial scale wind facility*: While stakeholders expressed concerns over visual impacts to onshore resources during scoping and preparation of this EA, those concerns focused on commercial wind power facilities (the installation and operation of wind turbines) rather than site characterization and site assessment activities (the installation and operation of a meteorological tower and/or two buoys), the subject of this EA. As discussed in Section 1.4.2 of this EA, installation, construction, and operation of a full-scale wind energy facility are outside the scope of this EA. Should a lessee submit a COP, BOEM would consider its merits, perform the necessary consultations with the appropriate state, federal, local, and tribal entities, solicit input from the public and the Task Force, and perform an independent, comprehensive, site- and project-specific NEPA analysis. Therefore, BOEM considered, but did not analyze in detail, alternatives that would eliminate areas from leasing due to concerns regarding visual impacts. Such alternatives would be evaluated by BOEM in detail later, if the New York WEA is leased and the lessee submits a COP.
- *Geographic and/or additional seasonal restrictions for North Atlantic right whales:* In previous EAs, BOEM has considered alternatives that included seasonal and/or geographic restrictions on activities associated with lease issuance, for endangered North Atlantic right whales. Currently, BOEM's SOCs include seasonal restrictions for pile driving. However, the low, sporadic, and variable distribution of the species within the New York Bight does not delineate any high density seasonal or geographic patterns. In addition, this area has not been identified as a calving or feeding ground, nor does it contain any designated critical habitat. BOEM also received recommendations from stakeholders that BOEM require additional mitigation measures during site characterization and site assessment activities in order to provide further protections for North Atlantic right whales. Additional mitigations included, but were not limited to, seasonal restrictions on sub-bottom profiling activities, a 500-meter (m) exclusion zone during sub-bottom profiler use, site specific risk assessment and marine mammal avoidance plans and the use of sound reduction devices during pile driving activities.

[6] The exception is the concern expressed by the squid fishing industry with respect to injurious sound, which is addressed earlier in this section.

BOEM conducted a review of the recommendations in light of the best available science and compared them to existing lease requirements, in line with BOEM's SOCs. Given the short duration and limited scope of the proposed action, which includes BOEM's SOCs to minimize any potential impacts to North Atlantic right whales, BOEM determined that the recommendations for additional mitigations did not support a reasonable alternative. As a result, a geographic and/or seasonal restriction alternative, based on right whale occurrence, was considered but not analyzed in detail in this assessment.

- *Analysis of Areas outside of the WEA*: As discussed in Section 1.2 *Purpose and Need*, the activities BOEM is considering in this EA are necessary to determine the suitability of the WEA. Therefore, issuing leases and approving site assessment activities outside of the New York WEA would not achieve the purpose and need of the proposed action and was eliminated from further consideration in this EA. In addition, the New York WEA was identified after more than 4 years of review and consideration (see Section 1.6.4 of this EA). There are currently no expressions of commercial interest offshore New York outside of the WEA. Therefore, BOEM has no duty under OCSLA or its renewable energy regulations to expand the scope of its analysis beyond areas currently proposed (i.e., the New York WEA). If an area were to be identified or proposed, then BOEM would conduct a planning and leasing process similar to the process now occurring for the New York WEA, including the preparation of a separate EA.

2.5 Standard Operating Conditions

BOEM has developed several measures, called SOCs, as part of the proposed action (Alternative A) and Alternative B to mitigate, minimize or eliminate impacts on protected species of marine mammals, sea turtles, fish, and birds listed as threatened or endangered under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). Conditions to minimize or eliminate impacts on marine mammals and sea turtles include vessel strike avoidance and marine debris awareness measures; protected species observers (PSOs), monitoring and exclusion zones; sound source verification, "ramp up," "soft start" and shutdown procedures; visibility, seasonal and frequency-dependent restrictions for various activities; as well as multiple reporting requirements. Conditions to minimize or eliminate impacts on avian species include the use of red-flashing aviation obstruction lights on a meteorological tower, requiring the use of navigation lights that meet USCG private aids to navigation (PATON) requirements for shipping vessels, requiring that additional lights on towers only be used when necessary and be hooded downward, and requiring that meteorological towers be designed to avoid using guy wires. Conditions to minimize or eliminate impacts on fish and essential fish habitat include "soft start" pile driving measures. The SOCs are fully described in Appendix B, and detailed SOCs are discussed in relevant sections of Chapter 4 of this EA. These SOCs were developed through the analyses presented in Section 4.4 *Alternative A – The Proposed Action* and through consultation with other federal and state agencies.

3 SCENARIO OF REASONABLY FORESEEABLE ACTIVITY AND IMPACT-PRODUCING FACTORS

The purpose of this chapter is to describe the impact-producing factors under the proposed action. Although the geographic area evaluated in the G&G Final PEIS (BOEM, 2014a) does not cover the area proposed for the New York WEA, the PEIS scenario of reasonably foreseeable activities and impact-producing factors for site characterization that included G&G survey activities, namely, multi-beam side scan and single beam sonar, sub-bottom profiling and cone penetrometer testing, boring and/or vibracoring, identical to the types of survey activities evaluated in this EA. The G&G Final PEIS also describes the activities that would be conducted during buoy installation under the proposed action of this EA. Therefore, BOEM has incorporated the G&G Final PEIS into Section 3 of this EA by reference to the extent practicable. Because installation, operation, and decommissioning of meteorological towers are not described in the G&G Final PEIS (BOEM, 2014a), Section 3.2.2.1 of this EA provides a full description of that process.

This EA relies on BOEM's *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* (BOEM, 2015c) and *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM, 2015d) to describe the geophysical and geotechnical survey methods for site characterization activities that could occur under the proposed action considered in this EA. Descriptions of the G&G activities specific to the New York WEA are provided below.

3.1 Assumptions for Reasonably Foreseeable Scenario

This EA uses a reasonably foreseeable scenario of site characterization surveys and site assessment activities that could be conducted as a result of the proposed action. Site characterization includes shallow hazards, geological, geotechnical, archaeological, and biological surveys. Site assessment includes the installation, operation, and decommissioning of data collection devices (i.e., a meteorological tower and/or buoys) under approved SAPs.

BOEM's assumptions for the proposed action scenario (Alternative A) in this EA are described below.

Overall Scenario Assumptions

- BOEM would issue one lease in the WEA.
- A lessee would construct no more than one meteorological tower, deploy one to two buoys, or a combination (e.g., one or two buoys and no meteorological tower *or* one meteorological tower and zero, one or two buoys).

Surveying and Sampling Assumptions

- Site characterization would likely take place in first 3 years following execution of lease (based on the fact that a lessee would likely complete the majority of site characterization prior to installing a meteorological tower and/or buoy, which would leave approximately 2 years for site assessment).

- Lessees would likely survey the whole WEA 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 buoy areas likely to be surveyed first.[7]
- The lessee would likely survey all OCS blocks in the TSS buffer zone since cable may be placed in the buffer zone area (although no site assessment structure placement would be allowed in the TSS buffer zone).
- 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.

Installation, Decommissioning, and Operations and Maintenance Assumptions

- Meteorological tower installation would likely take approximately 1 to 10 weeks.
- Tower decommissioning would likely take less than 1 week.
- Buoy installation and decommissioning would likely take approximately 1 day each.
- Tower and/or buoy installation and decommissioning would likely occur between April and August (due to weather).
- Tower and/or buoy installation would likely occur in Year 2 after lease execution.
- Tower and/or buoy decommissioning would likely occur in Year 6 or Year 7 after lease execution.

Assumptions for Generation of Noise

Under the reasonably foreseeable scenario of the proposed action, the following activities and equipment would generate noise:

- HRG survey equipment,
- Drilling and sediment sample collection as part of G&G surveys,
- Vessel engines during site characterization surveys and meteorological tower installation, operations and maintenance, and decommissioning,
- Installation of a meteorological tower, including pile driving, and
- Diesel engines on a meteorological tower and/or buoys where solar/wind are not used for power.

Details on the level of noise generated from HRG survey equipment are described in Section 3.2.1.1 *High-Resolution Geophysical Surveys*. Because the effects of pile driving noise can vary depending on the marine species being evaluated, details of pile driving noise are

[7] Although this EA assumes site characterization surveys for the entire WEA are likely to occur during the 5-year site assessment term, a lessee may survey smaller portions of the WEA to prepare a COP; they may also choose to survey the remainder of the WEA after a COP has been submitted. Thus, surveying may occur in phases.

provided separately under *Marine Mammals*, *Sea Turtles*, and *Finfish, Invertebrates, and Essential Fish Habitat* in Section 4.4.

The following sections outline the proposed action scenario (Alternative A).

3.2 Routine Activities

3.2.1 Site Characterization Surveys

BOEM regulations require that the lessee provide the results of a number of surveys with its SAP (30 CFR 585.610–585.611) and COP (30 CFR 585.626(a)(1)). BOEM refers to these surveys as "site characterization" activities. Table 3-1 describes the types of site characterization surveys, the types of equipment and/or method used, and which resources the survey information would be used to inform.

Table 3-1
Proposed Action Scenario 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,[(1] Archaeological,[(2] Bathymetric Charting, Benthic Habitat
Geotechnical/Sub-bottom Sampling[(3)]	Vibracores, deep borings, cone penetration tests	Geological[(4)]
Biological[(5)]	Grab sampling, benthic sled, underwater imagery/sediment profile imaging	Benthic Habitat
	Aerial digital imaging; visual observation from boat or airplane	Avian
	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

(1)30 CFR 585.610(b)(2) and 30 CFR 585.626(a)(1)
(2)30 CFR 585.626(a) and 30 CFR 585.610–585.611
(3)30 CFR 585.610(b)(1) and 30 CFR 585.626(a)(4)
(4)30 CFR 585.610(b)(4) and 30 CFR 585.616(a)(2)
(5)30 CFR 585.610(b)(5) and 30 CFR 585.626(a)(3)

Assumptions from the scenario are based on BOEM guidelines that provide recommendations to lessees for acquiring the information required for a SAP and COP under 30 CFR 585.610–585.611 and 30 CFR 585.626(a). BOEM has also published *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan (SAP)* (BOEM, 2016a), which are available at http://www.boem.gov/Final-SAP-Guidelines/. The survey guidelines are listed below and can be found at http://www.boem.gov/Survey-Guidelines/.

- *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* (BOEM, 2015c)

- *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM, 2015d)
- *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM, 2013b)
- *Guidelines for Providing Avian Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM, 2013c)
- *Guidelines for Providing Information on Marine Mammals and Sea Turtles for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 Subpart F* (BOEM, 2013d)
- *Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM, 2013e)
- *Guidelines for Submission of Spatial Data for Atlantic Offshore Renewable Energy Development Site Characterization Surveys* (BOEM, 2013f)

In these guidelines, BOEM provides recommendations of survey methods that BOEM expects will yield site characterization information sufficient to allow the agency to consider approving a SAP or COP. For the purposes of the proposed action scenario, BOEM assumes that the lessee would employ these methods to acquire the information required under 30 CFR 585.610–585.611 and 30 CFR 585.626(a).

3.2.1.1 High-Resolution Geophysical Surveys

The purpose of HRG surveys would be to acquire geophysical shallow hazards information, to obtain information pertaining to the presence or absence of archaeological resources, and to conduct bathymetric charting. Assuming the lessee would follow BOEM's guidelines to meet the geophysical data requirements at 30 CFR 585.610–585.611 and 30 CFR 585.626(a), BOEM anticipates that the surveys would be undertaken using the equipment to collect the required data as described in Table 3-2 and Table 3-3. Equivalent technologies to those shown in these tables may be used as long as their potential impacts are similar to those analyzed for the equipment described in this EA.

The line spacing for HRG surveys would vary depending on the data collection requirements of the different HRG survey types:

- For the collection of geophysical data for shallow hazards assessments, magnetometer, side-scan sonar and sub-bottom profiler systems BOEM recommends 492 feet (ft) (150 m) line spacing over the lease area;
- For the collection of geophysical data for archaeological resources assessments, magnetometers, side-scan sonar, and all sub-bottom profiler systems BOEM recommends 98 ft (30 m) line spacing over the lease area; and
- For bathymetric charting, the lessee would likely use a multi-beam echosounder at a line spacing appropriate to the range of depths expected in the survey area.

Table 3-2
High-Resolution Geophysical Survey Equipment and Methods

Equipment Type	Data Collection and/or Survey Types	Description of the Equipment
Bathymetry/Depth Sounder (multi-beam echosounder)	Bathymetric charting	A depth sounder is a microprocessor-controlled, high-resolution survey-grade system that measures precise water depths in both digital and graphic formats. The system would be used in such a manner as to record with a sweep appropriate to the range of water depths expected in the survey area. This EA assumes the use of multi-beam bathymetry systems, which may be more appropriate than other tools for characterizing those lease areas containing complex bathymetric features or sensitive benthic habitats, such as hardbottom areas.
Magnetometer	Collection of geophysical data for shallow hazards and archaeological resources assessments	Magnetometer surveys would be used to detect and aid in the identification of ferrous or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor, and anticipated to be no more than approximately 20 ft (6 m) above the seafloor.
Side-Scan Sonar	Collection of geophysical data for shallow hazards and archaeological resources assessments	This survey technique is used to evaluate surface sediments, seafloor morphology, and potential surface obstructions (MMS, 2007a). A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or “pingers”) located on the sides, which generate and record the returning sound that travels through the water column at a known speed. BOEM assumes that the lessee would use a digital dual-frequency side-scan sonar system with 300 to 500 kHz frequency ranges or greater to record continuous planimetric images of the seafloor.
Shallow and Medium (Seismic) Penetration Sub-bottom Profilers:	Collection of geophysical data for shallow hazards and archaeological resources assessments and to characterize subsurface sediments	Typically, a high-resolution CHIRP System sub-bottom profiler is used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. Another type of sub-bottom profiler that may be employed is a medium penetration system such as a boomer, bubble pulser or impulse-type system. Sub-bottom profilers are capable of penetrating sediment depth ranges of 10 ft (3 m) to greater than 328 ft (100 m), depending on frequency and bottom composition.

CHIRP = Compressed High Intensity Radar Pulse   kHz = kilohertz

Table 3-3
Typical High-Resolution Geophysical Survey Equipment and Their Acoustic Characteristics

Source	Pulse Length	Broadband Source Level (dB re 1 µPa at 3.3 ft [1 m])	Operating Frequency
Boomer	180 µs	212	200 Hz –16 kHz
Side-scan Sonar	20 ms	226	100 kHz 400 kHz
CHIRP Sub-bottom Profiler	64 ms	222	3.5 kHz 12 kHz 200 kHz
Multi-beam Depth Sounder	225 µs	213	240 kHz

Source: BOEM, 2014a

CHIRP = Compressed High Intensity Radar Pulse

dB re 1 µPa at 1 meter = source level, received level measured or estimated 3 ft (1 m) from the source

Hz = hertz
kHz = kilohertz
ms = millisecond

µPa = micropascal
µs = microsecond

Table 3-3 provides a list of typical equipment used in HRG surveys and their acoustic intensity. This table is representative of the types of equipment that BOEM has received in draft project plans submitted under Interim Policy leases in Delaware and New Jersey, and in survey plans submitted under leases in Maryland and Virginia. Actual equipment used could have frequencies and/or SPLs somewhat below or above those indicated in Table 3-3.

3.2.1.2 Geotechnical/Sub-bottom Sampling

The G&G Final PEIS (BOEM, 2014a), which is hereby incorporated by reference, provides an overview of the geotechnical sampling techniques and devices (such as bottom-sampling devices, vibracores, deep borings, and cone penetration tests [CPTs]) that would be used to assess the suitability of shallow sediments to support a structure foundation or transmission cable under operational and environmental conditions that could potentially be encountered (including extreme weather events), as well as to document the sediment characteristics necessary for design and installation of all structures and cables. The information from the G&G Final PEIS is summarized below.

Samples for geotechnical evaluation are typically collected using shallow-bottom coring and surface sediment sampling devices taken from a small marine drilling vessel. Likely methods to obtain samples to analyze physical and chemical properties of surface sediments are described in Table 3-4.

CPTs and bore holes are often used together because they provide different data on sediment characteristics. A CPT provides a fairly precise stratigraphy of the sampled interval, plus other geotechnical data, but does not allow for capture of an undisturbed soil sample. Bore holes can provide undisturbed samples, but are most effectively used in conjunction with CPT-based stratigraphy so that sample depths can be pre-determined. A CPT is suitable for use in clay, silt,

Table 3-4
Geotechnical/Sub-bottom Sampling Survey Methods and Equipment

Survey Method	Use	Description of the Equipment and Methods
Bottom-sampling devices	Penetrating depths from a few centimeters (cm) to several meters (m)	A piston core or gravity core is often used to obtain samples of soft surficial sediments. Unlike a gravity core, which is essentially a weighted core barrel that is allowed to free-fall into the water, piston cores have a "piston" mechanism that triggers when the corer hits the seafloor. The main advantage of a piston core over a gravity core is that the piston allows the best possible sediment sample to be obtained by avoiding disturbance of the sample (MMS, 2007a). Shallow-bottom coring employs a rotary drill that penetrates through several feet of consolidated rock. The above sampling methods do not use high-energy sound sources (MMS, 2004; MMS, 2007a).
Vibracores	Obtaining samples of unconsolidated sediment; may, in some cases, also be used to gather information to inform the archaeological interpretation of features identified through the HRG survey (BOEM, 2015d)	Vibracore samplers typically consist of a core barrel and an oscillating driving mechanism that propels the core barrel into the sub-bottom. Once the core barrel is driven to its full length, the core barrel is retracted from the sediment and returned to the deck of the vessel. Typically, cores up to 20 ft (6 m) long with 3 inch (in.) (8 cm) diameters are obtained, although some devices have been modified to obtain samples up to 40 ft (12 m) long (MMS, 2007a; USACE, 1987).
Deep borings	Sampling and characterizing the geological properties of sediments at the maximum expected depths of the structure foundations (MMS, 2007a)	A drill rig is used to obtain deep borings. The drill rig is mounted on a jack-up barge supported by four "spuds" that are lowered to the seafloor. Geologic borings can generally reach depths of 100 to 200 ft (30 to 61 m) within a few days (based on weather conditions). The acoustic levels from deep borings can be expected to be in the range of 118 to 145 decibels (dB) at a frequency of 120 hertz (Hz), which would be below the 160 dB threshold established by NMFS to protect marine mammals.
Cone penetration test (CPT)	Supplement or use in place of deep borings (BOEM, 2015c)	A CPT rig would be mounted on a jack-up barge similar to that used for the deep borings. The top of a CPT drill probe is typically up to 3 in. (8 cm) in diameter, with connecting rods less than 6 in. (15 cm) in diameter.

dB = decibels
Hz = hertz

sand, and granule-sized sediments as well as some consolidated sediment and colluvium. Bore hole methods can be used in any sediment type and in bedrock. Vibracores are suitable for extracting continuous sediment samples from unconsolidated sand, silt, and clay-sized sediment up to 33 ft (10 m) below the seafloor.

The U.S. Army Corps of Engineers (USACE) Nationwide Permit (NWP) Program (USACE, 2012) was developed to streamline the evaluation and approval process for certain types of activities that have only minimal impacts on the aquatic environment.[8] NWP 6 addresses survey activities such as core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, exploratory trenching, soil surveys, sampling, and historic resources surveys. Most site characterization surveys that require seafloor disturbance would be authorized by an NWP 6. An individual permit may be required from USACE if the proposed survey activities do not meet the terms and conditions of the NWP or if USACE determines that the survey activities will result in more than minimal adverse effects on the aquatic environment.

Sub-bottom sampling of the WEA would require a sub-bottom sample at every potential wind turbine location (which would only occur in the portion of the WEA where structural placement is allowed) and one sample per nautical mile of transmission cable corridor (which could occur in the TSS buffer zone area of the WEA, where no site assessment structures would be allowed). The amount of effort and vessel trips required to collect the geotechnical samples varies greatly by the type of technology used to retrieve the sample:

- Vibracore samples would most likely be advanced from a single small vessel (approximately 45 ft [14 m]).
- CPT sampling would depend on the size of the CPT; it could be advanced from a medium vessel (approximately 65 ft [20 m]), a jack-up barge, a barge with a four-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel.
- Geologic borings would be advanced from a jack-up barge, a barge with a four-point anchoring system, or a vessel with a dynamic positioning system. Each barge scenario would include a support vessel.

3.2.1.3 Biological Surveys

Under BOEM's regulations, the SAP, COP, and General Activities Plan (GAP) must describe biological resources that could be affected by the activities proposed in the plans, or that could affect the activities proposed in the plans (see 30 CFR 585.611(a)(3); 30 CFR 585.626(a)(3); and 30 CFR 585.645(a)(5)).

To support development of these plans, three primary categories of biological resources would need to be characterized using appropriate vessel and/or aerial surveys of the lease area: (1) benthic habitats, (2) avian and bat resources, and (3) marine fauna. Likely survey methods and timing are listed in Table 3-5 and further described below.

[8] USACE jurisdiction of the OCS pertains to structures or activities that could disturb the seabed.

Table 3-5
Biological Survey Types and Methods

Biological Survey Type	Survey Method	Timing
Benthic Habitat	Bottom sediment/fauna sampling and underwater imagery/sediment profile imaging (sampling methods described above under geotechnical surveys)	Concurrent with geotechnical/sub-bottom sampling
Avian	Visual surveys from a boat	10 OCS blocks per day; monthly for 2 to 3 years
	Plane-based aerial surveys	2 days per month for 2 to 3 years
Bats	Ultrasonic detectors installed on survey vessels being used for other biological surveys	Monthly for 3 months per year between March and November
Marine Fauna (marine mammals, fish and sea turtles)	Plane-based and/or vessel surveys – may be concurrent with other biological surveys	2 years of survey to cover spatial, temporal and inter-annual variance in the area of potential effect

For biological surveys, BOEM assumes that:

- All vessels associated with the proposed action would be required to abide by the SOCs detailed in Appendix B, and
- NMFS may require additional measures from the lessee to comply with the MMPA.

Benthic Habitat Surveys

Samples collected from the geotechnical sampling of shallow sediments and information from geophysical surveys would help identify sensitive benthic habitats. These surveys would acquire information suggesting the presence or absence of exposed hardbottoms of high, moderate, or low relief; hardbottoms covered by thin, ephemeral sand layers; and submerged aquatic vegetation or macro-algae, all of which are key characteristics of sensitive benthic habitat. There are two protocol surveys emphasized within the BOEM Benthic Habitat Survey Guidelines (BOEM, 2013b): a Sediment Scour and/or Deposition Survey and a Benthic Community Composition Survey. The first involves particle size analysis or sediment-profile imaging and multibeam/interferometric bathymetry (with the collection of backscatter data). The second requires benthic imagery (i.e., underwater video or still imagery of sediment bottom type) as well as physical sampling using one of the following methods:

- Hamon grab (hardbottom),
- Van Veen grab (soft sediment), and/or
- Benthic sled.

BOEM believes that these surveys may be conducted concurrently with other geophysical sampling and/or biological surveys and that the lessee would not need to conduct separate biological surveys to delineate benthic habitats. However, if the benthic surveys, G&G surveys, or other information identify the presence of sensitive benthic habitats on the leasehold, then further investigations would likely be necessary.

Avian Surveys

If avian surveys are required, BOEM anticipates that 2 to 3 years of surveys would be necessary to document the distribution and abundance of bird species within the WEA. This survey timeframe is based on the *Guidelines for Providing Avian Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM, 2013c), which indicate that the lessee must document the spatial distribution of avian resources in the areas proposed for development, incorporating both seasonal and inter-annual variation. Historically, avian data have been collected using a combination of boat and aerial surveys. Boat surveys could be completed in a single day for approximately 10 OCS blocks when subsampling 10 percent of the area, which is standard practice (Thaxter and Burton, 2009). A monthly sampling interval for boat-based surveys represents an upper limit of survey frequency; therefore, 2 to 3 years of surveying at monthly intervals would be anticipated.

Although both boat-based and aerial surveys using visual observers have been used in the past, including for offshore wind baseline studies in the United States (NJDEP, 2010; Paton et al., 2010), these methodologies have been largely replaced by aerial digital imaging surveys in Europe because of reduced observer effects, higher statistical and scientific validity of the data, and the ability to conduct surveys at altitudes above the rotor swept zone of commercial marine wind turbine rotors (Rexstad and Buckland, 2009; Thaxter and Burton, 2009).

Bat Resource Surveys

Bats use echolocation with species-specific characteristics when orienting through space, and ultrasonic detectors are a cost-effective method for monitoring multiple bat species on a large spatial scale. Ultrasonic detectors are portable and can be easily installed on survey vessels being used for other biological surveys. BOEM assumes that bat acoustic surveys would be conducted during the fall migration period and, if necessary, during the spring migration.

Marine Fauna Surveys

The lessee is required to characterize the marine fauna (i.e., marine mammals, sea turtles, and fish species) occurring within its lease area and include this information in its plan submissions (30 CFR 585.610(a)(8)). The lessee may use existing information, if the information meets plan requirements. If biological information is not available or does not meet plan requirements for the lease area, data gaps or special circumstances may need to be addressed and filled by survey work (BOEM, 2013e) over a period of 2 years, but perhaps more depending upon data needs in the area of potential effect. BOEM, the U.S. Department of Energy, and state governments are in the process of collecting biological information in several of the Atlantic WEAs. Regional-scale efforts, including the National Oceanic and Atmospheric Administration (NOAA)/BOEM Atlantic Marine Assessment Program for Protected Species, will also aid in providing data to support site characterization. The results of these studies could be used to determine whether additional surveys would be necessary to document marine mammal, fish, or sea turtle resources in the WEA prior to submitting a plan. BOEM anticipates that any vessel or aerial traffic associated with marine fauna surveys would not markedly add to current levels of traffic within the WEA.

3.2.1.4 Surveying of Potential Cable Route

BOEM assumes that during site characterization, a lessee would survey a potential transmission cable route (for connecting future wind turbines to an onshore power substation) from the WEA to shore using HRG survey methods. BOEM assumes that the HRG survey grids for a proposed transmission cable route to shore would likely occur over a 984-foot-wide (300-meter-wide) corridor centered on the potential transmission cable location to allow for all anticipated physical disturbances and movement of the proposed cable, if necessary.

Because it is not yet possible to predict precisely where an onshore power substation may ultimately be installed or the route that any potential future transmission line would take across the seafloor from the WEA to shore, this EA uses a direct route from the middle of the WEA and a hypothetical potential interconnection point onshore in southern Manhattan—a distance of 44 nm (74 km)—to conservatively approximate the level of surveys that may be conducted to characterize a transmission cable route. The hypothetical line used to approximate the level of surveys in no way represents a proposed cable route. A lessee would be required to submit detailed information on a proposed cable route(s) and wind turbine locations within their COP; per COP guidelines (BOEM, 2016b; available at http://www.boem.gov/COP-Guidelines/), BOEM encourages lessees to coordinate other subsea cable operators when planning cable routes. BOEM would then analyze the proposed route(s) and location(s) in a project-/site-specific environmental document.

3.2.1.5 Operational Waste Associated with Site Characterization

Operational wastes would be generated from all vessels associated with the proposed action. Requirements for management and disposal of bilge and ballast waters, solid waste (trash and debris), and sanitary/domestic wastes are described in the 2012 *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment* (BOEM, 2012b). BOEM assumes that these requirements would be followed and hereby incorporates them by reference.

The U.S. Environmental Protection Agency (EPA) regulates discharges incidental to the normal operation of all non-recreational, non-military vessels greater than 79 ft (24 m) in length into U.S. waters under Section 402 of the Clean Water Act. EPA requires that eligible vessels obtain coverage under the National Pollutant Discharge Elimination System Vessel General Permit. A separate, streamlined permit is available for vessels less than 79 ft (24 m) (Small Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels Less than 79 Feet). Typical discharges eligible for coverage under the Vessel General Permit include deck runoff, graywater (from showers, sinks, laundry facilities, etc.), bilgewater, and ballast water. The discharge of any oil or oily mixtures within bilgewater is prohibited under 33 CFR 151.10; however, discharges may occur in waters greater than 12 nm (22 km) from shore if the oil concentration is less than 100 parts per million and bilge/oily water separator effluent is covered for discharge under the final 2013 EPA Vessel General Permit. Ballast water is less likely to contain oil but is subject to the same limits. Ballast water is used to maintain stability of the vessel and may be pumped from coastal or marine waters. Generally, the ballast water is pumped into and out of separate compartments and is not usually contaminated with oil; however, the same discharge criteria apply as for bilgewater (33 CFR 151.10). Ballast water is subject to the

USCG Ballast Water Management Program to prevent the spread of aquatic nuisance species. New York state regulations for some of these discharges, such as bilge and ballast water, are more stringent than the EPA Vessel General Permit conditions. New York and New Jersey have several no discharge areas where the discharge of sewage is prohibited (NYSDEC, 2016a; EPA, 2016a).

The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and USCG (International Convention for the Prevention of Pollution from Ships [MARPOL], Annex V, Public Law 100–220 [101 Stat. 1458]). The Act to Prevent Pollution from Ships (APPS) is a U.S. federal law that was enacted to implement the provisions of MARPOL. The APPS applies to all U.S. flagged ships all across the globe and to all foreign flagged vessels operating in navigable waters of the United States or while at port under U.S. jurisdiction. The provisions of the APPS are found under 33 U.S.C. §§ 1901 through 1915 and are regulated and enforced by USCG.

3.2.2 Site Assessment Activities and Data Collection Structures

No site assessment activities could take place on a lease until BOEM has approved a lessee's SAP, which would most likely include installation of a meteorological tower and/or buoys (see 30 CFR 585.600(a)). Once approved, site assessment activities could occur over a 5-year period from the date of the lease. This EA assumes that a lessee would install some type of data collection device (i.e., meteorological tower, buoy, or both) on its lease area to assess the wind resources and ocean conditions of the lease area.

The following scenario is broad enough to address the range of data collection devices that may be installed under approved SAPs. The actual tower and foundation type and/or buoy type and anchoring system would be included in a detailed SAP submitted to BOEM, along with the results of site characterization surveys, prior to installation of any device(s).

3.2.2.1 Meteorological Towers and Foundations

One of the traditional instruments used for characterizing wind conditions is the meteorological tower. A typical meteorological tower consists of a mast mounted on a foundation anchored to the seafloor. The mast may be either a monopole or a lattice type (similar to a radio tower) (Figure 3-1 and Figure 3-2, respectively). Mast and data collection devices can be mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases) or on a floating platform (spar, semi-submersible, or tension-leg). Different types of foundations include tripod, monopile, or steel jacket. The mast, platform, and foundation types are described in further detail (including images and measurement specifications) in the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts Revised Final Environmental Assessment* (BOEM, 2014b) and hereby incorporated by reference and summarized below.

Figure 3-1 Example of Monopole Mast Meteorological Tower with a Tripod Foundation

Source: BOEM, 2011a (Note: the third leg of the tripod is not seen in this photo)

Figure 3-2 Example of a Lattice Mast Meteorological Tower with a Monopile Foundation

Source: GL Garrad Hassan, 2012 as cited in BOEM, 2014b

BOEM has not yet received a request to install a meteorological tower mounted on a floating platform in the Atlantic. Given that a fixed foundation is likely to be installed, a floating platform meteorological tower is not evaluated in this EA. However, should BOEM receive an application for a floating platform meteorological tower structure for the New York WEA, BOEM would consider whether such a platform would lead to environmental consequences not considered in this EA. Similarly, if foundation selection by the lease holder is different from the meteorological tower specifications presented in this EA, BOEM would determine the adequacy of the analysis of environmental consequences provided in this EA. If the proposed foundation is different than described in this EA, the specifications for the selected tower would be included in a detailed Project Plan submitted to BOEM after site characterization surveys are conducted and prior to construction.

Types of foundations include tripod (Figure 3-1), monopile (Figure 3-2 and Figure 3-3(a)), or steel jacket (Figure 3-3(b)). Characteristics of these foundation types are summarized in Table 3-6. The proposed foundation type for a given project would be identified in a lessee's SAP.

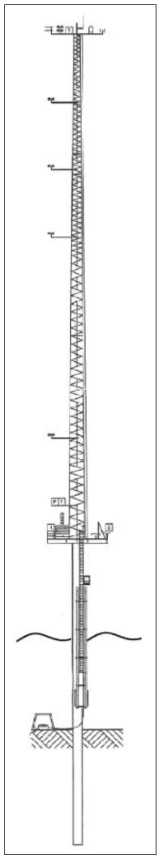

Figure 3-3(a) **Lattice-Type Mast-Mounted Meteorological Tower on a Monopile Foundation**

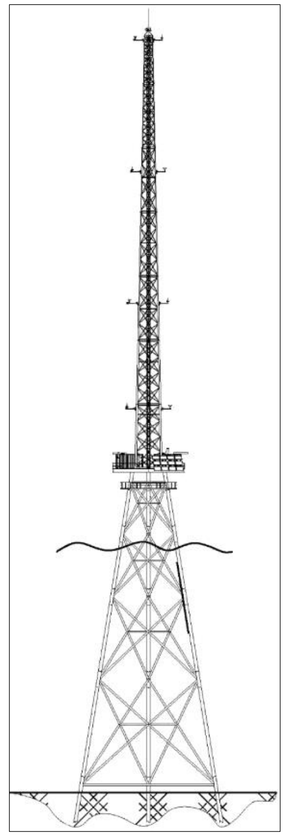

Figure 3-3(b) **Lattice-Type Mast-Mounted Meteorological Tower on a Steel Jacket Foundation**

Source: Deepwater Wind, LLC, as cited in BOEM, 2012b

Table 3-6
Meteorological Tower Foundations

Type of Foundation	Foundation Piles		Area of Bottom Covered[(1)] (ft²)	Depth Driven below Seafloor (ft)	Height above Mean Sea Level (ft)[(2)]
	Number	Diameter (ft)			
Tripod	3	10	1,500	25 to 100	295 to 393
Monopile	1	10	200	25 to 100	295 to 393
Steel Jacket	3 to 4	3	2,000	25 to 100	295 to 393

[(1)] Foundations may be surrounded by a scour system placed at the base of the structure that would cover up to 2 ac (0.81 ha) of ocean bottom.

[(2)] Height range based on the tallest commercially available meteorological tower.

SAP Requirements for the Meteorological Tower

After a lease is issued and initial survey activities are conducted, the lessee may not install a meteorological tower until a SAP is submitted for review and approved by BOEM.

Site characterization activities, as described in this EA, are covered under the Biological Opinion for *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas* (NER-2012-9211) issued by NMFS as part of the ESA Section 7 consultation for the area of Atlantic OCS offshore New York (NMFS, 2013a). Site assessment activities for the New York WEA were not addressed in that Biological Opinion; therefore, BOEM will consult with NMFS under Section 7 of the ESA for installation of a meteorological tower and/or buoys in the WEA, as appropriate. See Section 5.3.1 of this EA, *Endangered Species Act*, for further information regarding ESA consultation.

Installation

Total installation time for one meteorological tower would likely take between 1 and 10 weeks, depending on the type of structure installed, the weather, and the sea state conditions (MMS, 2009b). Because of delays caused by weather and sea conditions, acquisition of permits, and availability of vessels, workers, and tower components, installation may not occur during the first year of a lease and may be spread over more than one construction season. If installation occurs over two construction seasons, the foundation would likely be installed first with limited meteorological equipment mounted on the platform deck, and the mast and remaining equipment would be installed the following year (MMS, 2009b).

A USACE NWP 5 for Scientific Measurement Devices is required for devices and scientific equipment whose purpose is to record scientific data through such means as meteorological stations (which would include a meteorological tower and/or buoys). As stated in NWP 5, "*upon completion of the use of the device to measure and record scientific data, the measuring device and any other structures or fills associated with that device (e.g., foundations, anchors, buoys, lines, etc.) must be removed to the maximum extent practicable and the site restored to pre-construction elevations.*"

Installation – Onshore Activity

The meteorological tower platform would be fabricated onshore at an existing fabrication yard. Production operations would include cutting, welding, and assembling steel components. These yards occupy large areas with equipment, including lifts and cranes, welding equipment, rolling mills, and sandblasting machinery. The locations of these fabrication yards are directly tied to the availability of a large enough channel that would allow the towing of these structures. The average bulkhead depth needed for water access to fabrications yards is 15 to 20 ft (5 to 6 m). Therefore, platform fabrication yards must be located at deep-draft seaports or along the wider and deeper of the inland channels. Section 3.2.3 *Port Facilities* identifies the ports that could support the fabrication of a meteorological tower.

The meteorological tower could also be fabricated at various facilities or at inland facilities in sections and then shipped by truck or rail to the port staging area. The meteorological tower would then be partially assembled and loaded onto a barge for transport to the offshore site. Final assembly of the tower itself would be completed offshore (MMS, 2009b).

Installation – Offshore Activity

During installation, a radius of approximately 1,500 ft (457 m) around the site would be needed for the movement and anchoring of support vessels. The following sections describe the installation of a foundation structure and tower. Several vessels would be involved with construction of a meteorological tower (Table 3-7).

Installation of the Foundation Structure and Mast

A jacket or monopile foundation and deck would be fabricated onshore, then transferred to a barge(s) and carried or towed to the offshore site.

The foundation piles would be driven anywhere from 25 to 100 ft (8 to 30 m) below the seafloor with a pile driving hammer typically used in marine construction operations. Pile driving typically lasts 4 to 8 hours per day over 3 days for each tower (BOEM, 2014a). A jack-up barge equipped with a crane would be used to assist in the mounting of the platform decking, tower, and instrumentation onto the foundation. Depending on the type of structure installed and the weather and sea conditions, the in-water construction of the foundation pilings and platform would take a few days (monopole in good weather) to 6 weeks (jacket foundation in bad weather) (MMS, 2009b).

The mast sections would be raised using a separate barge-mounted crane; installation would likely be complete within a few weeks. The installation barges would be tended by appropriate tugs and workboats as needed. The types of vessels and number of trips to install one meteorological tower are listed in Table 3-7.

Table 3-7
Projected Vessel Usage and Specifications for the Construction of One Meteorological Tower

Vessel Type	Round Trips	Hours on Site	Length ft (m)	Displacement (tons)	Engines (horsepower)	Fuel Capacity (gallons)
Crane barge	2	232	150–250 (46–76)	1,150	0	500
Deck cargo	2	232	150–270 (46–82)	750	0	0
Small cargo barge	2	232	90 (27)	154	0	0
Crew boat	21	54	51–57 (16–17)	100	1,000	1,800
Small tug boat	4	54	65 (20)	300	2,000	14,000
Large tug boat	8	108	95 (29)	1,300	4,200	20,000

Source: MMS, 2009b

Scour Control System

BOEM assumes that scour control systems would be installed if required to prevent seabed scour at the site. There are several types of scour control systems, including placement of rock armoring and mattresses of artificial (polypropylene) seagrass around foundation structures or underwater cabling. The type of scour control system used may vary depending on the seabed at a specific site and the meteorological tower foundation used.

A rock-armor scour protection system may be used to stabilize a structure's foundation area. In water depths greater than 15 ft (5 m), the median stone size would likely be about 50 pounds (lbs) (22 kilograms [kg]) with a stone layer thickness of about 3 ft (1 m). If potential seabed scour is anticipated at the site, the foundation structure and a scour control system would occupy less than 1 ac (0.4 ha). Rock armor for a wind turbine monopole foundation typically occupies 16,000 square feet (ft^2) (1,486 square meters [m^2]) or 0.37 ac (0.15 ha) of the seabed (ESS Group, 2004). Although the piles for a meteorological tower would be much smaller than those for a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, using a conservative estimate and assuming a seafloor area approximating that of a monopole foundation, the maximum area of the seabed affected by rock armor for a single meteorological tower is estimated to be 16,000 ft^2 (1486 m^2) . The final foundation selection would be included in a detailed SAP submitted to BOEM along with the results of SAP-related site characterization surveys prior to BOEM consideration for approval.

Artificial seagrass mats are made of synthetic fronds that mimic seafloor vegetation to trap sediment. The mats become buried over time and have been effective for controlling scour in both shallow and deep waters (ESS Group, 2004). Scour monitoring at the Cape Wind meteorological tower indicated that a net increase of 12 inches (in.) (30 centimeters [cm]) of sand occurred where two artificial seagrass scour mats were installed. At another pile with artificial seagrass scour mats, there was a net scour depth of 7 in. (18 cm). Both events occurred over a 3-year timeframe (Ocean and Coastal Consultants, 2006). If used, these mats would be installed by a diver or remotely operated underwater vehicle (ROV). Each mat would be anchored at 8 to 16 locations, about 1 ft (0.3 m) into the sand. For a pile-supported platform, BOEM estimates that four mats, each about 8.2 ft by 16.4 ft (2.5 m by 5 m), would be placed around each pile. Including the extending sediment bank, BOEM estimates a total disturbance area of about 5,200 to 5,900 ft^2 (483 to 548 m^2) for a three-pile structure and 5,900 to 7,800 ft^2 (548 to 725 m^2) for a four-pile structure. For a monopile foundation, BOEM estimates that eight mats, about 16.4 by 16.4 ft (5 by 5 m), would be used; the total disturbance area would be about 3,700 to 4,000 ft^2 (344 to 372 m^2).

Operation and Maintenance

BOEM anticipates that a meteorological tower would be present for approximately 5 years before BOEM decides whether to allow the tower to remain in place for some or all of the operations term of a lease (25 years) or require that it be decommissioned immediately after the 5-year site assessment term. The meteorological tower could also remain in place during the time period that BOEM reviews the COP (i.e., the tower may remain for a number of years following the 5-year site assessment period).

While the meteorological tower is in place, data would be collected and processed remotely; as a result, data cables to shore would not be necessary. The structure and instrumentation would be accessible by boat for routine maintenance. As indicated in previous site assessment proposals submitted to BOEM (MMS, 2009b), as well as in US Wind Inc.'s SAP, lessees proposing meteorological towers could power equipment by solar panels, small wind turbines, and/or diesel generators. According to US Wind Inc.'s SAP, planned maintenance and operations could require two visits by the operations and maintenance vessel each quarter over the course of a year.

Previous proposals included monthly or quarterly vessel trips for operation and maintenance activity over the 5-year life of a meteorological tower. However, if a diesel generator is used to power the meteorological tower's lighting and equipment, a maintenance vessel could make a trip at least once every other week, if not weekly, to provide fuel, change oil, and perform maintenance on the generator (MMS, 2009b).

No additional or expansion of onshore facilities would be required to conduct these tasks. BOEM projects that crew boats would be used for routine maintenance and generator refueling, if diesel generators are used. The distance from shore would make vessels more economical than helicopters, so the use of helicopters to transport personnel or supplies during operation and maintenance is not anticipated.

Lighting and Marking

A PATON is a buoy, light, or day beacon owned and maintained by any individual or organization other than USCG. These aids are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation. A meteorological tower and/or buoys in the WEA, regardless of height, would be considered PATON and thus would be required to have lighting and marking for navigational purposes, as regulated by USCG under 33 CFR 66.

For a meteorological tower taller than 200 ft (61 m) and within 12 nm (22 km) from shore, the lessee would be required to file a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) per federal aviation regulations (14 CFR 77.7 and 14 CFR 77.9). This would also be necessary if it exceeds any other obstruction standard contained in 14 CFR Part 77. The FAA would then conduct an obstruction evaluation analysis to determine whether a meteorological tower would pose a hazard to air traffic, and would issue a Determination of Hazard/No Hazard. The FAA's current guidance on obstruction marking and lighting (FAA, 2015) does not specifically mention regulations for lighting and marking of ocean-based towers. In their current guidance, the FAA recommends voluntary marking and/or lighting of a meteorological evaluation tower less than 200 ft (61 m) in height above ground level to address safety impacts to low-level agricultural flight operations to enhance the conspicuity of these towers in remote and rural areas; therefore this voluntary marking and lighting in accordance with FAA regulations may not apply to meteorological towers in the WEA.

The closest location to land that a meteorological tower could likely be installed under the proposed action is approximately 13.5 nm (25 km) from the shoreline, given the 1 nm (1.9 km) buffer from the edge of the TSSs—the western-most tip of the WEA. Therefore, a meteorological tower would not likely be installed within the FAA's 12 nm (22 km) jurisdiction for which an FAA Notice of Proposed Construction or Alteration would be required. However, if a meteorological tower was to be placed within 12 nm (22 km) of the shoreline, and because BOEM anticipates that a tower would be greater than 200 ft (61 m) tall, the lessee would be required to file an FAA Notice of Proposed Construction or Alteration.

Other Uses

The meteorological tower and platform could be used to gather other information in addition to meteorological information, such as data regarding birds, bats, and marine mammals in the lease area.

Decommissioning

As late as 2 years after the cancellation, expiration, relinquishment, or other termination of the lease, the lessee would be required to remove all devices, works, and structures from the site and restore the leased area to its original condition before issuance of the lease (30 CFR 585, Subpart I). Lessees are required to submit a decommissioning application to BOEM for approval prior to starting decommissioning activities (30 CFR 585.902(b)).

BOEM estimates that the entire removal process for a meteorological tower would take 1 week or less (BOEM, 2012b). Decommissioning activities would begin with removal of all meteorological instrumentation from the tower, typically requiring a single vessel. A derrick barge would be transported to the offshore site and anchored adjacent to the structure. The mast would be removed from the deck and loaded onto the transport barge. The deck would be cut from the foundation structure. The same number of vessels necessary for installation would most likely be required for decommissioning. The sea bottom beneath installed structures would be cleared of all materials that have been introduced to the area in support of the lessee's project.

Cutting and Removing

As required by BOEM, the lessee would sever bottom-founded structures and their related components to at least 15 ft (5 m) below the mudline to ensure that nothing would be exposed that could interfere with future leases and other activities in the area (30 CFR 585.910(a)). Which severing tool the lessee would use depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions (MMS, 2005). Because of their type and size, piles for the meteorological tower in the WEA would be removed using non-explosive severing methods.

Common non-explosive severing tools and methods that might be used consist of abrasive cutters (e.g., sand cutters, abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters, oxyacetylene/oxyhydrogen torches), and diamond wire cutters. Of these, the most likely tools to be employed would be an internal cutting tool, such as a high-pressure water jet-cutting tool that would not require the use of divers to set up the system or jetting operations to access the required mudline (Kaiser et al., 2005). To cut a pile internally, the sand that had been forced into the hollow pile during installation would be removed by hydraulic dredging/pumping and stored on a barge. Once cut, the steel pile would then be lifted onto a barge and transported to shore. Following the removal of the cut pile and the adjacent scour control system, the sediments would be returned to the excavated pile site using a vacuum pump and diver-assisted hoses. As a result, no excavation around the outside of the monopole or piles prior to the cutting is anticipated. Cutting and removing piles would take anywhere from several hours to 1 day per pile. After the foundation is severed, it would be lifted on the transport barge and towed to a decommissioning site onshore (MMS, 2009b).

Removal of the Scour Control System

Any scour control system would also be removed during the decommissioning process. Scour mats would be removed by divers or ROV and a support vessel in a similar manner to installation. Removal is expected to result in the suspension of sediments that were trapped in the mats. If rock armoring is used, armor stones would be removed using a clamshell dredge or similar equipment and placed on a barge. BOEM estimates that the removal of the scour control system would take a half day per pile. Therefore, depending on the foundation structure, removal of the scour system would take a total of 0.5 to 2 days to complete (MMS, 2009b).

Disposal

Unless portions of the meteorological tower are approved for use as artificial reefs (30 CFR 585.909(d)), all materials would be removed by barge and transported to shore. The steel would be recycled and remaining materials would be disposed of in existing landfills in accordance with applicable laws. Obsolete materials have been used as artificial reefs along the coastline of the United States to provide valuable habitat for numerous species of fish in areas devoid of natural hardbottom. The meteorological tower structures may also have the potential to serve as artificial reefs. However, the structure must not pose an unreasonable impediment to future development. If the lessee ultimately proposes to use the structure as an artificial reef, its plan must comply with the artificial reef permitting requirements of the USACE and the criteria in the National Artificial Reef Plan of 1985 (33 CFR 35.2103). The New York State Department of Environmental Conservation (NYSDEC) manages New York's artificial reef program and must accept liability for the structure before BOEM would release the federal lessee from the obligation to decommission and remove all structures from the lease area.

3.2.2.2 Meteorological Buoy and Anchor System

Although a meteorological tower has been the traditional device for characterizing wind conditions, the lessee could install meteorological buoys instead or in addition to the meteorological tower. Should a lessee choose to employ buoys instead of a meteorological tower, this EA assumes that it would install a maximum of two buoys over the lease area. These meteorological buoys would be anchored at fixed locations and regularly collect observations from many different atmospheric and oceanographic sensors. Buoys may be equipped with generators holding approximately 250 gallons of fuel. The *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts Revised Environmental Assessment* (BOEM, 2014b) evaluated various meteorological buoy and anchor systems, including hull type, height, and anchoring methods. Examples of the buoy and anchor systems are provided below. NOAA has successfully used boat-shaped hull buoys (known as Naval Oceanographic and Meteorological Automated Devices, or "NOMADs") and the newest, the Coastal Buoy and the Coastal Oceanographic Line-of-Sight (COLOS) buoys, for weather data collection for many years (Figure 3-4).

The choice of hull type used usually depends on its intended installation location and measurement requirements. To ensure optimum performance, a specific mooring design is produced based on hull type, location, and water depth. For example, a smaller buoy in shallow coastal waters may be moored using an all-chain mooring. On the other hand, a large discus buoy deployed in the deep ocean may require a combination of chain, nylon, and buoyant polypropylene materials designed for many years of service (National Data Buoy Center, 2008).

Discus-shaped, boat-shaped, and spar buoys (Figure 3-5(a), Figure 3-5(b), and Figure 3-5(c)) are the buoy types that would most likely be adapted for offshore wind data collection. A large discus-shaped hull buoy has a circular hull ranging between 33 and 40 ft (10 and 12 m) in diameter and is designed for many years of service (National Data Buoy Center, 2012). The boat-shaped hull buoy is an aluminum-hulled buoy that provides long-term survivability in severe seas (National Data Buoy Center, 2012).

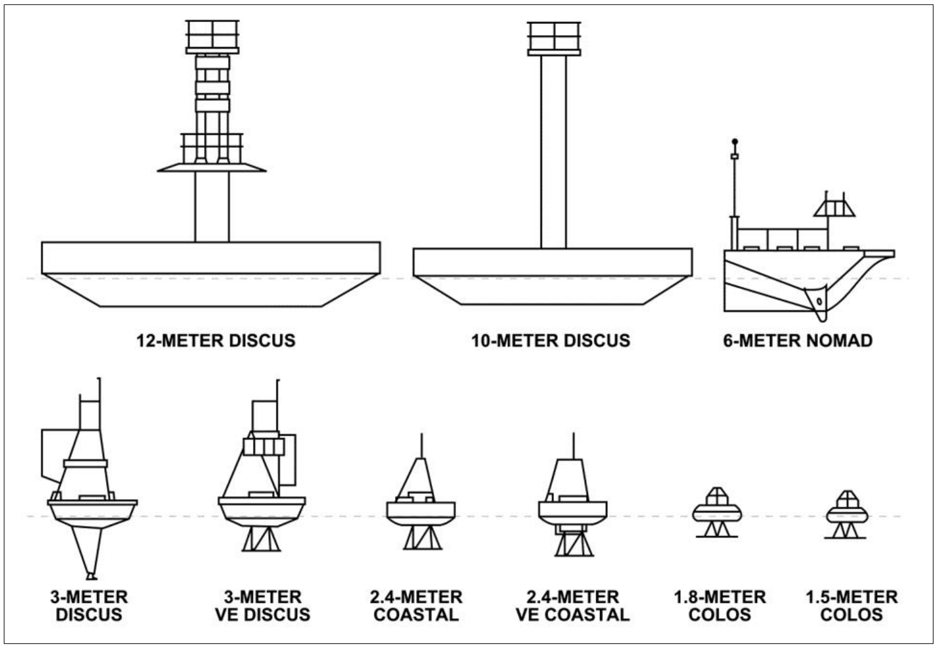

Figure 3-4 Buoy Schematic

Source: National Data Buoy Center, 2008

Figure 3-5(a) 10-Meter Discus-Shaped Hull Buoy

Source: National Data Buoy Center, 2012

Figure 3-5(b) 6-Meter Boat-Shaped Hull Buoy

Source: National Data Buoy Center, 2012

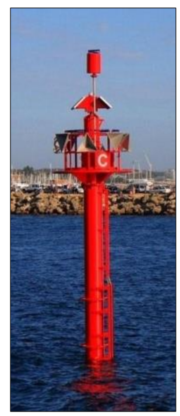

Figure 3-5(c) Spar Buoy

Source: Australian Maritime Systems, 2016

A buoy's specific mooring design is based on hull type, location, and water depth (National Data Buoy Center, 2012). Buoys can use a wide range of moorings to attach to the seabed. On the OCS, a larger discus-type or boat-shaped hull buoy may require a combination of a chain, nylon, and buoyant polypropylene materials designed for many years of ocean service.

Some deep ocean moorings have operated without failure for more than 10 years (National Data Buoy Center, 2012). The spar-type buoy can be stabilized through an on-board ballasting mechanism approximately 60 ft (18 m) below the sea surface. Approximately 30 to 40 ft (9 to 12 m) of the spar-type buoy would be above the ocean surface, where meteorological and other equipment would be located. Tension legs attached to a mooring by cables have been implemented for one spar-type buoy in federal waters offshore New Jersey.

In addition to the meteorological buoys described above, a small tethered buoy (typically 10 ft [3 m] in diameter or less) and/or other instrumentation could be installed on or tethered to a meteorological tower to monitor oceanographic parameters and collect baseline information on the presence of certain marine life.

Installation

Buoys would typically take approximately 1 day to install (Table 3-8).

Table 3-8
Spar-Type Buoy Installation Process

Installation Phases	Maximum Area of Disturbance	Transport Method	Total Time of Installation
Phase 1 – Deployment of clump anchor	484 ft^2	barge	1 day
Phase 2 – Deployment of the spar buoy and connection to the clump anchor with mooring chain	784 ft^2	barge	2 days

Source: Tetra Tech EC, Inc., 2010

Installation – Onshore Activity

Onshore activity (fabrication, staging, or launching of crew/cargo vessels) related to the installation of buoys is expected to use existing ports that are capable of supporting this activity. Refer to Section 3.2.3 *Port Facilities* for information pertaining to existing ports and industrial areas that would likely be used for meteorological buoys. No expansion of existing facilities would be necessary for the same reasons provided in the onshore activity section for a meteorological tower, above.

Installation – Offshore Activity

Boat-shaped and discus-shaped buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location, and then the mooring anchor dropped. A boat-shaped buoy in shallower waters of the WEA may be moored using an all-chain mooring, while a larger discus-type buoy would use a combination of chain, nylon, and buoyant polypropylene materials (National Data Buoy Center, 2012). Based on previous proposals, anchors for boat-shaped or discus-shaped buoys would weigh about 6,000 to 8,000 lbs (2721 to 3628 kg) with a footprint of about 6 ft^2 (0.5 m^2) and an anchor sweep of about 370,260 ft^2 (34398 m^2). After installation, the transport vessel would likely remain in the area for several hours while technicians configure proper operation of all systems. Transport and installation vessel anchoring for 1 day is anticipated for these types of buoys (Fishermen's Energy of New Jersey, LLC, 2011).

For the Garden State Offshore Energy project, a spar-type buoy equipped with light detection and ranging (LiDAR) was towed 23 mi (37 km) offshore New Jersey to the installation location by a transport vessel after assembly at a land-based facility. A barge-based crane lifted the buoy into the water where divers secured it to a 230-ton clump anchor by four tethers made of steel cables (Deepwater Wind, 2016a). Approximately 40 ft (12 m) of the buoy was visible above the water line. The maximum area of disturbance to benthic sediments occurs during anchor deployment and removal (e.g., sediment resettlement or sediment extrusion) for this type of buoy.

Operation and Maintenance

Monitoring information transmitted to shore would include systems performance information, such as battery levels and charging systems output, the operational status of navigation lighting, and buoy positions. Additionally, all data gathered via sensors would be fed to an on-board radio system that transmits the data string to a receiver onshore (Tetra Tech EC, Inc., 2010). On-site inspections and preventative maintenance (i.e., marine fouling, wear, or lens cleaning) are expected to occur on a monthly or quarterly basis. Periodic inspections for specialized components (i.e., buoy, hull, anchor chain, or anchor scour) would occur at different intervals, but would likely coincide with the monthly or quarterly inspection to minimize the need for additional boat trips to the site.

Because limited space on the buoy would restrict the amount of equipment requiring a power source, this equipment may be powered by small solar panels or wind turbines; however, diesel generators may be used, which would require periodic vessel trips for refueling.

Decommissioning

Decommissioning is basically the reverse of the installation process. Equipment recovery would be performed with the support of a vessel(s) equivalent in size and capability to that used for installation (see installation section above). For small buoys, a crane-lifting hook would be secured to the buoy. A water/air pump system would de-ballast the buoy into the horizontal position. The mooring chain and anchor would be recovered to the deck using a winching system. The buoy would then be transported to shore by a barge.

Buoy decommissioning is expected to be completed within 1 day. Buoys would be returned to shore and disassembled or reused in other applications. BOEM anticipates that the mooring devices and hardware would be re-used or recycled as scrap iron (Fishermen's Energy of New Jersey, LLC, 2011).

3.2.2.3 Meteorological Tower and Buoy Equipment

Meteorological Data Collection

To obtain meteorological data, scientific measurement devices consisting of anemometers, vanes, barometers, and temperature transmitters would be mounted either directly on the tower or buoy or on instrument support arms. In addition to conventional anemometers, LiDAR, sonic detection and ranging (SODAR), and coastal ocean dynamic applications radar (CODAR) devices may be used to obtain meteorological data. LiDAR is a ground-based remote sensing technology that operates via the transmission and detection of light, and recently, floating LiDAR (FLiDAR) is being used to collect meteorological data offshore of Europe. SODAR is also a ground-based remote sensing technology; however, it operates via the transmission and detection of sound. CODAR devices use high-frequency surface wave propagation to remotely measure ocean surface waves and currents.

Ocean Monitoring Equipment

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would most likely be installed on each meteorological tower or buoy. An ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplankton suspended in the water column. The ADCPs may be mounted independently on the seafloor or to the legs of the platform or attached to a buoy. A seafloor-mounted ADCP would most likely be located near the meteorological tower (within approximately 500 ft [152 m]) and would be connected by a wire that is hand-buried into the ocean bottom.

A typical ADCP has three to four acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300 to 600 kHz, with a sampling rate of 1 to 60 minutes. A typical ADCP is about 1 to 2 ft (0.3 to 0.6 m) tall and 1 to 2 ft (0.3 to 0.6 m) wide. Its mooring, base, or cage (surrounding frame) would be several feet wider.

Other Equipment

A meteorological tower or buoy could also accommodate environmental monitoring equipment, such as bird and bat monitoring equipment (e.g., radar units, thermal imaging cameras), acoustic monitoring equipment for marine mammals, data logging computers, power supplies, visibility sensors, water measurement equipment (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

3.2.3 Port Facilities

Specific ports that would be used by the lessee would be determined in the future and primarily by proximity to the lease blocks, capacity to handle the proposed activities, and/or established business relationships between port facilities and the lessee.

3.2.3.1 Staging Ports

Installation of a meteorological tower and/or two buoys would likely require port facilities with the following requirements:

- Deep-water vessel access (greater than 15 ft [4.6 m]) to accommodate large vessels.
- Landing and unloading facilities in close proximity to fabrication yards for staging, assembly, and temporary materials storage.
- Located within a reasonable travel distance to the WEA, which BOEM assumes to be 40 mi from the WEA boundary to the port.

BOEM has identified the following ports as potential staging ports for the New York WEA (ESS Group, 2015):

- Staten Island, NY
- Erie Basin, NY
- Brooklyn, NY
- Bayonne, NJ

- Newark, NJ
- Elizabeth, NJ
- Perth Amboy, NJ

3.2.3.2 Survey, Operations and Maintenance Ports

Surveying and operations and maintenance activities could be supported by smaller ports because these types of activities can use smaller vessels and do not need access to fabrication and storage yards for large infrastructure that would be required for installation of a meteorological tower and/or buoys. Vessels used for these activities are anticipated to be approximately 65 to 100 ft (20 to 30 m) in length. These smaller ports would serve as staging areas and crew/cargo launch sites for the survey and operations and maintenance vessels. While a variety of ports could be used for the survey, operations and maintenance activities, including some of the staging ports listed above, BOEM has identified the following ports as likely to support these activities associated with the New York WEA (ESS Group, 2015):

- Staten Island, NY
- Kismet Harbor, NY
- Ocean Beach Harbor, NY
- Perth Amboy, NJ
- Shark River, NJ
- Manasquan, NJ

3.2.4 Vessel Traffic

This EA assumes that vessels associated with site assessment would strongly trend to larger staging ports, while vessels associated with site characterization activities would use whatever port is convenient.

3.2.4.1 Vessel Traffic Associated with Site Characterization

Appendix C contains detailed vessel trip assumptions and calculations associated with site characterization; the primary assumptions are described below.

BOEM assumes that lessees would conduct surveys in the most efficient manner, which may involve 24-hour surveying; however, because inclement weather and equipment failure can result in delays, BOEM is also estimating the number of vessel round trips based on a conservative scenario of a 10-hour survey day (daylight hours minus transit time to and from the site) resulting in a single round trip per day. Therefore, the number of vessel round trips the lessee may undertake would likely fall within the range of the fewest estimated trips associated with 24-hour surveying and the maximum estimated trips associated with 10-hour survey days.

Table 3-9
Total Number of Maximum Vessel Trips for Site Characterization Activities under Alternative A

Survey Task	Number of Survey Days/Round Trips[1]	
	Based on 24-hour Surveying	Based on 10-hour Days
HRG surveys of all OCS blocks within WEA under Alternative A	65	157
HRG surveys of cable routes	4	10
Geotechnical sampling	18	247
Avian surveys	24–36	24–36
Fish surveys	92	92
Total	203–215	530–542

[1] A range has been provided when data or information was available to determine an upper and lower number of round trips. Otherwise, only a maximum value was determined.

HRG = high-resolution geophysical

As shown in Table 3-9, the number of vessel trips associated with site characterization under the proposed action would likely be between approximately 200 and 540. BOEM anticipates that vessel trips for site characterization would primarily occur between the months of April and August over a 5-year period.

The different types of surveys require data to be collected at varying line spacings. However, the same vessel (or group of vessels) following the smallest line spacing could conduct many of the surveys necessary to acquire relevant data at the same time. Therefore, BOEM assumes that the lessee would use the smallest line spacing, which is 98 ft (30 m) for the archaeological resource survey, and acquire relevant data for most surveys at once.

Assumptions specific to the different survey types are listed below.

- For HRG surveys:
  - A vessel speed of 4.5 knots (MMS, 2004).
  - Length of surveys per OCS block is 500 nm (926 km).
  - Length of survey per partial OCS block is 250 nm (463 km).
  - Survey time for one OCS block based on 10-hour survey day and a single round trip per day would be 11 days.
  - Proposed action survey area encompasses 14.25 whole OCS blocks.[9]

[9] Value of 14.25 whole OCS blocks was calculated by dividing the total number of sub-blocks (228) by the number of sub-blocks in a single OCS block (16).

- Although no site assessment structure placement would be allowed in the OCS blocks within the TSS buffer zone, a lessee would survey all OCS blocks in the TSS buffer zone since cable may be placed in the buffer zone area.
- Line spacing for surveying of the cable route would be 98 ft (30 m) for longitudinal lines and 1,640 ft (500 m) for perpendicular tie lines.
- Width of survey corridor for the cable route would be 984 ft (300 m); hypothetical length of cable survey corridor would be 44 nm (81 km).

- For geotechnical sampling:
  - Maximum of 20 wind turbines per whole OCS block with one sample (vibracore, CPT, and/or deep boring) taken at each potential turbine location and one sample conducted per work day.
  - One sub-bottom sample every nautical mile of transmission cable corridor and one at a potential meteorological tower site and/or buoy site.
- For biological surveys:
  - Avian surveys would be conducted by boat, and 10 whole OCS blocks could be surveyed per day (one round trip); because Alternative A contains the equivalent of 10 whole OCS blocks available for site assessment structure placement,[(10)] an avian survey would take approximately 1 day.
  - Marine mammal and sea turtle surveys would be conducted along with the HRG surveys and thus have not broken those surveys out individually for trip calculations.

3.2.4.2 Vessel Traffic Associated with Site Assessment

Vessel trips would be required during installation, decommissioning, and routine maintenance of a tower and/or buoys. These vessel trips may be spread over multiple construction seasons as a result of weather and sea state conditions, the time to assess suitable site(s), the time to acquire the necessary permits, and the availability of vessels, workers, and tower components. BOEM anticipates that tower and/or buoy installation would likely occur in Year 2 after lease execution, would likely remain in place during the 5-year site assessment term (Years 2 through 6 after lease execution), and would likely be decommissioned the year after the end of the 5-year site assessment term (Year 7 after lease execution).

Based on previous site assessment proposals submitted to BOEM, up to about 40 round trips by various vessels are expected during construction of the meteorological tower (Table 3-7 for details). Because the decommissioning process would basically be the reverse of construction, vessel usage during decommissioning would be similar to vessel usage during construction, so another 40 round trips are estimated for decommissioning of a tower. Meteorological buoys would typically take 1 to 2 days for one vessel to install and 1 to 2 days for one vessel to decommission.

[10] Value of the equivalent of 10 whole OCS blocks in the WEA available for structure placement was calculated using the total number of sub-blocks available for structure placement (160) divided by the number of sub-blocks in a single OCS block (16).

Maintenance trips to a meteorological tower may occur weekly (for a tower with diesel generators) to monthly or quarterly (for a tower powered by solar or wind), and monthly to quarterly for each buoy. However, to provide for a conservative scenario, total maintenance vessel trip calculations are based on weekly trips for a tower and monthly trips for buoys over the entire 5-year site assessment period (Year 2 after lease execution and going through Year 6 after lease execution; Table 3-10). BOEM anticipates that crew boats used for operations and maintenance activities would be approximately 51 to 57 ft (16 to 17 m) long with 400- to 1,000-horsepower engines and 1,800-gallon fuel capacity.

BOEM estimates that the total vessel traffic as a result of the installation, routine operations and maintenance, and decommissioning of a meteorological tower under the proposed action would be between 100 and 340 round trips over a 6-year period (Table 3-10). Installation, routine operations and maintenance, and decommissioning of two buoys are anticipated to result in between 44 and 128 round trips over approximately 6 to 7 years. If a tower and two buoys are installed, BOEM anticipates up to approximately 468 trips would be needed for installation, operations and maintenance, and decommissioning.

Table 3-10
Projected Maximum Vessel Trips for the Proposed Action (Alternative A) Site Assessment Activities

Buoy/Tower	Site Assessment Activity	Round Trips	Formula
Meteorological Buoys	Meteorological Buoy Installation	2–4	1–2 round trips x 2 buoys
	Meteorological Buoy Quarterly–Monthly Maintenance Trips	40–120	4 quarters x 2 buoys x 5 years – 12 months x 2 buoys x 5 years
	Meteorological Buoy Decommission	2 –4	1–2 round trips x 2 buoys
	Total Buoy Trips Over 5-Year Period	44–128	N/A
Meteorological Tower	Meteorological Tower Construction	40	40 round trips x 1 tower
	Meteorological Tower Quarterly–Weekly Maintenance Trips[1]	20–260	4 quarters x 1 tower x 5 years – 52 weeks x 1 tower x 5 years
	Meteorological Tower Decommission	40	40 round trips x 1 tower
	Total Tower Trips Over 5-Year Period	100–340	N/A
	Total Trips for a Tower and Two Buoys	**144–468**	**N/A**

(1) Although construction and decommissioning would occur during some of the weeks and, therefore, not all weeks would require maintenance trips for a tower, all weeks were included for maintenance to be conservative in the trip calculations.

N/A = not applicable

3.2.4.3 Vessel Traffic Summary

As described in Section 3.2.4.1 *Vessel Traffic Associated with Site Characterization*, for surveying, BOEM estimated the number of round trips based on both 24-hour surveying and a 10-hour survey day (and thus one vessel round trip per day). BOEM assumes that the actual number of vessel trips would fall within the range of range of the fewest estimated trips associated with 24-hour surveying and the maximum estimated trips associated with 10-hour survey days.

Based on the reasonably foreseeable scenario presented throughout Section 3 of this EA, BOEM estimates that the amount of vessel round trips associated with Alternative A for installation of one meteorological tower and two buoys would range from approximately 350 to 1,000 (Table 3-11). The vessel round trips would occur from various ports to the WEA spread over approximately 7 years.[11]

Table 3-11
Range of Estimated Vessel Round Trips for Alternative A Assuming Installation of One Tower and Two Buoys

Type of Activity	Number of Round Trips based on 24-hour surveying	Number of Round Trips based on a 10-hour-long Survey Day
Site Characterization	203–215	530–542
Site Assessment (One Tower and Two Buoys)	144–468	144–468
Total	**347–683**	**674–1,010**

3.3 Non-Routine Events

BOEM believes the following are the most reasonably foreseeable non-routine events and hazards that could occur during data collection activities: (1) severe storms such as hurricanes and extratropical cyclones, (2) collisions between the site assessment structure[12] or associated vessels and other marine vessels or marine life, and (3) spills from collisions or during generator refueling. These events and hazards are summarized in the sections that follow.

3.3.1 Storms

Severe weather events have the potential to cause structural damage and injury to personnel. Major storms, winter nor'easters, and hurricanes pass through the area regularly, resulting in elevated water levels (storm surge) and high waves and winds. Storm surge and wave heights from passing storms are worse in shallow water and along the coast but can pose hazards in offshore areas.

In the vicinity of the WEA, data collected between 1975 and 2008 from a National Data Buoy Center buoy located offshore New York City (Buoy 44025, located at 40°15'3" N 73°9'52" W)(National Buoy Data Center, 2015a) showed that average wind speeds are typically lowest in July and August, at approximately 9 to 10 knots, and highest in December and January, at approximately 24 knots (National Data Buoy Center, 2015b). Peak winds over the period of record (1996–2008) were recorded in the month of September at 75 knots at Buoy 44025 (National Data Buoy Center, 2015c). The highest winds are associated with tropical cyclones

[11] For trip calculations, BOEM assumes that site characterization would occur in Years 1 to 5 after lease execution, and site assessment would be spread across Years 2 to 7 after lease execution as follows: Year 2 for construction and operation, Years 3 to 6 for operation, and decommissioning to occur in Year 7 (although a tower may remain in place for a number of years following the 5-year site assessment period).

[12] Also referred to as a "meteorological structure."

(i.e., hurricanes), but more often, high-wind events are associated with extratropical cyclones (i.e., nor'easters) in the winter season.

The Atlantic Ocean hurricane season is June 1 to November 30 with a peak in September when hurricanes would be most likely to impact the WEA at some time during the proposed action (NOAA NHC, 2016). Historically, hurricane threats exist in the region of the WEA. From 1851 to 2010, a reported 12 hurricanes struck the New York coast and two hurricanes struck the New Jersey coastline, five and zero of which, respectively, were major (Blake et al., 2011). Blake et al. (2011) estimated the return period, in years, of all hurricanes (winds greater than or equal to 64 knots) passing within 50 nm (92.6 km) of various locations along the U.S. coast. In the region of the WEA, the return period for such an event is listed as 19 years, while the return period for a major (Category 3 or greater) hurricane, in the same location, is 74 years. Nor'easters are also cyclonic storms, but they come with winds from the northeast direction, and primarily affect New England and the Canadian Maritime Provinces (NOAA NWS, 2016).

3.3.2 Allisions and Collisions

An allision occurs when a moving object (i.e., a vessel) strikes a stationary object (e.g., meteorological tower or buoy); a collision occurs when two moving objects strike each other. A meteorological tower and/or buoys in the WEA could pose a risk to both vessel and aviation navigation. An allision between a ship or an airplane and a meteorological structure could result in the loss of the entire facility and/or the vessel/airplane, as well as loss of life and spillage of diesel fuel. If a vessel hits a buoy system, it could damage the buoy hull so the buoy loses its buoyancy and sinks or could damage the equipment or its supporting structure. Because a buoy would protrude from the ocean surface only 30 to 40 ft (9 to 12 m), an airplane striking a buoy is unlikely.

Vessels associated with site characterization and assessment activities could collide with other vessels, resulting in damages, diesel spills, or capsizing. Vessel collisions and allisions are unlikely because vessel traffic is controlled by multiple routing measures, such as safety fairways, TSSs, and anchorages. Airplane collisions and allisions are also considered unlikely. BOEM anticipates that aerial surveys would not be conducted during periods of storm activity because the reduced visibility conditions would not meet visibility requirements for conducting the surveys, and flying at low elevations would pose a safety risk during storms and times of low visibility. Risk of allisions with a meteorological tower and/or buoys for both vessels and airplanes would be further reduced by USCG-required marking and FAA-required lighting.

Historical data support the conclusion that the number of potential allisions and collisions resulting in major damage (defined as greater than $25,000 worth of damage) to property and equipment would be small. Allision and collision incident data were reviewed for the years 1996 through 2010 for the Gulf of Mexico and Pacific regions (BOEM, 2011b), which contain many fixed structures on the OCS, such as oil and gas platforms. The vessel traffic associated with operations and maintenance activities for fixed structures in the Gulf of Mexico and Pacific regions would likely be more than what is needed for a meteorological tower in the WEA, but provides a basis for comparison of the potential occurrence of allisions/collisions. The allision/collision data, which were recorded over a 15-year period on over 4,000 structures, reported 197 allisions and collisions in the Gulf of Mexico and Pacific regions; this number includes reports of all major damages and some, but not all, minor damages (less than $25,000 in damages). For those data (BOEM, 2011b), the most commonly reported causes of the allisions and collisions include human error, weather-related causes, equipment failure on the vessels, and navigational aids not working on the structures; BOEM would anticipate similar causes for allisions/collisions on the Atlantic OCS.

3.3.3 Spills

A fuel spill could occur as a result of hull damage from allisions, collisions between vessels, accidents during the maintenance or transfer of offshore equipment and/or crew, or due to natural events (i.e., strong waves or storms). The amount of diesel fuel that could be released by a marine vessel involved in a collision would depend on (1) the type of vessel, (2) the vessel size, (3) construction of the vessel (e.g., double-hulled cargo and/or bunker tanks), (4) the severity of the collision, and (5) the velocity of the vessel and angle of approach at the time of the impact (Bejarano et al., 2013). From 2000 to 2009, the average spill size for vessels other than tank ships and tank barges was 88 gallons (333 liters) (USCG, 2011); should a spill from a vessel associated with the proposed action occur, BOEM anticipates that the average volume would be similar. Diesel fuel is lighter than water and may float on the water's surface or be dispersed into the water column by waves. Diesel would be expected to dissipate very rapidly, evaporate and biodegrade within a few days (MMS, 2007b).

The results of a recent study of a Call Area in North Carolina and two WEAs (Maryland and Rhode Island/Massachusetts) estimated that the mostly likely spills—small spills releasing up to several hundred gallons—could occur once per month from vessel allisions, but the probability of a catastrophic spill[13] would be very low (occurring approximately once in over 1,000 years) (Bejarano et al., 2013). The most likely types of releases from vessel allisions could be up to a few thousand gallons of oils and are anticipated to result in minimal, temporary environmental consequences limited to the vicinity of the point of release; however, the probability of these types of releases is very small (Bejarano et al., 2013).

Diesel generators may be used to power the equipment on a meteorological tower and/or buoys; minor diesel fuel spills could occur during refueling of generators. Depending on the amount of diesel contained within generators on a meteorological tower and/or buoys, BSEE may require lessees to prepare and implement a spill response plan.

The extent, duration and potential effects of a spill would depend on the severity of the accident, the amount of corrosion or structural failure during a collision, the degree and rate of outflow of pollutant (oil, diesel), the type of material spilled, meteorological conditions, and the length of time before a spill is noticed, equipment is repaired, and the speed with which cleanup occurred. Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills.

[13] A catastrophic spill is categorized as a spill involving oil totaling 129,000 gallons or more or a chemical release totaling 29,000 gallons or more (Bejarano et al., 2013).

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4 ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES

4.1 Definitions of Impact Levels

The conclusions for most analyses in this EA use a four-level classification scheme (negligible, minor, moderate, and major) to characterize the environmental impacts predicted if the proposed action or an alternative is implemented. Definitions of impacts are presented in two separate groups: one for biological and physical resources and one for socioeconomic resources. The CEQ interprets the human environment "to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14).

The impact level definitions below were originally developed for BOEM's *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS, 2007a), and are used in this EA to provide consistency in BOEM's discussion of impacts. BOEM continues to refine these definitions as part of its NEPA decision-making process.

4.1.1 Impact Levels for Biological and Physical Resources

The following impact levels definitions are used for biological and physical resources. For biota, these levels are based on population-level impacts rather than impacts on individuals.

Negligible

- No measurable impacts.

Minor

- Most impacts on the affected resource could be avoided with proper mitigation.
- If impacts occur, the affected resource would recover completely without any mitigation once the impacting agent is eliminated.

Moderate

- Impacts on the affected resource are unavoidable.
- The viability of the affected resource is not threatened although some impacts may be irreversible, or the affected resource would recover completely if proper mitigation is applied during the life of the project or proper remedial action is taken once the impacting agent is eliminated.

Major

- Impacts on the affected resource are unavoidable.
- The viability of the affected resource may be threatened, and the affected resource would not fully recover even if proper mitigation is applied during the life of the project or remedial action is taken once the impacting agent is eliminated.

4.1.2 Impact Levels for Socioeconomic Issues

The following impact levels are used for the analysis of socioeconomic resources.

Negligible

- No measurable impacts.

Minor

- Adverse impacts on the affected activity or community could be avoided with proper mitigation.
- 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 without any mitigation.

Moderate

- Impacts on the affected activity or community are unavoidable.
- Proper mitigation 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

- Impacts on the affected activity or community are unavoidable.
- Proper mitigation would reduce impacts somewhat during the life of the project.
- The affected activity or community would experience unavoidable disruptions to a degree beyond what is normally acceptable, and once the impacting agent is eliminated, the affected activity or community may retain measurable effects indefinitely, even if remedial action is taken.

4.2 Other NEPA Reviews Incorporated by Reference

As discussed in Section 1.4.1 *Information Considered* and Section 1.5 *Supporting NEPA Evaluations*, BOEM has completed other NEPA reviews for the same types of resources. Although the geographic area evaluated in the G&G Final PEIS (BOEM, 2014a) does not cover the area proposed for the New York WEA, the proposed action included similar survey activities, impact-producing factors, and types of impacts from G&G surveys that may be conducted in the New York WEA. Therefore, BOEM has incorporated the G&G Final PEIS, BOEM's *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (MMS, 2007a) and other relevant NEPA documents into this EA by reference. See Section 1.5 *Supporting NEPA Evaluations* for a list of the supporting NEPA evaluations referenced and summarized as appropriate in the following impact analyses.

4.3 Resources Eliminated from Further Consideration

NEPA requires issues (resource areas) that are significant to the action be the focus of the analysis. Because many of the activities described in this EA have been previously analyzed, the potential for impacts are well documented. The *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts* (BOEM, 2014b), the *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina* (BOEM, 2015a), the G&G Final PEIS (BOEM, 2014a), and other relevant EAs (see Section 1.5 *Supporting NEPA Evaluations*) address the three resource areas listed below. Although these previous documents do not specifically address the New York area, the same types of activities described in this EA are addressed in those documents. The evaluations and conclusions in those documents are consistent with BOEM's determination that the following resource areas will not be carried forward for analysis in this EA because impacts to those resources are anticipated to be negligible.

4.3.1 Geology and Soils

The potential impacts on sediments, geology, and soils from deep stratigraphic and shallow test drilling and bottom sampling off the coast of New York would be negligible. This is consistent with the analysis of the G&G Final PEIS (BOEM, 2014a). Although the G&G Final PEIS (BOEM, 2014a) addresses the Mid-Atlantic and South Atlantic planning areas and, therefore, does not address New York specifically, it does address impacts from similar activities. The installation of a meteorological tower would result in more impacts to the seafloor than disturbance from bottom sampling (approximately 10 m^2 per sample) or disturbance from installation of a meteorological buoy (approximately 8.5 ac with anchor sweep) (BOEM, 2014a). Disturbance associated with the installation of a meteorological tower would affect the sediments on the seafloor at a maximum radius of 1,500 ft (~450 m), or 162 ac (66 ha) around the bottom-founded structure, including all anchorages and appurtenances of the support vessels. The resulting 162 ac (66 ha) of affected seafloor is less than 0.2 percent of the total 81,130 ac (32,832 ha) of the WEA, if the meteorological tower is installed and disturbs the maximum foreseeable area of seafloor. This would create negligible impacts on the geology and soil of the seafloor associated with the construction of the meteorological tower.

4.3.2 Physical Oceanography

Physical oceanography would not be affected by survey vessels, or by the installation of meteorological tower or buoys off the coast of New York. Ocean current characteristics, water column density stratification, and vertical current structure, among other factors, would be considered by the lessee during the planning, operation, and data post-processing activities as part of the SAP. Construction of a meteorological tower would affect a small portion of the seafloor at a maximum radius of 1,500 ft (~450 m) or 162 ac (66 ha) around each bottom-founded structure, including all anchorages and appurtenances of the support vessels. With the exception of the meteorological tower foundations, these would be temporary seafloor impacts and only small areas within each radius would be affected by vessel anchorages and appurtenances at one time. Seafloor disturbances would also occur from installation of scour prevention methods such as rock armoring or artificial seagrass. If a scour control system were installed, the maximum seafloor disturbance would be approximately 0.6 ac (0.37 ac [0.15 ha] or less for rock armor, 0.18 ac [0.07 ha] or less for artificial seagrass, and 0.05 ac [0.02 ha] or less for the foundation, as discussed in Section 3.2.2.1 *Meteorological Towers and Foundations*). Impacts to ocean currents, water column density, or other physical oceanographic characteristics would be negligible.

4.3.3 Coastal Infrastructure

Vessel and crew usage of onshore facilities associated with site characterization have been analyzed in previous EAs (hereby incorporated by reference; *see* Section 1.5 *Supporting NEPA Evaluations* for a complete list) and are not discussed here, because these activities would be the same. Existing commercial ports (listed in Section 3.2.3 *Port Facilities*), harbors, or industrial areas composing the coastal infrastructure in New York and New Jersey could be used when implementing the proposed action.

Activities associated with the proposed action would not require additional coastal infrastructure to be constructed, nor would they require expansion of port areas, even if smaller ports are used, and would be smaller in scale than ongoing activities at existing ports. Activities associated with site characterization and site assessment have been analyzed previously by BOEM in the North Carolina EA (BOEM, 2015a), the Rhode Island/Massachusetts EA (BOEM, 2013a), and the Mid-Atlantic EA (BOEM, 2012d; covering New Jersey, Maryland, Delaware, and Virginia), which are incorporated by reference. In those EAs, BOEM determined that there would be no impacts on coastal infrastructure from site characterization and assessment because the existing infrastructure and facilities would be adequate to accommodate proposed action activities. Therefore, there would be no impacts on coastal infrastructure in the vicinity of the WEA.

Since the use of existing ports and marinas for site characterization and site assessment activities would be consistent with existing uses, and no additional infrastructure would be required for site characterization and assessment activities, there would be **no impacts** to coastal infrastructure as a result of the proposed action.

4.4 Alternative A – The Proposed Action

4.4.1 Physical Resources

4.4.1.1 Air Quality

Description of the Affected Environment

Potential air quality impacts from site characterization activities and meteorological buoys were evaluated in the G&G Final PEIS (BOEM, 2014a), and were found to be negligible. The following sections present an area-specific evaluation of air quality impacts associated with G&G activities under Alternative A, along with an evaluation of air impacts associated with site assessment activities and the construction, operation, and decommissioning of a meteorological tower and/or two buoys.

Air Quality Standards and Regulations

The Clean Air Act of 1970 (42 U.S.C. § 7401 et seq., as amended) directed EPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants listed as "criteria" pollutants because there was adequate reason to believe that their presence in the ambient air "may reasonably be anticipated to endanger public health and welfare." The NAAQS apply to:

- Sulfur dioxide (SO_2),
- Nitrogen dioxide (NO_2),
- Carbon monoxide (CO),
- Ozone (O_3),
- Particulate matter (PM_{10} and $PM_{2.5}$ [particulate matter with aerodynamic diameters of 10 microns or less and 2.5 microns or less, respectively]), and
- Lead (Pb).

EPA sets the primary NAAQS at levels to protect public health with an adequate margin of safety, and the secondary NAAQS at levels to protect public welfare (40 CFR 50). All of the standards are expressed as concentrations in air and duration of exposure. Many standards address both short- and long-term exposures. When the monitored pollutant levels in an area of a state are within the NAAQS for any pollutant, EPA classifies that area as "attainment" for that pollutant. When monitored pollutant levels exceed the NAAQS, the area is classified as "nonattainment." Former nonattainment areas that have achieved attainment are classified as "maintenance" areas. EPA assigns an air quality rating for each area ranging from marginal to extreme.

A review of New Jersey and New York land areas that may be affected by emissions associated with Alternative A (i.e., the coastal counties nearest the WEA) revealed that O_3 is in marginal non-attainment in all of the reviewed counties. These counties include: Monmouth, Ocean, and Hudson in New Jersey and Suffolk, Queens, Kings, Nassau, and Richmond in New York. Some of the areas (five of the eight counties reviewed) are also a moderate maintenance area for CO. All other criteria pollutants are in attainment in the coastal counties nearest the WEA (EPA, 2015a).

The "Visibility Protection" and "Prevention of Significant Deterioration" provisions of the Clean Air Act (Sections 169A and 162, respectively) protect certain lands designated as mandatory federal Class I areas (e.g., national parks and wilderness areas) because air quality is a special feature of the area. Very little degradation of air quality, including air quality-related values such as visibility, is allowed in Class I areas. In general, if a project is located within 62 mi (100 km) of a Class I area, its impacts on concentrations of criteria pollutants in the Class I area should be determined (EPA, 1992). The closest Class I area to the project is the Brigantine Wilderness Area in New Jersey (40 CFR 81), which is approximately 75 mi (121 km) southwest of the WEA, and is therefore not considered in this evaluation.

Meteorology

There are two dominant seasonal wind directions: spring and summer winds (March through September) are generally from the south-southwest, while fall and winter winds (September through March) are generally from the west-northwest (BOEM, 2014e). The frequency that the wind is blowing in a given compass direction at any given time of year can be shown by using wind roses. In the wind rose, the longer the bar, the more frequent the winds in that direction. Typical wind speeds are also shown within the bars. Figure 4-1 and Figure 4-2 show modeled wind roses in the spring-summer season and winter-fall season, respectively, in the WEA.

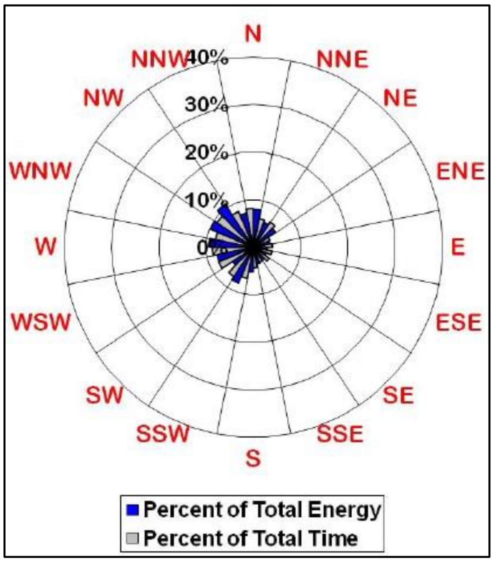


Figure 4-1 Wind Rose for September to March for a Modeled Monitoring Location in the WEA

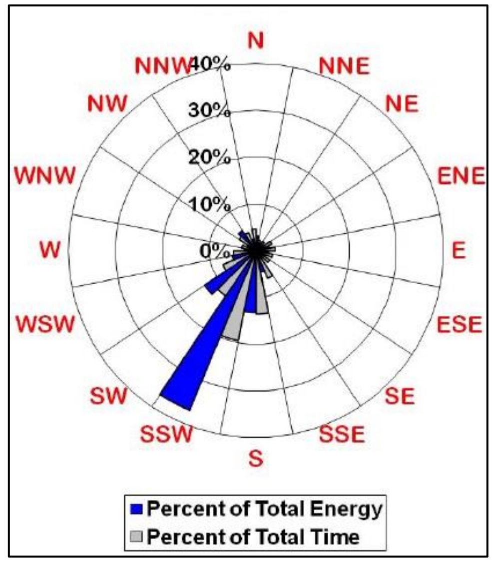


Figure 4-2 Wind Rose for April to August for a Modeled Monitoring Location in the WEA

Source: NYSERDA, 2010

The highest wind speeds tend to occur during winter storms, while lower wind speeds are more common in the milder spring-summer season (BOEM, 2014e). Wind speeds offshore New York and New Jersey average about 29 ft (8.8 m) per second, with the average wind speed decreasing near the shore (NYSERDA, 2010). Extreme weather conditions such as Nor'easters and hurricanes, which affect the WEA and onshore areas of New York and New Jersey, are described in Section 3.3.1 *Storms*.

A common meteorological feature along coastal areas is the "sea breeze" and "land breeze." During the day, the land tends to heat up faster than the water, leading to higher air temperatures over the land surface than over the water surface, causing a circulation system in which the air nearest the surface flows onshore (sea breeze). During the night, the land cools faster than the water, leading to lower air temperatures over the land surface than over the water surface, causing a circulation system in which the air nearest the surface flows offshore (land breeze) (NOAA, 2010). The sea/land breeze circulation can affect air quality because it can cause recirculation of pollutants. Emissions generated early in the day may be carried offshore and then may be carried back onshore in the evening (BOEM, 2014e). This circulation can contribute to increased O_3 concentrations onshore because emissions of precursor pollutants (primarily nitrogen oxides [NO_x] and volatile organic compounds [VOCs]) can be transported offshore in the morning and can form O_3 while over the ocean, and then the afternoon breeze can transport the O_3 back over land.

Air Quality Measurements

State air quality agencies maintain networks of monitoring sites to measure ambient air pollutant concentrations and evaluate compliance with NAAQS.

In New Jersey coastal areas closest to the WEA, monitoring sites maintained by the New Jersey Department of Environmental Protection are located in:

- Monmouth University in Monmouth County,
- Toms River in Ocean County,
- Bayonne in Hudson County, and
- Jersey City in Hudson County.

According to 2013 data, O_3 was found to be in exceedance of the NAAQS 1 day of the year at Bayonne and 3 days of the year at Monmouth University. All other criteria pollutants were found to be below the NAAQS at these monitoring sites (NJDEP, 2013).

In New York coastal areas closest to the WEA, monitoring sites maintained by NYSDEC are located in:[14]

- Eisenhower Park in Nassau County,
- Babylon in Suffolk County,
- Holtsville in Suffolk County,
- Queens College in Queens County,
- Maspeth Library in Queens County,
- Brooklyn, and
- South Wagner High School on Staten Island.

According to 2014 data, all criteria pollutants were found to be below the NAAQS at these monitoring sites (NYSDEC, 2014).

Regulatory Controls on OCS Activities that Affect Air Quality

OCS sources that may affect the air quality of any state are regulated by EPA under Section 328 of the Clean Air Act Amendments of 1990 (40 CFR 55). For the proposed action, OCS sources would include a meteorological tower and/or buoy, any vessels used to construct, service, or decommission that tower or buoy, and seafloor boring activities. Under the EPA rules, for all OCS sources within 25 nm (46 km) of the states' seaward boundaries,[15] the requirements

[14] No monitoring stations are located in Kings County, NY or Richmond County, NY.

[15] As specified in 43 U.S.C. § 1312, in the states potentially affected by Alternative A, the state seaward boundaries extend 3 nm from the coastline.

are the same as would be otherwise applicable if the sources were located in the corresponding onshore area (40 CFR 55.3). With respect to calculations of a facility's Potential to Emit, EPA considers emissions from vessels that are servicing or associated with the operations of OCS sources as direct emissions from the OCS source when those vessels are at the source or en route to or from the source as long as they are within 25 nm (46 km) of the shoreline (40 CFR 55.2).

Impact Analysis of Alternative A

Both routine activities and non-routine events were considered in the analysis below to determine impacts.

Routine Activities

Routine activities include site characterization surveys and site assessment activities. Emission sources considered for these activities are identified below.

Emissions Sources

Air emissions sources potentially associated with Alternative A include:

- Emissions from vessels used for:
  - Site characterization surveys
  - Site assessment activities (i.e., construction, operations and maintenance, and decommissioning of metrological tower/buoys)
- Emissions from onshore vehicles and equipment, such as:
  - Heavy duty trucks
  - Personal vehicles from commuting workers
  - Construction equipment used in construction of a meteorological tower
- Diesel engines used to operate the meteorological tower and/or buoys.

Assumptions

Emissions of criteria pollutants from site characterization surveys and site assessment activities were calculated to estimate the reasonably foreseeable scenario for emissions in any given year of the lease period (Appendix C).

The following assumptions were made to provide a representative evaluation of potential air impacts:

- Round-trip vessel mileage is based on the distance from representative ports to the mid-point of the WEA.
- Total number of vessel round trips is based on 10-hour survey days. Lessees would conduct surveys in the most efficient manner, which may involve 24-hour surveying; however, because inclement weather and equipment failure can result in delays, BOEM is basing emissions calculations on a conservative scenario of a 10-hour survey day resulting in a single round trip per day.

- Site characterization activities would take place over 5 years. Total round-trip travel was divided equally over a 5-year period.
- Although the tower and buoys could be decommissioned a number of years following the 5-year site assessment period, BOEM assumes that decommissioning would occur in Year 7 after lease execution (1 year after the end of the 5-year site assessment period, which would likely start in Year 2 after lease execution).
- Boats (rather than aircraft) would be used for avian surveys.
- Power to operate a meteorological tower and/or buoys would be provided by diesel engines. Diesel engines would be permitted to operate, as needed.
- The meteorological tower and/or buoys would be installed in the same year.
- Activities under Alternative A would occur simultaneously with other navigation/vessel traffic that frequents the same water and airways.
- The impacts of miscellaneous activities onshore would be considered **negligible** because of the temporary nature and nearly undetectable impact of the activities when compared to the existing industrial activities/production operations already occurring at the fabrication yards.

Site Characterization and Site Assessment Activities

Vessel traffic due to site characterization surveys and site assessment activities would add to current vessel traffic levels in the WEA and to the ports used by the survey vessels. As described in Section 4.4.3.2 *Navigation/Vessel Traffic,* the additional vessel activity would be temporary and minor when compared with existing vessel traffic levels (Table 3-11) for a summary of vessel trips associated with Alternative A). Impacts from air pollutant emissions associated with these vessels would be localized within the WEA and in the vicinity of vessel activity.

The onshore areas that are closest to the WEA are classified as non-attainment areas for O_3. Hudson, Queens, Kings, Nassau, and Richmond Counties are classified as maintenance areas for CO (Table 4-1). Nonattainment and maintenance areas are subject to the EPA General Conformity Rule (40 CFR 93, Subpart B). The rule establishes emissions thresholds, or *de minimis* levels, for use in evaluating a project's conformity with the applicable State Implementation Plan. If the net air pollutant emissions exceed these thresholds, a formal conformity determination may be required. If a submitted SAP indicates that project-related activities in the non-attainment and maintenance areas would emit more than the thresholds, then a General Conformity analysis would be performed. The *de minimis* levels for consideration in the project's conformity analysis are:

- 100 tons/year (90.7 metric tons/year) of NO_x (O_3 precursor),
- 50 tons/year (45.5 metric tons/year) VOCs (O_3 precursor), and
- 100 tons/year (90.7 metric tons/year) CO.

Table 4-1
Summary of Annual Criteria Emissions by Activity for Alternative A

Activity and Year after Lease Execution	Emissions (tons/year)						Emissions (metric tons/year)		
	CO	NO_x	VOCs	$PM_{2.5}$	PM_{10}	SO_x	CO_2[1]	N_2O	CH_4
Year 1 – Site Characterization	1.41	15.57	0.91	0.85	0.85	1.53	747.32	0.02	0.10
Year 2 – Site Characterization and Site Assessment (Construction and Operation)	6.59	40.35	3.47	2.58	2.58	3.23	1,664.91	0.02	0.11
Year 3 – Site Characterization and Site Assessment (Operation)	6.39	39.04	3.09	2.50	2.50	3.11	1,579.63	0.02	0.10
Year 4 – Site Characterization and Site Assessment (Operation)	6.39	39.04	3.09	2.50	2.50	3.11	1,579.63	0.02	0.10
Year 5 – Site Characterization and Site Assessment (Operation)	6.39	39.04	3.09	2.50	2.50	3.11	1,579.63	0.02	0.10
Year 6 – Site Assessment (Operation)	4.98	23.47	2.19	1.65	1.65	1.57	832.32	0.00	0.00
Year 7 – Site Assessment (Decommissioning)	0.15	1.15	0.36	0.07	0.07	0.11	64.33	0.00	0.01

[1] The CO_2 value for generators (included in the Operation) is in CO_2e (carbon dioxide equivalent), which provides an expression of CO_2, N_2O, and CH_4 emissions combined.

CH_4 = methane
CO = carbon monoxide
CO_2 = carbon dioxide
N_2O = nitrous oxide
NO_x = nitrogen oxides
PM_{10} = particulate matter with aerodynamic diameters of 10 microns or less
$PM_{2.5}$ = particulate matter with aerodynamic diameters of 2.5 microns or less
SO_x = sulphur oxides
VOC = volatile organic compound

If the project results in net increases in emissions that are lower than the *de minimis* levels, the project is presumed to conform, and no further conformity evaluation is necessary. Based on the emissions sources and assumptions listed above, estimated annual emissions associated with Alternative A for NO_x, VOCs, and CO were below *de minimis* levels; therefore, no further conformity evaluation is needed.

Emissions associated with buoy deployment would be less than those associated with tower installation because buoys would be towed or carried aboard a vessel and then anchored to the seafloor. No drilling equipment would be required to install meteorological buoys. Installation and decommissioning of a meteorological buoy can likely be completed in 2 days (and thus a maximum of two vessel round trips), which BOEM anticipates would involve up to eight round trips combined (two round trips for two buoys for installation and the same for decommissioning) (Table 3-10). This is well below the 80 trips estimated for tower installation and decommissioning combined, therefore, projected emissions associated with construction and decommissioning of meteorological buoys would be lower than for a tower.

Estimated Emissions

Table 4-1 shows estimated emissions for site characterization surveys and site assessment activities, using recognized emission factors and conservative assumptions. The numbers of vessel trips and associated emission calculations, along with the assumptions used to complete the calculations, are provided in Appendix C.

Non-Routine Events

Non-routine events include fuel spills, collisions, and allisions. Although spills are unlikely, vapors from fuel spills resulting either from vessel collisions/allisions or from servicing or refueling generators on the meteorological tower and/or buoys may result in impacts on air quality in the WEA or along the cable survey route. The estimated spill size is assumed to be approximately 88 gallons (333 liters) (see Section 3.3.3 *Spills*). If such a spill were to occur, it would be expected to dissipate rapidly and then evaporate and biodegrade within a few days (MMS, 2007b). A diesel spill in the WEA would not be expected to have impacts on onshore air quality because of the estimated size of the spill, prevailing atmospheric conditions over the WEA, and distance from shore.

A spill could occur in the event of vessel collision while on the way to and from the WEA or during surveys. Spills occurring in the WEA, along the cable route, in harbors and along coastal areas are not anticipated to have significant impacts on onshore air quality because of the small estimated size and short duration of the spill.

Conclusion

Although the emissions estimates from site characterization and site assessment activities are measurable, they would not be distinguishable from other air emissions onshore or offshore; therefore, emissions associated with the proposed action would be **negligible**. As shown in Table 4-1, air pollutant concentrations due to emissions from the proposed action are not expected to lead to any violation of the NAAQS.

4.4.1.2 Water Quality

Description of the Affected Environment

The affected environment for water quality includes waters within the OCS in the WEA and along navigation routes between the WEA and the specific primary ports that have been identified as likely to be used by a lessee.

New York/New Jersey Coastal Waters

In the *National Coastal Conditions Report IV* (EPA, 2012), EPA assessed the overall water quality and sediment quality of Northeast coastal waters, with sampling inclusive of coastal waters of New York and New Jersey. Based on an index derived from water quality parameters of nutrient concentrations, dissolved oxygen, water clarity, and chlorophyll *a* concentration, EPA rated the overall water quality for the Northeast coast, including the portions of the New York and New Jersey coasts within the affected environment for this EA, as “fair” (EPA, 2012). However, monitoring conducted primarily during the summer months of 2000 to 2006 within the New York/New Jersey Harbor area indicated consistently elevated nutrient levels. Areas of high human population densities are more susceptible to eutrophication, or elevated nutrient concentrations. The New York/New Jersey region is the most densely populated portion of the Northeast coast, with a population density exceeding 6,000 people per mi^2 throughout much of the metropolitan area and 20,645 people per mi^2 within New York City itself (EPA, 2012). EPA characterized sediment quality using an index based on sediment toxicity, sediment contaminants, and sediment total organic carbon (EPA, 2012). Overall sediment quality for the Northeast coast was rated as "fair" based on data from 1,024 sediment-monitoring sites in the region. While the distribution of sites in each rating category is relatively uniform along the Northeast coast, the New York/New Jersey Harbor area stands out as having an unusually high density of sites with "poor" sediment quality.

Marine Waters

No data specific to water quality or sediment quality within the WEA are available at this time, though limited data are available for waters in the vicinity of the WEA (Balthis et al., 2009). The majority of pollutants to marine water quality originate onshore; these onshore sources include discharges from point sources such as wastewater treatment facilities, non-point sources such as stormwater runoff, and agricultural runoff. Surface currents in the vicinity of the WEA, which reflect the complex interaction between shelf circulation, wind-driven circulation, and freshwater discharge from the Hudson River (Chant et al., 2008), result in continual movement and circulation of water in the WEA. The WEA is far enough from shore that oceanic circulation and the volume of water in the offshore environment where the WEA is located would begin to disperse, dilute, and biodegrade many contaminants that originate from shore (BOEM, 2012b). This assertion is consistent with maps of seasonally averaged chlorophyll *a* and turbidity of the area derived from satellite imagery, which show that values of these parameters within the WEA are significantly lower than the values found near shore (Kinlan et al., 2012). Offshore sources of pollutants would be potential discharges from ships; ocean-going vessels sometimes discharge bilge and ballast water and sanitary waste prior to entering state waters due to state restrictions on discharges in their waters (MMS 2007a). Such discharges would be subject to regulation under 33 CFR 151.10 (bilge and ballast water) and 33 CFR 159 (sanitary waste).

Impact Analysis of Alternative A

Activities associated with Alternative A that may result in impacts to water quality include routine activities such as mechanical disturbance of the seafloor and discharge of bilge water, ballast water, or sanitary/domestic wastewater, as well as non-routine events such as accidental spills of fuel and maintenance materials, such as lubricants and solid debris. The potential water quality impacts related to site characterization and G&G activities on the OCS have previously been examined and found to be negligible (MMS, 2007a).

Routine Activities

Routine activities that have the potential to adversely affect water quality include discharges from survey vessels and vessels servicing the tower and/or buoys (i.e., bilge water, ballast water, sanitary waste, and debris). Bilge and ballast water discharges may contain small amounts of petroleum-based products and metals, and as such are prohibited within 13 nm (24 km) of the shore. Any vessels conducting surveys or servicing a tower and/or buoys are likely to be equipped with holding tanks for sanitary waste and would not discharge untreated sanitary waste within state or federal waters. The regulations governing the relevant discharges are discussed in Section 3.2.1.5 *Operational Waste Associated with Site Characterization*. The instrumentation used for site characterization is self-contained, so there should be no discharges from instruments aboard the survey vessels that would impact water quality.

Impacts to water quality would occur during construction and decommissioning, with water quality returning to its original state both during operation of the tower and/or buoys and after decommissioning. The seabed would be disturbed locally during construction of a meteorological tower and/or buoys as a byproduct of anchoring, pile driving, and placement of scour protection devices. The resulting mobilization of sediments would produce **minor**, transient impacts to water quality in the immediate vicinity of the disturbance in the form of increased turbidity. These changes would likely be small in magnitude and limited in spatial scale, since the displaced sediments are rapidly diluted as they spread within the water column. Assuming mobilized sediments spread radially within a confined layer at the bottom of the water column (i.e., cylindrical spreading), the concentration of these disturbed sediments in the water column will decrease as the inverse square of the distance from the boundary of the original disturbance due to dilution alone. For example, if disturbance of a circular patch of sediments with a radius of 3 ft (1 m) initially produces an increase in total suspended solids of 100 milligrams per liter (mg/L) directly above the patch, that excess concentration will have decreased to 25 mg/L when it has spread to a radius of 6 ft (2 m) and to 11 mg/L when it has spread out over a radius of 9 ft (3 m). The example used here is meant to illustrate the effects of dilution on suspended sediment concentrations and provide a simplified, conservative estimate of suspended sediment concentrations in the water column based on the physical principle of conservation of mass. This example is not meant to provide a definitive, quantitative assessment of suspended sediment concentrations in the vicinity of a disturbance.

Most site characterization activities are likely to be covered by USACE NWP Numbers 5 and 6, which were developed under Section 404(e) of the Clean Water Act to provide a streamlined evaluation and approval process for certain activities that have minimal adverse impact, both individually and cumulatively, on the environment. NWP 5 covers the placement of scientific measurement devices, including tide gages, water recording devices, water quality testing and improvement devices, meteorological stations and similar structures. NWP 6 covers a variety of survey activities including core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, exploratory trenching, soil surveys, sampling, and historic resources surveys.

Non-Routine Events

Storms would be the primary non-routine event that would affect water quality. Large storm events, including both tropical storms/hurricanes and nor'easters, are capable of producing large waves and strong currents that can potentially mobilize sediments from the seabed, resulting in erosion as well as suspension, transport, and deposition of sediments. This can result in temporary increases in water turbidity during and immediately after storm events. The activities associated with Alternative A would not appreciably add to these natural changes in water quality during storm events.

Accidental spills of oils or lubricants or releases of solid debris are possible during construction, maintenance, and decommissioning of the tower and/or buoys. The discharge and disposal of garbage and other solid debris, including plastics, from vessels into the sea or navigable waters of the U.S. is prohibited (MARPOL Annex V, Public Law 100-220 [Statute 1458]). According to 33 CFR §§ 151.51 through 151.77, all trash and debris must be returned to shore for proper disposal with municipal and solid waste unless it can pass through a comminutor and a 25-millimeter mesh screen onboard ship. The combination of crew training on avoiding accidental discharge and on existing regulations will minimize the risk of solid debris entering the water.

The meteorological tower and/or buoys may include a diesel generator for powering equipment, and small diesel spills could occur during refueling. Vessel collisions/allisions are also a potential source of small diesel spills, if they were to involve major hull damage. Accidental spills of diesel fuel from vessels would likely be small in volume; as described in Section 3.3.3 *Spills*, between 2000 and 2009, the average spill size for vessels other than tank ships and tank barges was 88 gallons (333 liters). Diesel fuel, which is lighter than water, would float on the water surface as a sheen that is readily dispersed by wave action into the water column. Dispersion down to the seafloor would be extremely unlikely. Because diesel oil does not contain the heavier, more persistent components found in crude oil, it would be expected to dissipate rapidly in the environment (MMS, 2007a). The likelihood of a diesel spill would be greatest during construction and decommissioning; the potential for impacts would be reduced substantially during operation of the tower and/or buoys because vessels would be needed only for periodic maintenance. BOEM expects that each of the vessels involved with the installation and operation of a tower and/or buoys will minimize the potential for a release of oils and/or chemicals to the Atlantic Ocean, in accordance with 33 CFR part 151, 33 CFR Part 154, and 33 CFR Part 155, which contain guidelines for implementation and enforcement of vessel response plans, facility response plans, and shipboard oil pollution emergency plans. Impacts from a small diesel spill are anticipated to be **minor** and localized.

Overall, releases/spills (oils, lubricants, trash, debris, fuel) due to non-routine events are likely to be small and result in **minor**, transient impacts on water quality over a localized area in the immediate vicinity of the release/spill.

Conclusion

Overall, activities associated with Alternative A would have a **minor** impact on water quality, with any changes being small in magnitude, highly localized, and transient. Any operational discharges from vessels during surveying or servicing of buoys and a tower would be small and have a **minor** adverse effect. Seabed disturbances during construction, deployment, and decommissioning of buoys or a tower would result in **minor**, localized impacts on water quality in the area immediately adjacent to the meteorological structure or disturbance.

4.4.2 Biological Resources

4.4.2.1 Birds

Bird species that are likely to occur in the WEA are generally found in other nearshore areas of the Atlantic Ocean from North Carolina to Massachusetts. Birds found in these areas have been described in several recent environmental reviews by BOEM (BOEM, 2014a; BOEM, 2015a; BOEM, 2015b) and others (e.g., USCG, 2015a). These descriptions of the affected environment for birds are incorporated herein by reference.

Description of the Affected Environment

Bird Species Likely to Use the WEA Offshore New York

Bird species that would be expected to forage or rest in the WEA (including surrounding nearshore waters and ports) were determined using a variety of sources (Geo-Marine, 2010; Howell, 2012; Menza et al., 2012; ABC, 2015; eBird, 2015; IUCN, 2015; Rodewald, 2015). Data from the coastline to approximately 100 mi (161 km) seaward of the WEA was used to compile a list of bird species that may potentially be present in the WEA. Table 4-2 lists 52 bird species that are most likely to occur in the vicinity of the WEA, their relative frequency of observation, and the seasons in which those species occur. Past offshore surveys (O'Connell et al., 2009) identified 11 seabird species in the WEA (Table 4-2). Compared to other areas of the Atlantic OCS, relatively low numbers of nearshore bird species, pelagic bird species, and gull-like species are predicted to occur within the New York WEA (Figure 4-3 to Figure 4-5).

Table 4-2
Seasonal Occurrence (January through December)
and Frequency of Observation of Bird Species Most Likely to Use the WEA

Common Name	Scientific Name	Group[1]	Frequency[2]	J - F - M - A - M - J - J - A - S - O - N - D[3]
Atlantic Puffin	*Fratercula arctica*		0.01	
Audubon's Shearwater	*Puffinus lherminieri*		0.03	
Black Scoter	*Melanitta americana*	Nearshore	2.55	
Black Skimmer	*Rynchops niger*		3.02	
Black Tern	*Chlidonias niger*		0.59	
Black-legged Kittiwake[4]	*Rissa tridactyla*	Gull-like	0.1	
Bonaparte's Gull	*Chroicocephalus philadelphia*	Gull-like	1.88	
Bufflehead	*Bucephala albeola*		7.17	
Common Eider	*Somateria mollissima*	Nearshore	0.69	
Common Goldeneye	*Bucephala clangula*		1.9	
Common Loon[4]	*Gavia immer*	Nearshore	4.45	
Common Murre[4]	*Uria aalge*		0.04	
Common Tern[4]	*Sterna hirundo*	Nearshore	4.06	
Cory's Shearwater	*Calonectris diomedea*	Pelagic	0.07	
Double-crested Cormorant[4]	*Phalacrocorax auritus*	Nearshore	16.44	
Dovekie	*Alle alle*	Pelagic	0.04	
Forster's Tern	*Sterna forsteri*		6.69	
Glaucous Gull	*Larus hyperboreus*		0.19	
Great Black-backed Gull[4]	*Larus marinus*	Gull-like	16.54	
Great Cormorant	*Phalacrocorax carbo*		1.16	
Great Skua	*Stercorarius skua*		<0.01	
Great Shearwater	*Puffinus gravis*	Pelagic	0.06	
Greater Scaup	*Aythya marila*		1.9	
Harlequin Duck	*Histrionicus histrionicus*		0.37	
Herring Gull[4]	*Larus argentatus*	Gull-like	22.54	
Horned Grebe	*Podiceps auritus*		2.11	
Iceland Gull	*Larus glaucoides*		0.33	
King Eider	*Somateria spectabilis*		0.18	

Common Name	Scientific Name	Group[1]	Frequency[2]	J - F - M - A - M - J - J - A - S - O - N - D[3]
Laughing Gull	*Leucophaeus atricilla*	Gull-like	11.2	
Leach's Storm-Petrel	*Oceanodroma leucorhoa*		0.02	
Least Tern	*Sternula antillarum*		2.64	
Lesser Black-backed Gull	*Larus fuscus*		1.52	
Little Gull	*Hydrocoloeus minutus*		0.09	
Long-tailed Duck	*Clangula hyemalis*	Nearshore	2.43	
Manx Shearwater	*Puffinus puffinus*		0.03	
Northern Fulmar	*Fulmarus glacialis*	Pelagic	0.03	
Northern Gannet[4]	*Morus bassanus*	Gull-like	2.05	
Parasitic Jaeger	*Stercorarius parasiticus*		0.39	
Pomarine Jaeger	*Stercorarius pomarinus*	Pelagic	0.05	
Razorbill[4]	*Alca torda*	Nearshore	0.19	
Red Phalarope	*Phalaropus fulicarius*	Pelagic	0.06	
Red-breasted Merganser	*Mergus serrator*		4.57	
Red-necked Grebe	*Podiceps grisegena*		0.61	
Red-necked Phalarope	*Phalaropus lobatus*		0.08	
Red-throated Loon	*Gavia stellata*	Nearshore	2.48	
Ring-billed Gull	*Larus delawarensis*	Gull-like	22.4	
Roseate Tern	*Sterna dougallii*	Nearshore	0.12	
Royal Tern	*Thalasseus maximus*		2.49	
Sooty Shearwater[4]	*Puffinus griseus*	Pelagic	0.04	
Surf Scoter	*Melanitta perspicillata*	Nearshore	2	
White-winged Scoter	*Melanitta fusca*	Nearshore	1.23	
Wilson's Storm-Petrel[4]	*Oceanites oceanicus*	Pelagic	0.18	

(1) Species grouping in Kinlan et al. (unpublished).
(2) The relative frequency of occurrence that indicates how common the species is relative to the other species.
(3) Bar height is the relative frequency of eBird checklists reporting this species. Note: bar heights are not comparable among species. Source: eBird (2015) data for New York State
(4) Detected in the WEA during previous surveys (O'Connell et al., 2009)

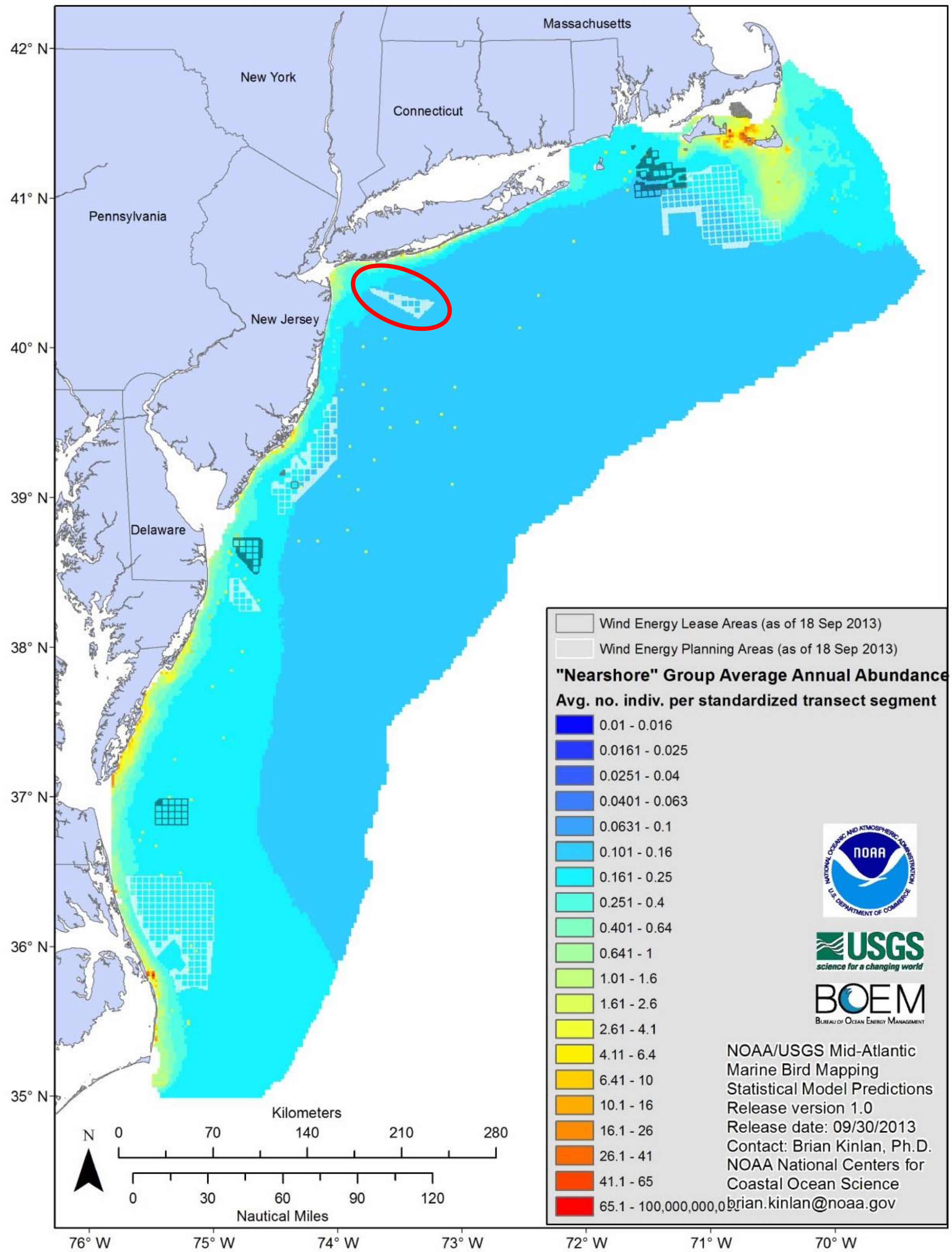


Figure 4-3 Predicted Average Annual Distribution of Nearshore Bird Species (Black Scoter Common Eider, Common Loon, Common Tern, Double-crested Cormorant, Long-tailed Duck, Razorbill, Roseate Tern, Red-throated Loon, Surf Scoter, and White-winged Scoter). Note: Red oval identifies the NY WEA. Source: BOEM, 2015b.

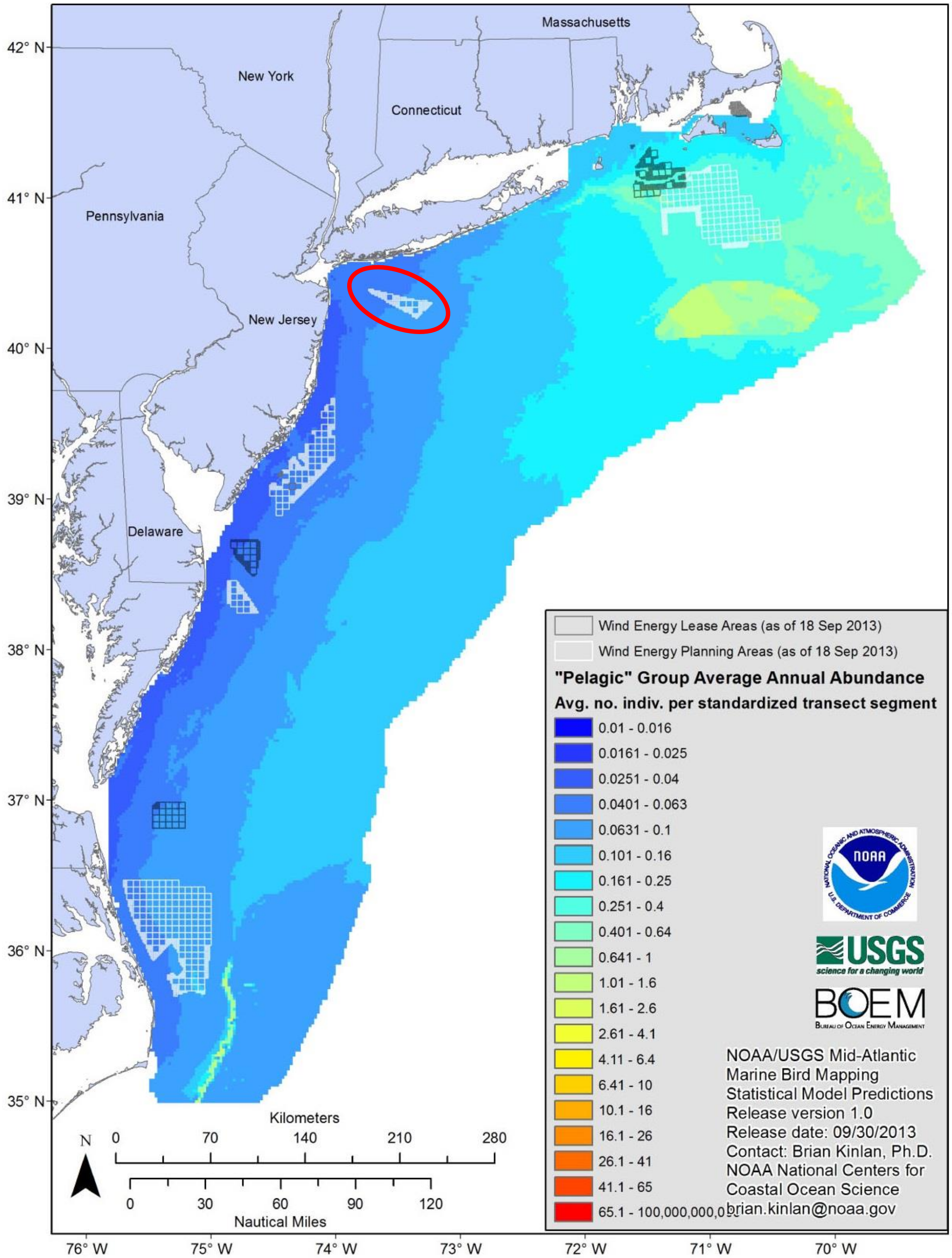


Figure 4-4 Predicted Average Annual Distribution of Pelagic Bird Species (Cory's Shearwater, Dovekie, Greater Shearwater, Northern Fulmar, Pomarine Jaeger, Red Phalarope, Sooty Shearwater, and Wilson's Storm Petrel). Note: Red oval identifies the NY WEA. Source: BOEM, 2015b.

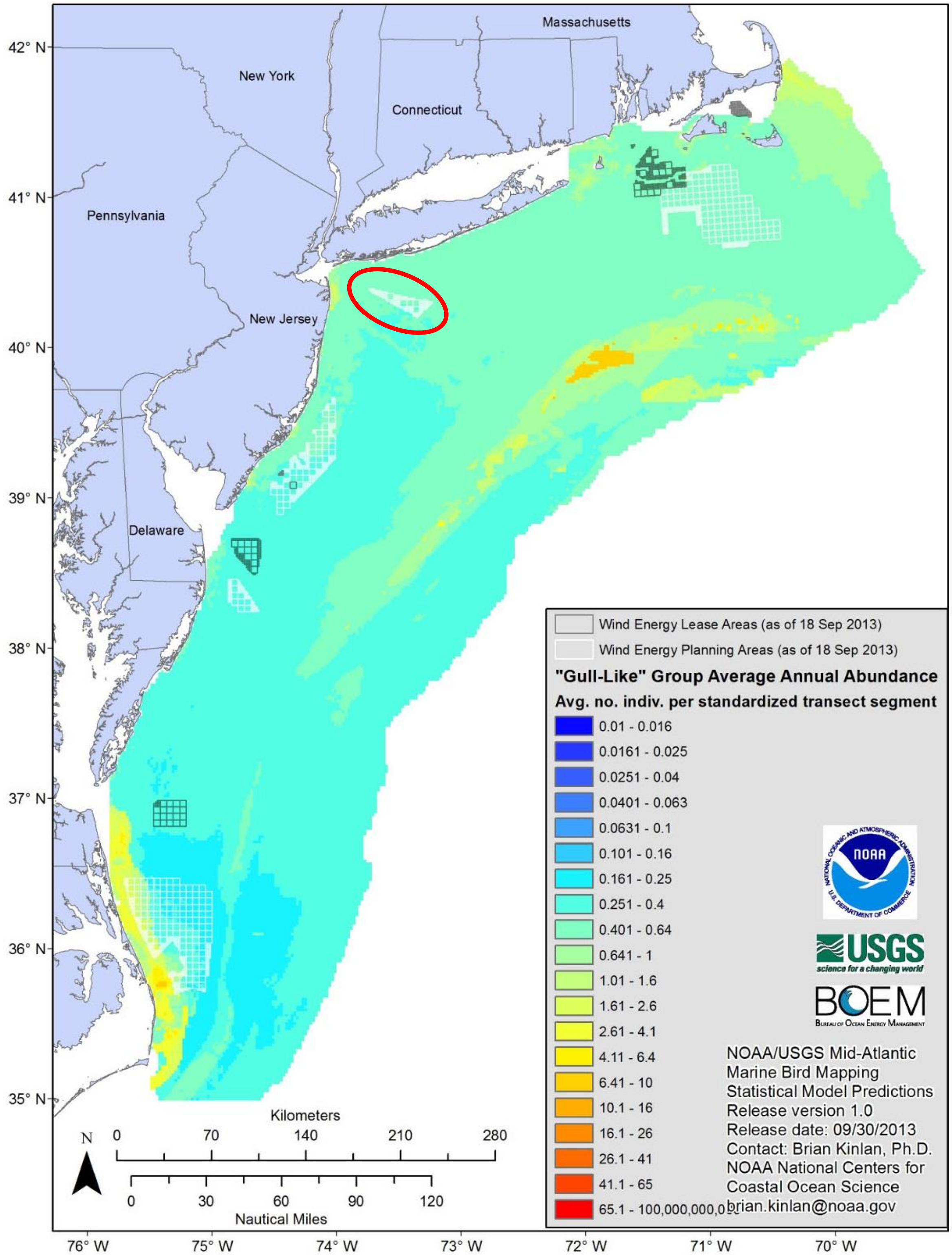


Figure 4-5 Predicted Average Annual Distribution of Gull-like Bird Species (Black-legged Kittiwake, Bonaparte's Gull, Great Black-backed Gull, Herring Gull, Laughing Gull, Northern Gannet, and Ring-billed Gull). Note: Red oval identifies the NY WEA. Source: BOEM, 2015b.

Threatened and Endangered Species

Although the Bermuda Petrel has been documented less than 100 mi (161 km) offshore in New York, it is unlikely to use the WEA because the core of its range is farther east (Madeiros et al., 2014). Three other ESA-listed bird species may be found in nearshore waters of New York. The Piping Plover and Red Knot are both terrestrial shorebirds and would not use the WEA for foraging or roosting but may fly over the WEA during migration. Although Roseate Terns nest on Long Island (McGowan and Corwin, 2008), the closest colony is approximately 23 mi (37 km) from the WEA. In addition, very little Roseate Tern activity is expected to occur within marine waters (Figure 4-6) (Appendix L in Kinlan et al., 2016). This prediction is based on a statistical model that used 328 Roseate Tern sightings throughout the Atlantic during the spring, summer, and fall months to predict Roseate Tern presence. The modeled results are based on the relationship between Roseate Terns and surface chlorophyll *a*, distance from shore, turbidity, and other factors (Appendix H in Kinlan et al., 2016). As shown in blue on Figure 4-6, the model predicts that Roseate Terns are virtually absent from the marine portion of the project area. However, given that Roseate Terns migrate mainly offshore during spring and fall (Nisbet et al., 2014), it is possible some birds may pass through the WEA during migration.

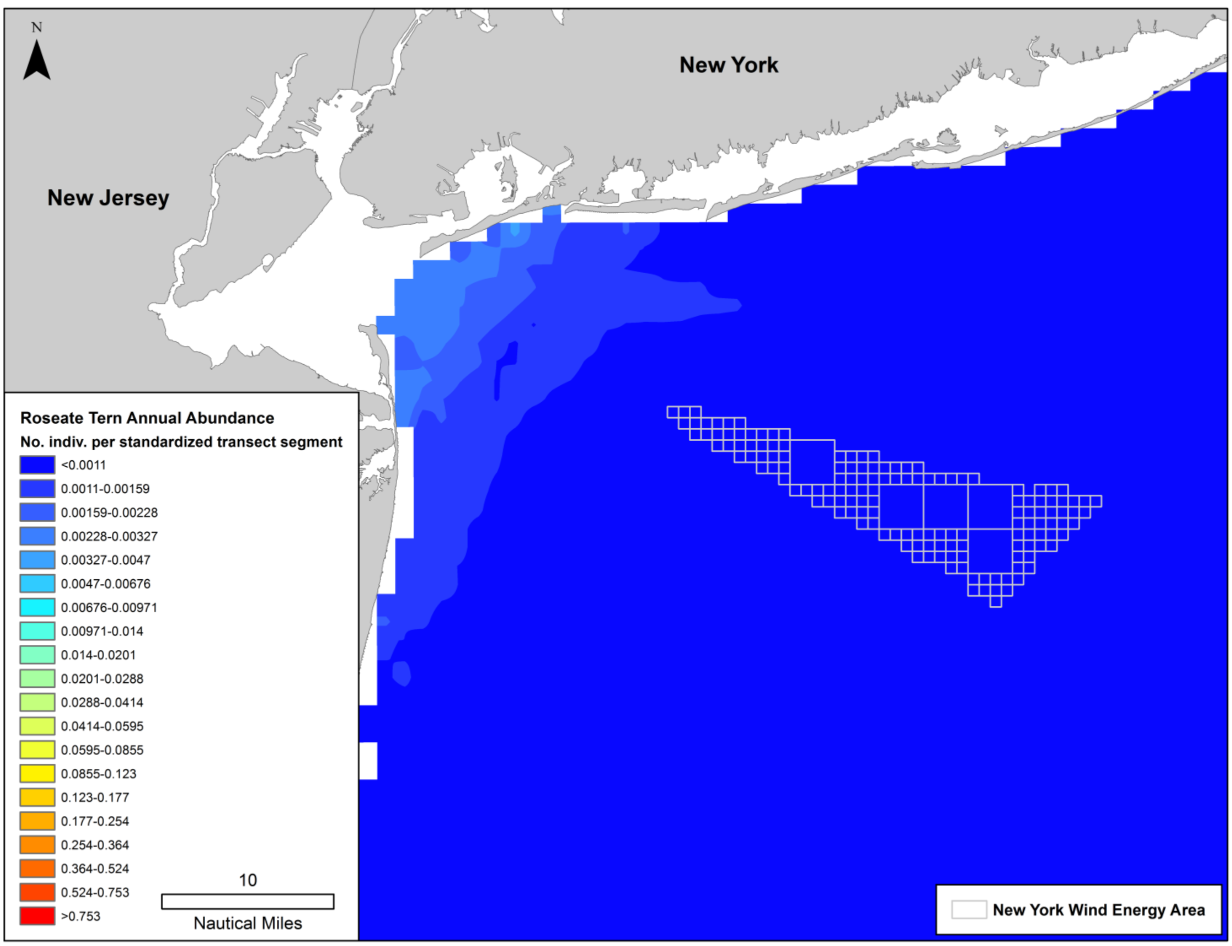


Figure 4-6 Modeled Roseate Tern Distribution in Mid-Atlantic during Spring, Summer, and Fall (from Kinlan et al., 2016)

Migratory Birds

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, which encompasses the WEA, is a major route for migratory birds that are protected under the Migratory Bird Treaty Act of 1918 (MBTA).

The official list of migratory birds protected under the MBTA, as well as 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 (EO) 13186, BOEM and USFWS established a Memorandum of Understanding (MOU) on June 4, 2009, which identifies specific areas where cooperation between the agencies would substantially contribute to the conservation and management of migratory birds (BOEM, 2009). The purpose of the MOU is to strengthen migratory bird conservation through enhanced collaboration between the agencies (MOU, Section A). One of the underlying tenets identified in the MOU is to evaluate potential impacts on migratory birds and design or implement measures to avoid, minimize, or mitigate such impacts as appropriate (MOU, Sections C, D, E(1), F(1-3, 5), G(6)).

Birds from a wide variety of taxonomic groups migrate. Bird species that could be expected to forage or rest in the WEA (during or outside of migration periods) are discussed above. This section specifically addresses migratory land birds, including songbirds, shorebirds (apart from phalaropes), and other species that do not land on the water but could use the WEA.

Many studies have been conducted on bird migration over the Atlantic Ocean (e.g., Williams et al., 1977; McClintock et al., 1978; Larkin et al., 1979; Stoddard et al., 1983; Williams et al., 2015). In addition to almost 100 species of songbirds, birds from a variety of other land bird taxa likely use this migratory route (Williams et al., 1977). Radar data show that the autumnal migration over windward Caribbean islands for songbirds and shorebirds occurred as early as late August, with peaks in early September and again in October and the heaviest migrations in mid-October (Williams, 1985). Most of these birds would have left land somewhere along the Atlantic seaboard. Because land birds, by definition, do not alight on the water, they might be expected to fly over the WEA during migration, mostly during the fall, but would not use the waters of the WEA for foraging or resting. One exception to this is the Peregrine Falcon (*Falco peregrinus*), which are known to fly offshore, often for days at a time (Desorbo et al., 2015), and can eat on the wing (White et al., 2002). Peregrine Falcons might opportunistically hunt in the WEA and could potentially perch on boats or anchored structures in the area.

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668–668d), prohibits the "take" and trade of Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*). Neither Bald Eagles nor Golden Eagles regularly migrate offshore (Buehler, 2000; Kochert et al., 2002). Golden Eagles are mainly found in the western United States, much less frequently in the eastern mountains, and only very rarely on the east coast (Kochert et al., 2002) and would not likely occur in the WEA or associated ports. Bald Eagles occur near wetlands such as seacoasts, rivers, large lakes, and marshes. Rarely do they travel over the open ocean, although there is a record of Bald Eagle sightings in Bermuda and in Cuba (eBird, 2015), Bald Eagles are not be expected to occur regularly in the WEA. The closest nesting Bald Eagles to the ports of New York and New Jersey are more than 20 mi (32 km) to the north (Town, 2015).

Impact Analysis of Alternative A

BOEM has recently conducted several NEPA reviews (e.g., BOEM, 2012b, 2013c, 2014b, 2015a) that evaluate impacts to birds that could occur as a result of the proposed action. These impacts include the effects associated with light, noise, vessel traffic, trash and debris release, and accidental fuel spills. A review of the avifauna in the vicinity of the WEA was also discussed in the *Final Environmental Impact Statement for the Port Ambrose Project Deepwater Port Application* (USCG, 2015a). The impacts to bird species considered in this EA would be similar to those considered in these recent reviews due to the similarity of impact-causing factors and of bird species composition. Thus, the impacts from those recent reviews that were determined to be negligible are summarized here and will not be further discussed in this EA.

The following conclusions for site characterization that were made in the recent reviews are expected to be the same in the New York WEA:

- Impacts from active acoustic sound sources used in renewable energy surveys are expected to be **negligible**.
- Impacts from vessel and equipment noise are expected to be **negligible**.
- Impacts from vessel traffic are expected to be **negligible**.
- Impacts from trash or debris releases are expected to be **negligible**.
- Impacts from accidental fuel spills are expected to be **negligible**.
- This project would have *no effect* or would *not likely adversely* affect federally listed bird species.

Meteorological Tower and Buoys

Other activities covered in this EA that could affect bird species are those associated with the meteorological tower and buoys, such as pile driving noise, lighting, collisions, loss of habitat, and decommissioning.

Noise and other disturbance generated by the installation or decommissioning of meteorological buoys are expected to be short-term and localized, resulting in negligible impacts to birds. Because buoys height is anticipated to be up to approximately 40 ft (12 m) above the ocean surface, collisions with buoys are unlikely. Although seabirds, including terns, gulls, cormorants, and boobies may roost on the buoys, roosting on the buoys does not pose a threat to these birds. Thus, overall impacts to birds from meteorological buoys are expected to be **negligible**.

The construction of a meteorological tower would produce noise, primarily from pile driving activities, but also from other construction activities. The type and intensity of the sounds and the distance these sounds travel depends on multiple factors (e.g., size of the impact hammer, depth, sediment type, atmospheric conditions). Birds that forage in or migrate through the area where the meteorological tower is being constructed would be exposed to noise during construction. The reaction of birds to these sounds could range from ignoring the sound to avoiding the source of the sound. Such impacts from noise would be temporary and would last only for the duration of the pile driving activity. Noises generated from tower construction activities are not anticipated to affect the migratory movement or migratory behavior of birds through the area and are expected to have minimal impacts on migratory species that use the area for foraging. Therefore, construction noise from pile driving may adversely affect these bird species, but the effect would be localized, short-term and **minor**. Tower decommissioning could generate noise, but those levels are anticipated to be less than construction (e.g., no pile driving would be required during tower removal) and would, therefore, be **negligible**.

Due to their excellent vision, birds flying during daytime hours are unlikely to collide with a meteorological tower. However night-flying or flying under other conditions that would impair their vision, birds could potentially collide with a meteorological tower, leading to injury or death. Although the number of bird collisions with land-based communications towers was estimated to be 6.8 million birds per year (Longcore et al., 2012), mortality at land-based communications towers is lower with the presence of the following features (Longcore et al., 2012):

- Red flashing aviation obstruction lights;
- Absence of floodlights and other light sources at the base of the tower, especially those left on all night; and
- Absence of guy wires.

The meteorological tower on the OCS would not require guy wires for support. Although seabirds such as terns, gulls, cormorants, and boobies may perch on the tower's lattice-type mast, handrails, and equipment sheds, perching on the tower would not pose a threat to the birds. Although it is possible that Peregrine Falcons could use a tower as a perch to opportunistically prey on seabirds, this predation would be expected to have a **negligible** impact on birds overall.

Because the meteorological tower would be more than 10 nm (19 km) from the shoreline, the chances of birds colliding with the meteorological tower would be rare, resulting in **minor** impacts on marine and coastal bird populations. Because the meteorological tower would be removed after the site assessment activities are concluded or at the end of the lease, any impacts on birds from the tower would be temporary.

Bald and Golden Eagles

Site assessment activities would not require expansion of existing onshore facilities, and as a result, no impacts on Bald and Golden Eagles would be expected onshore. Offshore impacts to Bald or Golden Eagles would be expected to be **negligible** because neither species occurs regularly offshore.

Standard Operating Conditions for Birds

To minimize the potential for adverse impacts on birds, BOEM has developed SOCs that would be required during activities conducted by a lessee. These SOCs include lighting restrictions on vessels, the meteorological tower, and buoys, and a prohibition on guy wires. SOCs for birds are described in detail in Appendix B, Section B.6.

Conclusion

Overall, impacts to birds would be **minor**. The construction, presence, and decommissioning of a meteorological tower and/or buoys would pose minimal threats to birds. Loss of water column habitat, benthic habitat, and associated prey abundance are expected to have **negligible** impacts because of the small area affected by a tower and/or buoys. Impacts to birds in coastal waters from vessel traffic are expected to be **negligible** due to the amount of existing vessel traffic. Impacts on birds from site characterization surveys are expected to be **negligible**. Impacts to birds from trash or debris releases and from accidental fuel spills are expected to be **negligible**. Potential noise impacts from meteorological tower construction could have localized, short-term **minor** impacts on birds foraging near or migrating through the construction site, and noise impacts from decommissioning are expected to be **negligible**. The risk of collision with the meteorological tower would be **minor** because of the lack of guy wires and its distance from shore. For ESA-listed bird species, the USFWS has concurred with BOEM's *no effect* and *not likely to adversely affect* determinations for similar projects (e.g., BOEM, 2012b, 2013a, 2014b, 2015a) for all activities that would occur under this proposed action. Additionally, the proposed action includes SOCs for birds (Appendix B, Section B.6) to reduce the potential for the proposed action to adversely impact birds.

4.4.2.2 Bats

Description of the Affected Environment

Nine species of bat occur in New York and New Jersey. Of these, two non-migratory species are ESA-listed: the Indiana bat (*Myotis sodalis*) is endangered and the northern long-eared bat (*M. septentrionalis*) is threatened (Table 4-3).

Table 4-3
Bat Species Occurring in New York and New Jersey Listed with Federal Conservation Status and Migratory Habits

Common Name	Scientific Name	Federal Status	Migratory Pattern
Indiana bat	*Myotis sodalis*	Endangered	Sub Continental
Northern long-eared bat	*Myotis septentrionalis*	Threatened	Unknown
Little brown bat	*Myotis lucifugus*	Not listed	Mostly philopatric-some latitudinal migration
Tri-colored bat	*Perimyotis subflavus*	Not listed	Mostly philopatric-some latitudinal migration
Big brown bat	*Eptesicus fuscus*	Not listed	None
Eastern small-footed bat	*Myotis leibii*	Not listed	None
Eastern red bat	*Lasiurus borealis*	Not listed	Continental
Hoary bat	*Lasiurus cinereus*	Not listed	Continental
Silver-haired bat	*Lasionycterius noctivagans*	Not listed	Continental

Source: Cryan, 2003; Fraser et al., 2012; NatureServe, 2015; Norquay et al., 2013; Stegemann and Hicks, 2008; USFWS, 2015a; USFWS, 2015b

The WEA is about 11 nm (20 km) offshore, and at such distances the occurrence of bats is possible but uncommon. Migratory patterns for bats are not well documented. Most studies document almost all bat migration as broad-front and occurring over land, with some evidence to suggest the use of landscape features such as rivers, mountain ranges, and coastlines for navigation (Tenaza, 1966; Baerwald and Barclay, 2009; Furmankiewicz and Kucharska, 2009). Although studies have been undertaken in Europe to assess bat activity offshore, there are very few offshore studies for bats in U.S. waters. Studies undertaken in U.S. waters suggest the likelihood of only three species of bats potentially occurring in the WEA (eastern red bat, hoary bat, and silver-haired), none of which are ESA-listed.

A study in Scandinavia was conducted using portable incandescent spotlights and an infrared thermal imaging camera for visual observations, as well as both handheld and automated ultrasound detectors to monitor echolocation calls (Ahlen et al., 2009). The study differentiated between foraging bats and migrating bats based on activity patterns. The study found 11 species of bats over open water, three of which were non-migratory and foraging, and the other eight were migrating. During long-term acoustic monitoring conducted between 2009 and 2013 in the mid-Atlantic (Pelletier and Peterson, 2013), and between 2012 and 2014 on islands, offshore structures, and coastal sites in the Gulf of Maine, mid-Atlantic, and Great Lakes (Stantec, 2016), the identified bat species that were recorded truly offshore rather than on or very near islands were the migratory species of eastern red bat, hoary bat, and silver-haired bat; none of which is ESA-listed. Unidentified *Myotis* species were reported in the Stantec (2016) study in very low numbers (four passes over 1,609 detector nights) from sites between 9 and 15 nm (17 and 28 km) from any land mass. Diurnal offshore surveys in the mid-Atlantic using boat-based observers and digital imagery also recorded eastern red bat; 12 individuals of this species were recorded during diurnal hours in September 2012 (Hatch et al., 2013).

Most of the few documented records of bats in the offshore environment occur in August and September, with May being the only other month showing some very low-level activity (NJDEP, 2010; Johnson et al., 2011; Hatch et al., 2013; Pelletier and Peterson, 2013; Stantec, 2016). In the New Jersey *Ocean/Wind Power Ecological Baseline Studies Final Report*, which includes survey results for bats over BOEM's WEA offshore New Jersey out to 20 nm (37 km) (NJDEP, 2010), boat-based surveys conducted from March to June and August to October 2009 made only one bat detection in May, and a further 53 detections over eight nights in August. All offshore detections belonged to primarily eastern red bat, but also included hoary bat and silver-haired bat. Mean distance from shore for detections in this study was 5.2 nm (9.6 km), with a maximum distance from shore of 10.4 nm (19.3 km). Johnson et al. (2011) recorded a peak in bat detections on a coastal barrier island in Maryland during August. In addition to the three species most commonly recorded offshore, this study also recorded big brown bat (3.05 percent of bat passes) and tri-colored bat (0.10 percent of bat passes). Stantec (2016) data from sites between 9 and 15 nm (17 and 28 km) from any land mass also show nearly all activity occurring in August, the exception being five eastern red bat passes occurring at Chesapeake Light Tower on the night of May 2, 2012. These offshore activity and density patterns support results from other offshore bat studies (e.g., Hatch et al., 2013; Pelletier et al., 2013; Robinson Willmott et al., 2015) where bat diversity and density is low or absent.

Impact Analysis of Alternative A

While bats are rare in the WEA, bats could have avoidance or attraction responses to the tower or buoys due to noise, lighting, and the possible presence of insects. Bats have been recorded as using offshore ships as opportunistic stopover sites (Pelletier et al., 2013); thus, while it is undocumented, it is possible that vessels could unintentionally transport bats into the offshore environment.

Routine Activities

Site Characterization Activities

Impacts to bats from site characterization activities would be limited to avoidance or attraction responses to the vessels (or aircraft) conducting surveys. Lights and noise from vessels associated with site characterization activities could potentially disturb migrating or feeding bats and affect a bat's ability to forage, navigate, and communicate easily (Schaub et al., 2008). However, site characterization activities would not be concentrated and the noise and light from vessels are not likely to be intense. Few bats are expected to migrate or forage in the WEA, and activity, if any, is most likely to occur during a short period during August. Therefore, any impacts on bats from site characterization activities would be **negligible**.

Site Assessment Activities

Lights and noise from the vessels associated with construction, operation, and decommissioning of a meteorological tower and/or buoys (e.g., pile driving) could affect a bat's ability to forage, navigate, and communicate easily and influence the behavior of migrating or feeding bats (Schaub et al., 2008; Stone et al., 2009).

No studies of the effects of intense light have focused on the three main bat species that may be found in the WEA. From light tolerance studies, *Myotis* species appear to be the species most intolerant of intensely lighted areas (Stone et al., 2009; Lacoeuilhe et al., 2014) and most likely to have foraging and migratory behavior affected. Few *Myotis*, if any, are expected to occur in the WEA.

Red aviation lighting does not attract invertebrate prey (Bennet and Hale, 2014). A study of the effects on bats from red aviation lighting on wind turbines found that hoary bats are neither attracted nor repelled from such lighting, and eastern red bat is not attracted to aviation lights (Bennet and Hale, 2014). No evidence suggests that hoary bat, eastern red bat or silver-haired bat is repelled by light.

Some species of bats, particularly passive listening bats such as *Myotis*, can be repelled from areas with constant broadband noise (Schaub et al., 2008). Species using passive listening (using prey generated sound to detect prey) continue to emit echolocation calls while approaching prey (Russo et al., 2006), which suggests that, although foraging success in *Myotis* species could be affected by noise, there is no reason that navigation and communication will be affected. A study by Bunkley et al. (2015) concluded that *Myotis* species were not affected by compressor noise, which is broadband in nature and may be assumed similar to generator and pile driving noise. Acoustic deterrent research has inferred through collision mortality comparisons that broadband ultrasonic broadcasts can reduce bat activity, with silver-haired bats and hoary bats avoiding areas with such broadcasts (Arnett et al., 2013). Broadband ultrasonic noise is dissimilar from any noise anticipated from vessels associated with construction, operation, and decommissioning of a meteorological tower and/or buoys.

Not all bat species are equally affected by either light or noise, or by the same types of light and noise, and data show some species of bat continuing to forage in both lighted and noisy suburban habitats, while foraging efficiency of other species has been adversely affected (Rydell, 1991; Threlfall et al., 2012; Arnett et al., 2013; Bunkley et al., 2015; Bunkley and Barber, 2015). No studies specifically address the effect of audible acoustic noise on the three species of bats found most often in the offshore environment—eastern red bat, hoary bat, and silver-haired bat—so it is unknown if these species could be repelled or unaffected by noise or light. However, because bats do not depend on food or resting opportunities in the WEA, and because site assessment activities will be largely during daylight hours and of short duration, impacts to bats in the WEA are expected to be **negligible**.

A meteorological tower or a buoy could potentially provide a roosting opportunity not only for bats, but also birds that prey on bats such as Herring Gull and Peregrine Falcon (Speakman, 1991). If bats were active during daylight and early dusk hours near the tower or buoys, there would be an opportunity for predation on bats while they forage or migrate offshore. Given the scarcity and distribution of both bats and predatory birds in the WEA, predation on bats is remote and unlikely, and impacts are expected to be **negligible**.

Non-Routine Events

It is rare but possible that migrating bats may be driven into offshore OCS waters by a storm and subsequently into a tower. Bat collisions with stationary structures, including meteorological towers, have been reported and are most likely to occur during stormy weather (Crawford and Baker, 1981). However, the land-based roosting, breeding, and foraging behavior of bats, as well as their limited home ranges and echolocation sensory systems, suggest that there is little risk of a bat being blown that far out of its habitat range. In the unlikely event that a bat blown off course returns from the open ocean in the vicinity of the tower or buoys in the WEA, the chances of the bat striking the tower or buoy are very small and would therefore be **negligible**.

The impacts from accidental fuel spills should not interfere with any aspect of bat behavior offshore, and impacts would therefore be **negligible**.

Conclusion

To the extent that there would be any impacts on individual bats, the overall impact on bats would be **negligible**. There is evidence to suggest that three species of migratory tree bats, none of which are state or federally listed, could migrate through the WEA in very low abundance, and mostly during 2 to 3 weeks in August. *Myotis* species could potentially occur in the WEA, although occurrence is anticipated to be rare. During periods of high boat activity, particularly nocturnal activities in August, there is a small chance that bats might avoid any areas associated with the proposed action. The meteorological tower and/or buoys could serve as roosting structures for bats and birds. The presence of a predatory bird at the tower or buoys could increase the possibility of predation if bird presence coincides with bat migration or foraging before darkness. The likelihood of collision between bats and boats, buoys, or a meteorological tower would be remote. Instances of bat collisions with towers are reported infrequently at terrestrial sites, and distribution and scarcity of bats in the offshore environment further reduce the potential for a collision with a comparatively small and isolated tower or buoy offshore. The

SOCs for birds (Appendix B, Section B.6), including lighting restrictions and prohibition on guy wires, installation of anti-perching devices, may also reduce potential impacts on bats.

4.4.2.3 Benthic Resources

Description of the Affected Environment

Bathymetry, Geology, and Sediments

Depths within the WEA range from 66 ft (20 m) in the northwest corner to 138 ft (42 m) in the southeast (Poti et al., 2012a). Depths generally increase moving offshore from northwest to southeast. Seafloor topography is characterized by flat expanses marked by occasional depressions (Greene et al., 2010) (Figure 4-7).

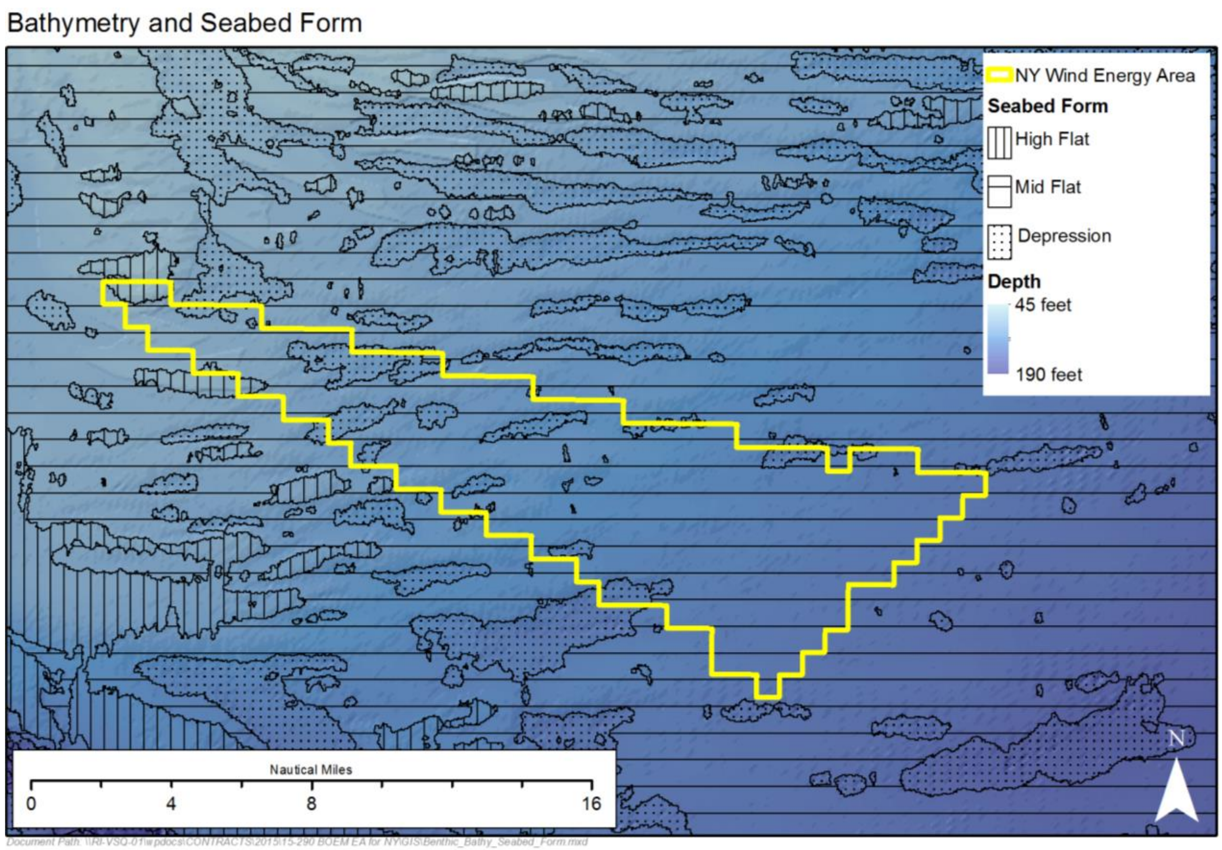


Figure 4-7 Bathymetry and Seabed Form In and Surrounding the WEA

Source: Greene et al., 2010 (seabed form); Poti et al., 2012a (bathymetry)

Within the WEA, sediments are predominantly sand and gravel (Poppe et al., 2014; Reid et al., 2005), although isolated areas of gravelly, muddy sand may exist (Poti et al., 2012b). These characterizations are based on records from physical sampling equipment (e.g., sediment grabs, cores) and virtual samples, such as seafloor photographs and videos. These point-based methods are limited in their spatial coverage. Thus, one alternative is to predict the composition of the seafloor at unsampled locations using statistical models. Figure 4-8 includes the results of sediment composition and hardbottom occurrence models built on point samples from various databases (Poti et al., 2012b). Taken together, these models indicate that while relatively finer-grained sediments predominate throughout the WEA, there is a high likelihood of hardbottom occurrence at its nearshore, northwestern end. This suggests that isolated hardbottom components, such as large boulders, bedrock, or highly consolidated sediments, are intermixed with relatively more abundant unconsolidated sediments in this area. This area comprises part of the undersea feature known to fishers as the Cholera Banks (Figure 4-9), which attracts economically important finfish and shellfish species.

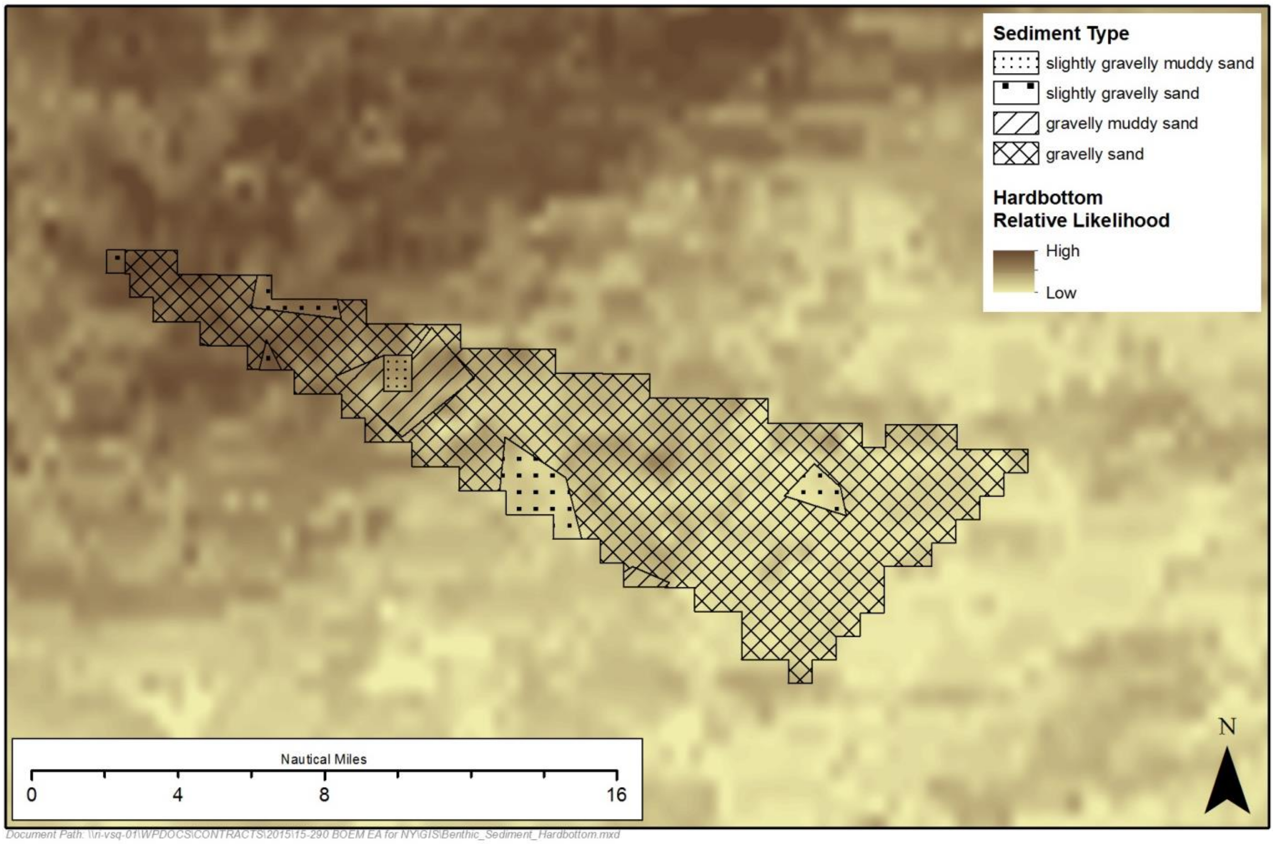


Figure 4-8 Sediment Type and Relative Likelihood of Hardbottom Presence in the WEA

Source: Poti et al., 2012b

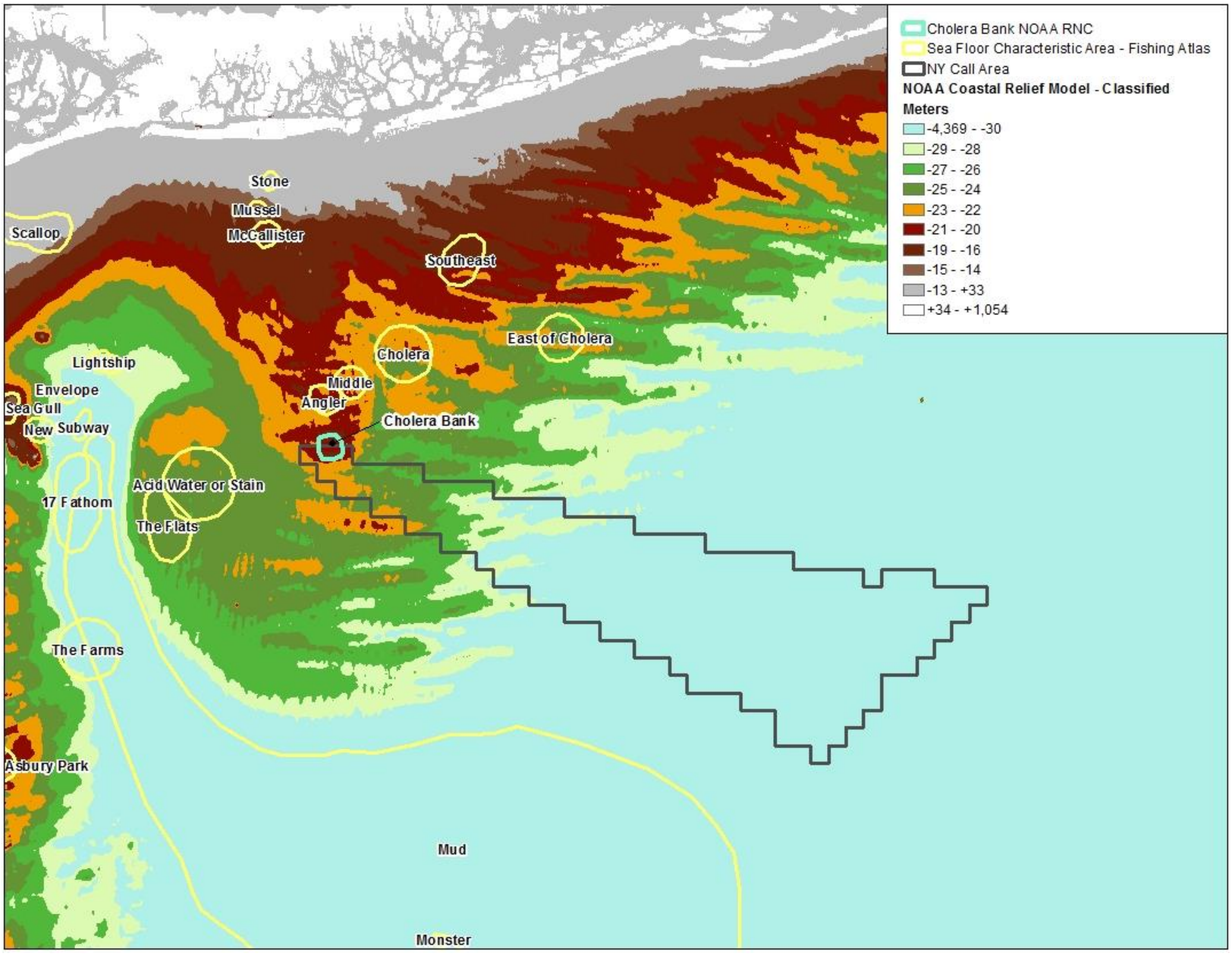


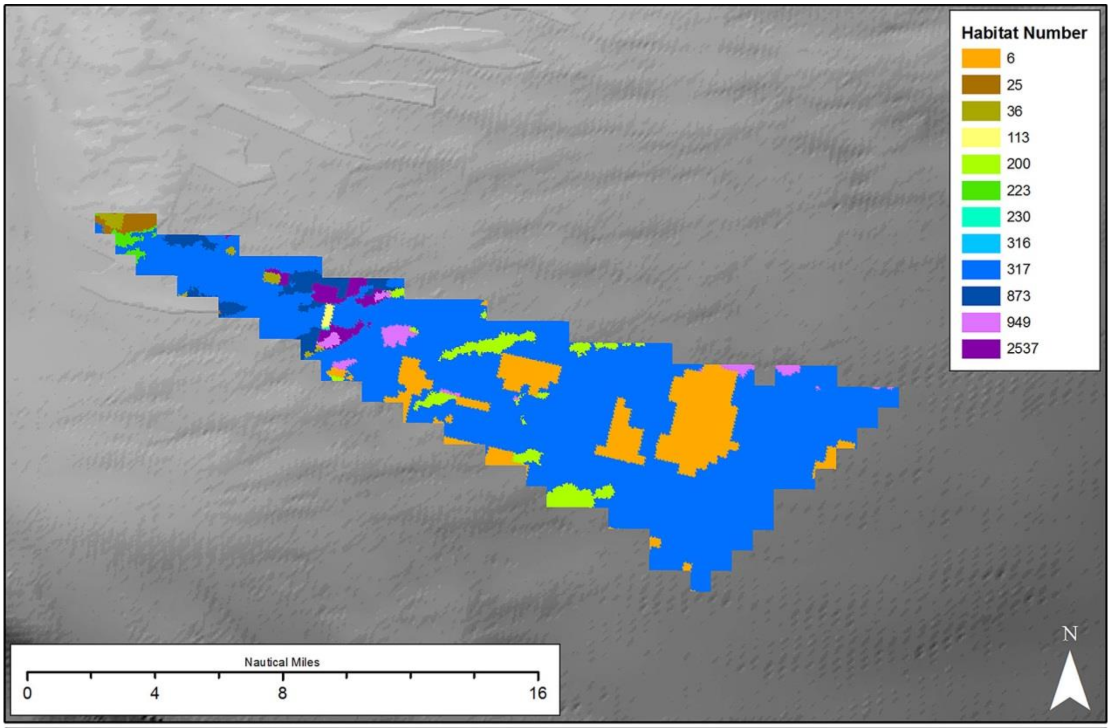
Figure 4-9 Location of Cholera Bank Relative to the WEA

Benthic Habitats and Associated Species

From the mid-1950s to the mid-1960s, the NOAA Northeast Fisheries Science Center (NEFSC) collected roughly 1,000 grab samples of macrobenthic invertebrates from Maine to Long Island, NY (Theroux and Wigley, 1998). Within the Southern New England Shelf region (the area in which the WEA is located), the average number of individuals per square meter (roughly 11 ft^2) was 2,382, and the average net weight per square meter was 9.42 ounces (267 grams). These values were the highest among the six geographic regions defined. By number of specimens, samples within this region were dominated by crustaceans, followed by annelids, mollusks, and echinoderms. However, by weight, samples within this region were heavily dominated by mollusks. Sand sediments harbored the highest density and biomass of organisms.

The Nature Conservancy (TNC) obtained a more extensive record of these same types of benthic grab samples from NOAA NEFSC, spanning from the mid-1950s to the early 1990s and including 22,000 samples. TNC first clustered these individual grab samples together based on similarities in species composition and abundance (Greene et al., 2010) and then associated these species groups with various combinations of physical variables (depth, grain size, and topography) to define benthic habitats. Within the WEA, the most common habitat (covering about 75 percent of the area of the WEA) was mid-position flats at moderate depths (101 to

246 ft [31 to 75 m]) on fine to medium sand (Figure 4-10). Characteristic species for this habitat are provided in Table 4-4. These species-habitat associations were derived from data spanning the entire Southern New England Region; the species in Table 4-4 may not be exactly the same as those within the WEA. For example, scallop survey and fisheries landings data indicate that scallops also occur in the middle and eastern portions of WEA (GSOE, 2015; BOEM, 2015e).



Habitat No.	Habitat Description	% of WEA
6	High slopes and flats at moderate to deep depths (44 - 139 m) on coarse to fine sand.	13.16
25	Depressions at moderate depths (15 - 82 m) on fine to coarse sand.	0.79
36	Depressions and high flats in very shallow to moderate depths (0 – 75 m) on medium to coarse sand.	0.62
113	Depressions and mid-position flats at moderate depths (23 - 44 m) on very fine sand.	0.20
200	Depressions at very shallow to moderate depths (0 – 44 m) on very fine to medium sand.	3.63
223	Mid-position flats and depressions at moderate depths (44 - 75 m) on fine to medium sand.	0.49
230	Depressions in shallow depths (23 - 44 m) on very fine sand.	0.02
316	Flats in shallow water (8-44 m) on very fine to medium sand.	0.0004
317	Mid-position flats at moderate depths (31 - 75 m) on fine to medium sand.	74.95
873	Flats and side slopes in shallow water (8 - 31 m) on very fine to medium sand.	2.83
949	Mid and low flats in deep water (75-139 m) on medium to fine sand.	1.61
2537	Depressions and high flats in shallow water (23 - 31 m) on very fine to fine sand.	1.70

Figure 4-10 Benthic Habitat Types within the WEA (habitat numbers arbitrarily assigned by a clustering algorithm)

Source: Greene et al., 2010 (includes species lists associated with each number)

Table 4-4
Characteristic Species for Mid-position Flats at Moderate Depths (101 to 246 ft) on Fine to Medium Sand (i.e., benthic habitat type 317), which Compose 75 Percent of the WEA

Taxon	Common Name	Scientific Name
Annelids	Bamboo worm	*Clymenura dispar, Euclymene zonalis*
	Burrowing scale worm	*Sigalion areicola*
	Chevron worm	*Goniadella gracilis*
	Feather duster worm	*Euchone elegans*
	Fringe worm	*Caulleriella killariensis, Chaetozone setosa*
	Thread worm	*Lumbrinerides acuta, Lumbrineris acicularum*
	Orbiniid worm	*Orbinia swani, Scoloplos acmeceps*
	Paraonid worm	*Aricidea wassi, Cirrophoris brevicirratus, C. furcatus, Paraonis pygoenigmatica*
	Sandbar worm	*Ophelia denticulata*
	Scale worm	*Harmothoe extenuata*
	Shimmy worm	*Aglaophamus circinata*
	Spionid mud worm	*Polydora caulleryi*
	Syllid worm	*Exogone hebes, Sphaeroyllis erinaceus, Streptosyllis arenae, Syllides* sp.
	Other polychaetes	*Drilonereis magna*
Arthropods	Acadian hermit crab	*Pagurus acadianus*
	Lysianisid shrimp	*Hippomedon serratus*
	Sand shrimp	*Crangon septemspinosa*
	Cumacea	*Petalosarsia declivis*
	Tanaidacea	*Tanaissus lilljeborgi*
	Other amphipods	*Acanthohaustorius spinosus , Byblis serrata, Corophium crassicorne, Pseudunciola obliquua, Phoxocephalus holbolli, Protomedeia fasciata, Monoculodes* sp., *Rhepoxynius hudsoni, Siphonoecetes* sp., *Unciola inermis*
	Other isopods	*Cirolana polita*
Mollusks	Chestnut astarte	*Astarte castanea*
	Northern moon shell	*Lunatia triseriata*
	Northern moonsnail	*Euspira immaculata*
	Paper clam	*Lyonsia arenos*
	Pearly top snail	*Margarites groenlandicus*
	Stimpson's whelk	*Colus pygmaeus*
	Top snail	*Solariella obscura*
Echinoderms	Common sand dollar	*Echinarachnius parma*

Cold Water Corals

Cold water corals (also known as "deep sea" corals), such as *Pennatulacea* (sea pens), *Scleractinia* (hard corals), and *Alcyonancea* (soft corals), are known to inhabit the Atlantic waters offshore New York (Packer and Dorfman, 2012). There are no known locations of cold water/deep sea corals within the WEA. However, there is extremely limited information on the distribution and abundance of these organisms in the northeastern United States. Nonetheless, predictive habitat maps developed by NOAA rank the region occupied by the WEA as "low suitability" habitat for stony corals, soft corals, and sea pens (NCCOS, no date [n.d.]). The most suitable habitats for these organisms are generally further offshore, along the continental slope.

Artificial Reefs

Artificial reefs may include shipwrecks or other materials lost at sea, as well as materials intentionally placed to support and enhance habitat or recreational fishing (e.g., tires, subway cars, concrete or steel debris, rock). According to a database compiled by TNC (MARCO, n.d.), there are no artificial reefs within the WEA, but shipwrecks and marine debris are likely present.

Seagrasses

Seagrasses provide habitat and food for a variety of species. They are also protected under a number of state and federal statutes. In New York, *Zostera marina* is the dominant seagrass species and inhabits shallow coastal and estuarine waters in depths ranging from less than 3 ft (1 m) to about 26 ft (8 m) (NYS Seagrass Task Force, 2009), well outside the depth range of the WEA. Furthermore, according to the NOAA/BOEM Marine Cadastre, seagrass beds are not found within or near the WEA (Marine Cadastre, 2015).

Impact Analysis of Alternative A

Seagrasses and purpose-built artificial reefs are not present in the WEA and are therefore not discussed further in this section. Additionally, there are no known locations of stony or soft corals in the WEA, and the seafloor in the WEA is ranked as "low suitability" habitat for these organisms. Although hardbottom habitats are likely isolated and limited to the northwestern end of the WEA, data collected during initial remote geophysical surveys would identify possible locations of sensitive hardbottom resources (e.g., rocky reef communities) where they exist. BOEM would require the lessee to develop and implement avoidance measures near these resources before physical sampling and activities that would disturb the seafloor, such as installation of the meteorological tower. Although sea pens (order: *Pennatulacea*) are common in soft sediments, the WEA is ranked as "low suitability" habitat for them. Because of their widespread presence in general, sea pens are typically not of concern for biodiversity or ecosystem management (Packer and Dorfman, 2012). Thus, discussion of impacts on benthic resources is limited to other organisms primarily associated with soft-bottom habitats, including annelids, arthropods, mollusks, and echinoderms.

Routine Activities

The main impacts on benthic organisms from routine activities would be crushing or smothering of organisms by anchors and moorings, the scour control system (if employed), and foundation piles for the meteorological tower (if constructed). Larger, mobile benthic organisms (e.g., lobsters, crabs) may be able to avoid lethal impacts but would still experience displacement within the footprint of project-related infrastructure. Additionally, sediment suspension and redistribution during tower or buoy construction/deployment could interfere with the filter-feeding mechanisms of bivalve mollusks (e.g., scallops). Because sonar, bottom profiling, magnetometry, and benthic imaging (e.g., video) involve remote sensing of the seafloor, these site characterization activities would not directly affect benthic resources.

Sub-bottom profilers, such as boomers, emit intense sound pulses, but the few available studies indicate that such pulses have minimal effects on marine invertebrates (Michel et al., 2007). However, physical sampling methods, such as grab samplers, benthic sleds, bottom cores, deep borings, and CPTs may disturb, injure, or cause mortality to benthic resources in the immediate area sampled. BOEM estimates that approximately 247 sub-bottom samples would be taken by the lessee for site characterization under Alternative A (see Appendix C for geotechnical sampling calculations). The physical bottom sampling footprint for each collection is anticipated to be on the order of 1 ft^2 (0.1 m^2) per sample in surficial area. The recovery of benthic soft-bottom communities from routine activities is discussed below. Thus, benthic impacts from site characterization activities are expected to be **minor**.

The area of sea bottom covered by a meteorological tower foundation, which is expected to range from 200 to 2,000 ft^2 (18.6 to 186 m^2; Table 3-6) depending on the type of foundation selected, would result in direct removal of benthic organisms and substrate. If scour control systems for the foundation are installed, they would affect up to an estimated 16,000 ft^2 (1,486 m^2) for rock armor and 7,800 ft^2 (725 m^2) for artificial seagrass mats. If scour control systems are not installed and scouring occurs, the area of benthic habitat affected by scour is expected to be similar to or slightly larger than the areas affected by a scour control system. Together, the area of seabed potentially affected as a result of the tower foundation and scour control system, or the scour area if no scour control system is installed, is a maximum of about 26,000 ft^2 (2,415 m^2), which is less than 0.001 percent of the WEA. Note that this number does not take into account the area of the seabed potentially affected by the anchoring of support vessels. This anchoring would occur sporadically within a radius of approximately 1,500 ft (457 m) around the foundation site. The resulting area affected would be less than 0.2 percent of the total WEA area. A small area beyond the footprint of the scour control mats may be affected by sediments suspended during mat installation. Thus, benthic impacts from meteorological tower installation are expected to be **minor**.

A spar-type buoy is estimated to disturb a maximum of 1,268 ft^2 (118 m^2) of seafloor between its clump anchor and mooring chain. Anchors for boat-shaped or discus-shaped buoys are assumed to have a sweep of about 370,260 ft^2 (34,398 m^2), which is about 0.01 percent of the WEA. Note that the anchor cable would not make complete contact with all areas of the bottom within its sweep. Thus, benthic impacts from buoy installation and operation are expected to be **minor**.

Tower decommissioning activities would include non-explosive severing methods and the removal of scour mats by divers or ROVs. Removal would result in the suspension of sediments that were trapped in the mats and would affect the same area of the seafloor as when the mats were installed, with a small additional area affected by deposition of resuspended sediments. Resuspended sediment would temporarily interfere with filter feeding organisms until the sediment resettles. The duration of sediment suspension would depend on ocean currents and sediment grain size but is anticipated to be short-lived due to the predominantly sandy composition of the seafloor in the area. Benthic impacts from tower decommissioning are expected to be **minor**.

Decommissioning of buoys is not expected to result in adverse impacts on benthic resources. A decommissioning report for a research spar buoy deployed offshore New Jersey in 2015 states that after the buoy platform, mast, weights, and base were lifted to the surface by crane, a diver was able to remove all bottom debris (e.g., plastic sheeting, straps) introduced by the lessee's operations and return the seafloor to its original state (GSOE, 2015). Thus, benthic impacts from buoy decommissioning are expected to be **negligible**.

Benthic soft-bottom communities that are affected by routine activities would take some time to recover. Generally, recovery times vary depending on species density and diversity, as well as the size of the disturbed area. BOEM (2012b) cites 1 to 3 years for benthic communities to recover from meteorological platform installation (though the benthic communities directly under the tower pilings and scour mats would not recover until after decommissioning). Brooks et al. (2006) note a recovery time of 3 months to 2 1/2 years after disturbance linked to sediment removal, based on a synthesis of a limited number of existing studies. However, the area affected by physical site characterization activities (e.g., grabs, cores) is very small, on the order of 1 ft^2 (0.1 m^2) per sample. Thus, organisms from adjacent, unaffected sediments would simply migrate to the location where a grab or core had been taken, resulting in rapid recovery. For instance, Lindholm et al. (2004) found that sandy areas in water depths up to 197 ft (60 m) were characterized as mobile sand, influenced by tide and storm-driven currents, which regularly alter the microtopography of the bottom.

Sandy substrates are less stable than silt/clay substrates, and the benthic macrofauna consists mainly of opportunistic species that have rapid dispersal and high reproductive rates that allow them to colonize disturbed sediments rapidly (Grassle and Sanders, 1973). The macrobenthos in the Middle Atlantic continental shelf region is dominated by opportunistic species (Boesch et al., 1977; Port Liberty License Application, 2012). The recolonization of disturbed areas by opportunistic species has been reported many times since Grassle and Sanders (1973) (Thrush and Dayton, 2002; Ray, 2001; Kaiser et al., 1998; Thistle, 1981). Lindholm et al. (2004) concluded that mobile sand habitats that experience natural movement are able to recover in a relatively short timeframe (less than 1 year). Blake et al. (1996) reported that in a sandy substrate, epibenthic surveys pre- and post-dredge were very similar because of the dynamic nature of sand and the low species diversity.

Not all effects from the introduction of meteorological structures in the benthic environment would be adverse. For example, foundation structures would increase the hard surface available to support certain benthic organisms that prefer structured and hardbottom habitats, similar to an artificial reef. Michel et al. (2007) note that the composition of this "fouling community" (e.g., mussels, barnacles, algae, other encrusting organisms) would be very different from that of the original soft-bottom community. Furthermore, scour mats can provide habitat to marine organisms that settle into the stabilized sediment trapped therein. Therefore, over time, some of the total area covered by the mats might recover to some degree even prior to decommissioning and removal.

While none of the benthic invertebrates discussed in this section are listed under the ESA, some of these invertebrates are prey items for listed species (e.g., whales, sea turtles). Thus, impacts to benthic resources may alter the diet composition of these ESA-listed species.

However, because the amount of benthic habitat affected by routine activities would be extremely small relative to the available foraging habitat in the WEA and mid-Atlantic, any effects to listed species resulting from benthic disturbance would be **negligible** (NMFS, 2013a).

Non-Routine Events

Non-routine events that could potentially have benthic impacts include spills from collisions/allisions and generator refueling operations. The material most likely to be spilled is diesel fuel, which is lighter than water and would float on the water surface or be dispersed by wave action into the water column. Dispersion down to the seafloor would be extremely unlikely. Because diesel oil does not contain the heavier, more persistent components found in crude oil, it would be expected to dissipate rapidly in the environment (MMS, 2007a), and therefore have no impact on the benthic community. Thus, benthic impacts from non-routine events are expected to be **negligible**.

Conclusion

Overall, impacts to benthic organisms and habitats would be **minor**. Impacts of routine activities including site characterization surveys and construction, operation, and removal of a meteorological tower and/or buoys on benthic communities would be **minor**, with the exception of buoy decommissioning and removal, which would have **negligible** impacts. Primary effects of routine activities would be crushing and smothering by anchors, moorings, driven piles, and scour control equipment. These impacts would be limited to the immediate footprint of the infrastructure. The maximum area affected would be less than 0.001 percent of the WEA for tower-related activities and about 0.01 percent of the WEA for buoy-related activities. The recovery of affected soft-bottom communities to pre-disturbance levels is expected to take between a few months to 3 years, depending on the degree of impact and specific composition of the benthic community. BOEM would require a lessee to incorporate avoidance measures before physical sampling and tower and/or buoy installation near any hardbottom communities identified during geophysical surveying.

Impacts to benthic communities from non-routine events are limited to those associated with diesel spills. Given the low likelihood of spills and extremely low likelihood of diesel reaching the seafloor in the event of a spill, impacts from non-routine events would be **negligible**.

4.4.2.4 Coastal Habitats

Description of the Affected Environment

The *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS, 2007a) includes a general description of the affected environment for coastal habitats along the entire Atlantic coast, and is hereby incorporated by reference and summarized here. The WEA is located offshore of the Atlantic coastal plain. This plain is a flat stretch of land that borders the Atlantic Ocean for approximately 2,200 mi (3,541 km) from Cape Cod through the southeast United States. The coastal resources of the New York and New Jersey shorelines include sandy beaches, coarse-grained beaches, cliffs, shellfish beds in tidal flats, seagrass beds, coastal dune systems, barrier island forests, and salt and freshwater marshes. These habitats and the species present within them are described in detail in the aforementioned PEIS (MMS, 2007a). Descriptions of site-specific coastal habitats present near the WEA in each state are included below.

New York has 120 mi (193 km) of coastline bordering the Atlantic Ocean between Coney Island and Montauk (Tanski, 2012). Most of the ocean-facing barrier islands along the south shore of Long Island consist of fine-to-medium grained sand beaches, solid manmade structures (e.g., docks, marinas, jetties, seawalls), and rip-rap (ESI, 2009). North-facing shores of the barrier islands border the Great South Bay and consist of tidal flats and tidal/brackish wetlands, while the interior of the islands comprise pockets of freshwater marshes, swamps, and scrub-shrub wetlands (ESI, 2009). Further west and deeper into the New York-New Jersey harbor, the shoreline is composed of rocky, exposed cliffs, man-made structures, and coarse-grained sand and gravel beaches, with fewer scattered tidal flats, eroding scarps, and saltwater marshes (ESI, 2001). Within the harbor, the Port of New York-New Jersey is the largest container port on the East Coast (NJDEP, 2002).

New Jersey has 127 mi (204 km) of oceanfront shoreline, much of which is densely populated; however, about 31 mi (50 km) of non-contiguous shoreline between Sandy Hook and Cape May Point has no man-made barriers between land and water (Stockton University, 2015). New Jersey contains over 300,000 ac (121,400 ha) of tidal wetlands and over 1.5 million shorebirds use Cape May Point as a migratory stopover (NJDEP, 2002). In northern New Jersey, much of the shoreline around Raritan Bay is composed of coarse-grained beaches, mixed-sand and gravel, rip-rap, exposed tidal flats, as well as both salt/brackish and freshwater marshes. Sandy Hook is composed of fine- to medium-grained sand beaches, which extend south along most of the ocean-facing shoreline, along with exposed rocky cliffs and rip-rap (ESI, 2001). Another important bay in New Jersey is Barnegat Bay.

The *National Coastal Conditions Report IV* (EPA, 2012) summarizes the conditions of U.S. coastal waters based on EPA National Coastal Assessment data and USFWS National Wetland Inventory Status and Trends data from 2003 through 2006. The Northeast Coast region, which includes the New York and New Jersey coasts, has an overall condition rated fair. This overall condition is based on five indices, including water quality, sediment quality, benthic habitat, coastal habitat, and fish tissue contaminants. The coastal habitat index summarizes the health of coastal wetland habitats such as salt and brackish marshes, mangroves, intertidal oyster reefs, and tidal flats. The coastal habitat index for the Northeast is rated good to fair, but data more recent than the year 2000 are not available. Coastal wetlands along the New York and New Jersey coasts have been lost through land subsidence, sea-level rise, and exotic species impacts (EPA, 2012).

Impact Analysis of Alternative A

The WEA is located approximately 12 nm (22 km) south of Long Island, NY, and 16 nm (30 km) east of New Jersey, and extends in a southeasterly direction away from shore for approximately 26 nm (48 km). Given the distance from shore, vessel traffic from site characterization surveys and site assessment activities would have no direct impacts on coastal habitats. Only nearshore vessel traffic and use of coastal facilities have the potential to affect coastal habitats in heavily used port areas.

Routine Activities

BOEM anticipates a range of between approximately 350 and 1,000 vessel round trips to conduct routine activities in the WEA over approximately 6 to 7 years, primarily during the months of April to August. These trips would be split between ports in New York and New Jersey. No expansion of these ports is expected in support of the proposed action, and the specific ports used by a lessee in the future would be determined primarily by proximity to the lease blocks and capacity to handle proposed activities.

Indirect impacts from routine activities may include wake erosion and increased turbidity caused by nearshore vessel traffic. Given that the Port of New York and New Jersey is the largest port on the East Coast and the third-largest port in the nation (Port Authority of New York and New Jersey, 2015), there would be a **negligible** increase, if any, to wake-induced erosion of channels or increases in turbidity based on the relatively small size and number of vessels associated with Alternative A. Because these ports handled over 3 million cargo containers in 2014, any coastal erosion from increased vessel traffic would likely be mitigated by preventive measures already in place. Although barrier beaches near smaller ports could be vulnerable to increased wake erosion and nearshore coastal habitats could experience increased levels of turbidity, the small number of vessel trips associated with Alternative A would have **negligible** impacts, if any.

Non-Routine Events

Non-routine events that could potentially affect coastal habitats include storms, vessel collisions/allisions, or spills/releases of contaminants. Major storms, nor'easters, and hurricanes pass through the region regularly and can cause storm surge and wave heights that impact coastal habitats. Although vessel collisions/allisions are unlikely, if a vessel collision/allision were to occur and result in a spill, the most likely pollutant would be diesel fuel, and the average spill size would be small (88 gallons [333 liters]; *see* Section 3.3.3 *Spills*). Diesel dissipates rapidly in the water column, then evaporates and biodegrades within a few days (MMS, 2007a); therefore, given the distance of the WEA from shore, BOEM anticipates that there would be **negligible** impacts to coastal habitats from a spill.

Conclusion

Overall, impacts on coastal habitats would be **negligible**. Given the distance of the WEA from shore, no expansion of existing facilities is expected, lessees would use existing ports, and the amount of vessel traffic associated with the proposed action would be minor compared to existing levels of traffic. No direct impacts on coastal habitats are anticipated from routine activities associated with site characterization and site assessment, or from non-routine events in the WEA. Indirect impacts from routine activities would be **negligible**.

4.4.2.5 Marine Mammals

Description of the Affected Environment

There are 31 species of marine mammals that occur in the New York Bight. These 31 species include the following:

- 6 mysticetes (baleen whales; five federally endangered),

- 21 odontocetes (toothed whales including dolphins, a porpoise, beaked whales, dwarf and pygmy sperm whales, and federally endangered sperm whales), and
- 4 pinnipeds (seals).

The following extralimital species have also been reported in the New York Bight: Beluga Whale (*Delphinapterus leucas*), Ringed Seal (*Phoca hispida*), and West Indian Manatee, Florida subspecies (*Trichechus manatus latirostris*). Sightings of these three species represent relatively rare encounters with individuals that are outside of their typical geographic range. These species are not discussed further in this EA.

Sightings data for species most commonly reported in the New York Bight, along with data treatment and preparation methods for handling those data, are presented in Appendix E. Details regarding abundance estimates, life history, hearing abilities, and foraging behavior for these species in general can be found in BOEM (2011c), the G&G Final PEIS (BOEM 2014a), and Waring et al. (2015), which are incorporated by reference herein.

In addition, there are several relatively new reports specific to offshore energy planning and marine mammals occurring in New York on the following topics: marine mammal and sea turtle distribution off Long Island, NY, North Atlantic right whale occurrence off New Jersey from visual and acoustic surveys, cetacean and sea turtle distribution in the New York offshore planning area, baseline monitoring for large whales in the New York offshore planning area, and distribution and habitat use for the six cetacean species of the greatest conservation need (Kenney and Vigness-Raposa, 2010; Lagueux et al., 2010; Whitt et al., 2013; NYDOS, 2013; Schlesinger and Bonacci, 2014; NYSDEC, 2015a).

The endangered North Atlantic right whale is the rarest whale in the western North Atlantic, with an estimated population of at least 465 individuals in this region (Waring et al., 2015). Because of potential impacts to this species from the proposed action, this EA includes an analysis of the existing conditions in the action area with respect to the presence of the North Atlantic right whale.

Non-ESA-Listed Marine Mammals

Twenty-five species of marine mammals that occur in the New York Bight are not listed under the ESA (Table 4-5). These species are not listed as threatened or endangered under the ESA, but are offered protections under the MMPA. Four of these non-listed species are likely to occur in the action area: harbor porpoise, short-beaked common dolphins, Atlantic white-sided dolphins, and bottlenose dolphins (Right Whale Consortium, 2015; Kenney and Vigness-Raposa, 2010; Lageaux et al., 2010; Appendix E). Sightings data indicate the following patterns of occurrence for these species in the action area: Atlantic white-sided dolphins in the fall, short-beaked common dolphins in the spring, and bottlenose dolphins in the fall and to a lesser extent in the winter (Right Whale Consortium 2015; Appendix E). Harbor porpoise occur in the action area in relatively lower densities during the winter (Right Whale Consortium 2015; Kenney and Vigness-Raposa, 2010; Lageaux et al., 2010; Appendix E). Seals are very difficult to sight and identify at sea, with the only visible target being their head above the surface (Kenney and Vigness-Raposa, 2010). Nonetheless, stranding reports indicate that four species of seals may occur in the New York Bight: harp, harbor, grey, and hooded seals (RFMRP, 2015). Stranding records for New York from 1980 to 2013 indicate these four seal species have been a regular component of the regional marine mammal fauna (hooded seal, n = 117; gray seal, n = 434; harp seal, n = 904; and harbor seal, n = 707; RFMRP, 2015). The remaining 16 non-listed marine mammal species occur farther offshore or are considered accidental or rare and are not likely to occur in the action area.

Table 4-5
Non-ESA Listed Marine Mammals that Occur in the New York Bight

Common Name	Scientific Name	Federal Status	Potential to Occur in the Action Area
Mysticetes			
Common Minke Whale	*Balaenoptera acutorostrata*	MMPA	May occur year-round in continental shelf waters
Odontocetes			
Atlantic Spotted Dolphin	*Stenella frontalis*	MMPA	Rarely sighted near or beyond the shelf break; one confirmed stranding in New York in the 1980s
Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	MMPA	May occur year-round; peak in the fall[1]
Bottlenose Dolphin	*Tursiops truncatus*	Western North Atlantic Coastal Morphotype (Northern Migratory Stock), MMPA Depleted	May occur during the summer.
		Western North Atlantic Offshore Stock, MMPA	May occur year-round.
Dwarf Sperm Whale	*Kogia sima*	MMPA	May occur in deep continental shelf waters. Strandings in the area have occurred rarely.
False Killer Whale	*Pseudorca crassidens*	MMPA	Accidental; may occur very rarely, typically beyond the shelf break.
Killer Whale	*Orcinus orca*	MMPA	Uncommon or rare.
Long-finned Pilot Whale	*Globicephala melas*	MMPA	May occur primarily on the shelf break year-round.
Pan-tropical Spotted Dolphin	*Stenella attenuata*	MMPA	Rarely sighted near or beyond the shelf break; two confirmed strandings in New York in the 1980s.
Pygmy Sperm Whale	*Kogia breviceps*	MMPA	May occur in deep continental shelf waters. Strandings in the area have occurred throughout the year.
Risso's Dolphin	*Grampus griseus*	MMPA	May occur primarily on the shelf year-round.
Short-beaked Common Dolphin	*Delphinus delphis*	MMPA	May occur year-round with peak in the winter and spring.[1]
Short-finned Pilot Whale	*Globicephala macrorhynchus*	MMPA	May occur primarily on the shelf break year-round.

Common Name	Scientific Name	Federal Status	Potential to Occur in the Action Area
Striped Dolphin	*Stenella coeruleoalba*	MMPA	May occur near and beyond shelf edge year-round.
White-beaked Dolphin	*Lagenorhynchus albirostris*	MMPA	Rare in southeastern New England; rare sightings at the shelf break near Hudson Canyon.
Harbor Porpoise	*Phocoena phocoena*	MMPA	May occur year-round, peak in spring and winter.[(1)]
Blainville's Beaked Whale	*Mesoplodon densirostris*	MMPA	Rare near shelf break; seasonality is poorly known, but sightings have been recorded in spring or summer. Strandings in New England scattered throughout the year.
Cuvier's Beaked Whale	*Ziphius cavirostris*	MMPA	Rare near shelf break; seasonality is poorly known, but sightings have been recorded in spring or summer. Strandings in New England scattered throughout the year.
Gervais' Beaked Whale	*Mesoplodon europaeus*	MMPA	Rare near shelf break, seasonality is poorly known, but sightings have been recorded in spring or summer. Strandings in New England scattered throughout the year.
Sowerby's Beaked Whale	*Mesoplodon bidens*	MMPA	Rare near shelf break; seasonality is poorly known, but sightings have been recorded in spring or summer. Strandings in New England scattered throughout the year.
True's Beaked Whale	*Mesoplodon mirus*	MMPA	Rare near shelf break; seasonality is poorly known, but sightings have been recorded in spring or summer. Strandings in New England scattered throughout the year.
Pinnipeds			
Gray Seal	*Halichoerus grypus*	MMPA	Sightings and/or strandings have occurred year-round on Long Island, NY, mainly in winter and spring.
Harbor Seal	*Phoca vitulina*	MMPA	May occur from September through May; small numbers occur year-round on Long Island and Connecticut.
Harp Seal	*Pagophilus groenlandicus*	MMPA	Sightings and/or strandings have occurred year-round on Long Island, NY, mainly in winter and spring
Hooded Seal	*Cystophora cristata*	MMPA	Rare; sightings and/or strandings have occurred year-round on Long Island, NY.

[(1)] Occurrence reported in the Right Whale Consortium (2015) database.

MMPA = Marine Mammal Protection Act

ESA-Listed Marine Mammals

The ESA-listed marine mammal species that occur in the New York Bight include six large whale species (fin, sei, humpback, North Atlantic right, blue, and sperm whales; Table 4-6). Sperm, blue, and sei whales that are sighted in the New York Bight are generally found farther offshore and/or near the shelf edge (Kenney and Vigness-Raposa, 2010; Right Whale Consortium, 2015). Thus, these species are not expected to occur in the action area. Only three listed species, all endangered, are likely to occur in the action area: fin, humpback, and North Atlantic right whales (Right Whale Consortium, 2015). However, NMFS is currently proposing to establish 14 distinct population segments (DPS) for humpback whales, two of which will be listed as endangered and two will be listed as threatened. The West Indies DPS covers all humpbacks along the Atlantic, and this DPS will be de-listed (80 FR 22303).

Sightings per unit effort (SPUE) results for fin, humpback, and North Atlantic right whales combined indicate that while these species are not particularly common (Figure 4-11), they could occur in the action area at any time during the year (Table 4-6).

Table 4-6
ESA-Listed Marine Mammals that Occur in the New York Bight

Common Name	Scientific Name	Federal Status	Potential to Occur in the Action Area
Blue Whale	*Balaenoptera musculus musculus*	Endangered	Rare, Occurrence not well known, but primarily deep water, unknown seasonality
Fin Whale	*Balaenoptera physalus*	Endangered	Most common; may be found in groups throughout NY Bight year-round
Humpback Whale	*Megaptera novaeangliae*	Endangered[2]	Common; may be found in groups generally within continental shelf waters in spring, summer, early winter and fall;[1] abundance in the area may vary from year to year; rarely observed in New York Harbor and surrounding shore
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Uncommon but regularly observed year round; primarily coastal, migratory, but may also may be foraging
Sei Whale	*Balaenoptera borealis*	Endangered	Rare, primarily found near the continental shelf edge; unknown seasonal occurrence
Sperm Whale	*Physeter macrocephalus*	Endangered	Rare, primarily found on the continental shelf, but also near Montauk Point; cows and calves regularly sighted in NY Bight; unknown seasonal occurrence

Source: USFWS, 1997; BOEM, 2011c; Whitt et al., 2013; Schlesinger and Bonacci, 2014; Right Whale Consortium, 2015; Waring et al., 2015

(1) Occurrence reported in the Right Whale Consortium (2015) database.

(2) NMFS is currently proposing to de-list this population (80 FR 22303)

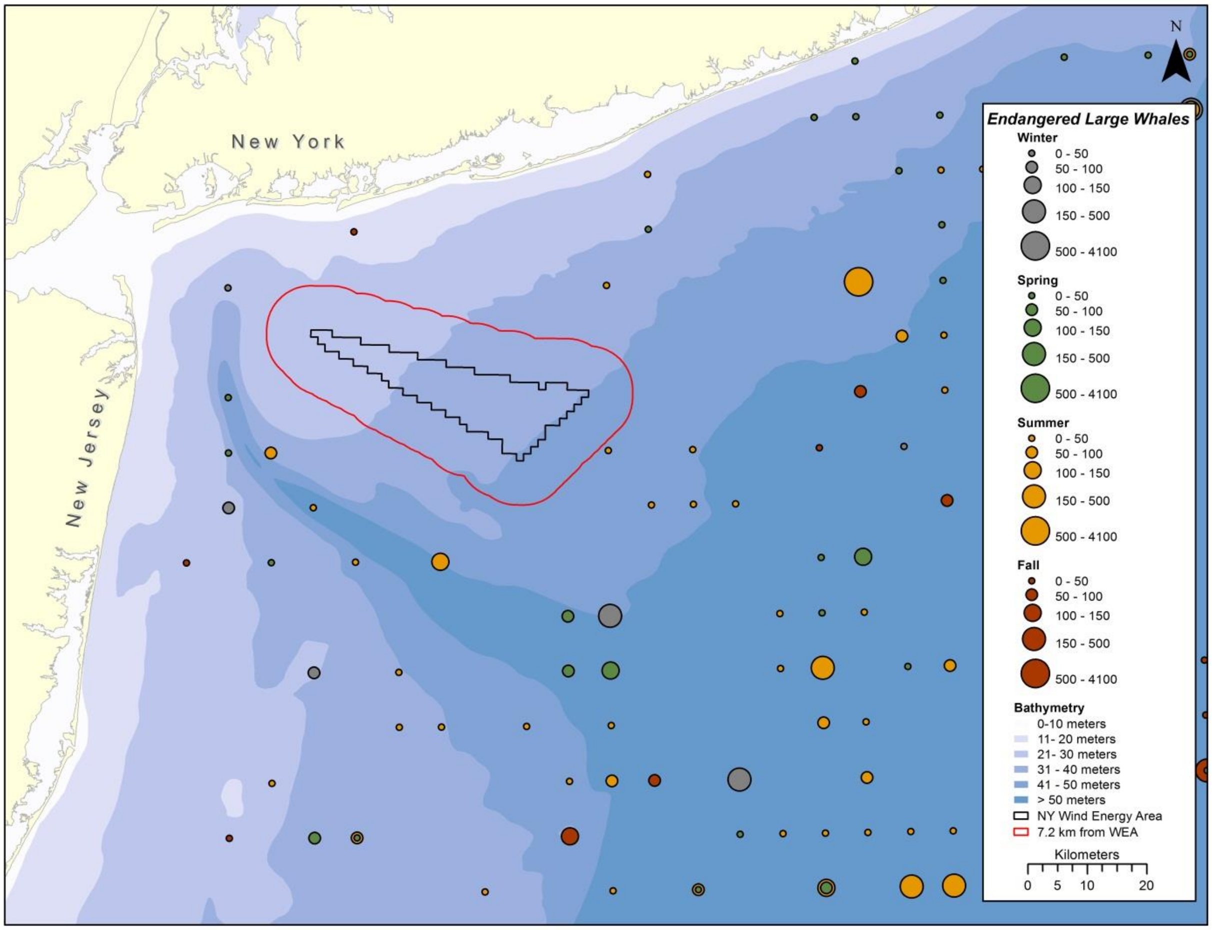


Figure 4-11 SPUE (whales per 621 mi [1,000 km] surveyed) for Endangered Large Whales (fin, humpback, and North Atlantic right whales) in the Vicinity of the WEA from 1979 through 2014

Source: Right Whale Consortium, 2015 (map prepared by Normandeau Associates, Inc.)

Fin whales are the most abundantly occurring endangered whale in the area, and may be found in the vicinity of the WEA during the summer, and in nearby inshore waters in all seasons (see Figures E-3 and E-4 in Appendix E). In addition, raw sightings data for North Atlantic right, humpback, and fin whales (see Figures E-1 through E-3 in Appendix E) indicate that these three species may occur in the action area more regularly than the SPUE data suggest (SPUE is a more limited dataset of sightings corrected for effort). For example, raw sightings data (Right Whale Consortium, 2015; see Figure E-2 in Appendix E) indicated that humpbacks have occurred in the area during the spring, summer, fall, and winter, while the map presenting SPUE data indicated their occurrence only during fall and spring (see Figure E-5 in Appendix E).

North Atlantic Right Whale

North Atlantic right whales are the most endangered whale in the North Atlantic. The detection of only one whale in a management area is enough to trigger management protocols. For management purposes, determining whether the whales are present in an area is a priority over abundance information, particularly regarding vessel strikes (Clark et al., 2010). North Atlantic right whales are known to migrate through the New York Bight from November 1 through April 30. However, results from recent passive acoustic surveys offshore New Jersey (Whitt et al., 2013) and raw sightings data (Figure 4-12) suggest that this species may occur in the action area during all seasons.

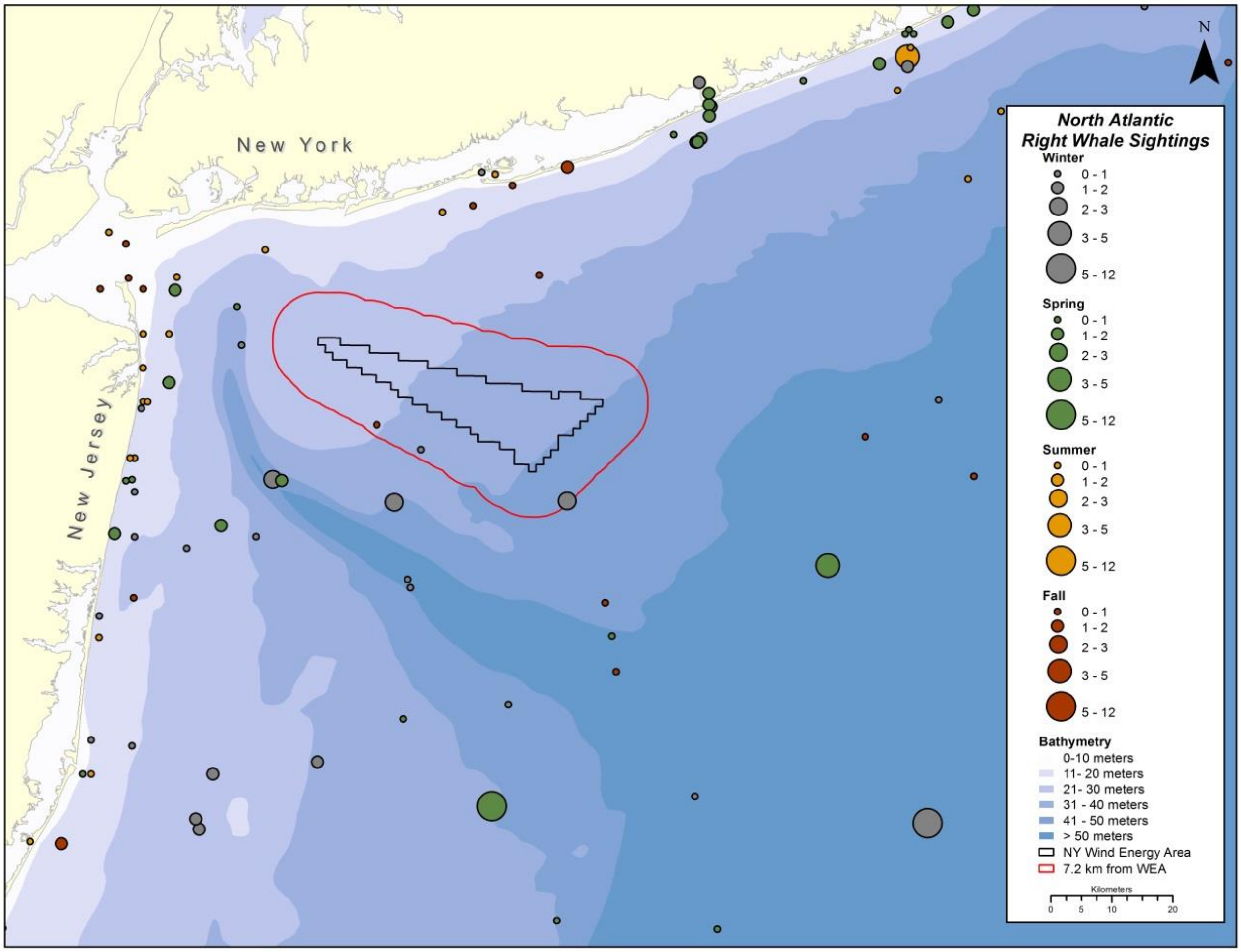


Figure 4-12 Raw Sightings for North Atlantic Right Whales in the Vicinity of the WEA from 1979 through 2014

Source: Right Whale Consortium, 2015 (map prepared by Normandeau Associates, Inc.)

Seasonal occurrence patterns and the spatial distribution of North Atlantic right whale sightings are illustrated by maps of both the opportunistic sightings data and the SPUE data for this species (Figure 4-12, Figure 4-13, and Figure E-1 in Appendix E). The opportunistic sightings data provide the most comprehensive record of sightings available since they include sightings reported by a wide variety of groups and individuals including federal agencies, mariners, commercial fisherman, whale-watch operators, and recreational boaters. In contrast, the SPUE data provide a more rigorous, effort-corrected assessment of occurrence and distribution, based on a subset of the raw sightings data for which effort was recorded. A detailed description of the differences between these data types is provided in Appendix E.

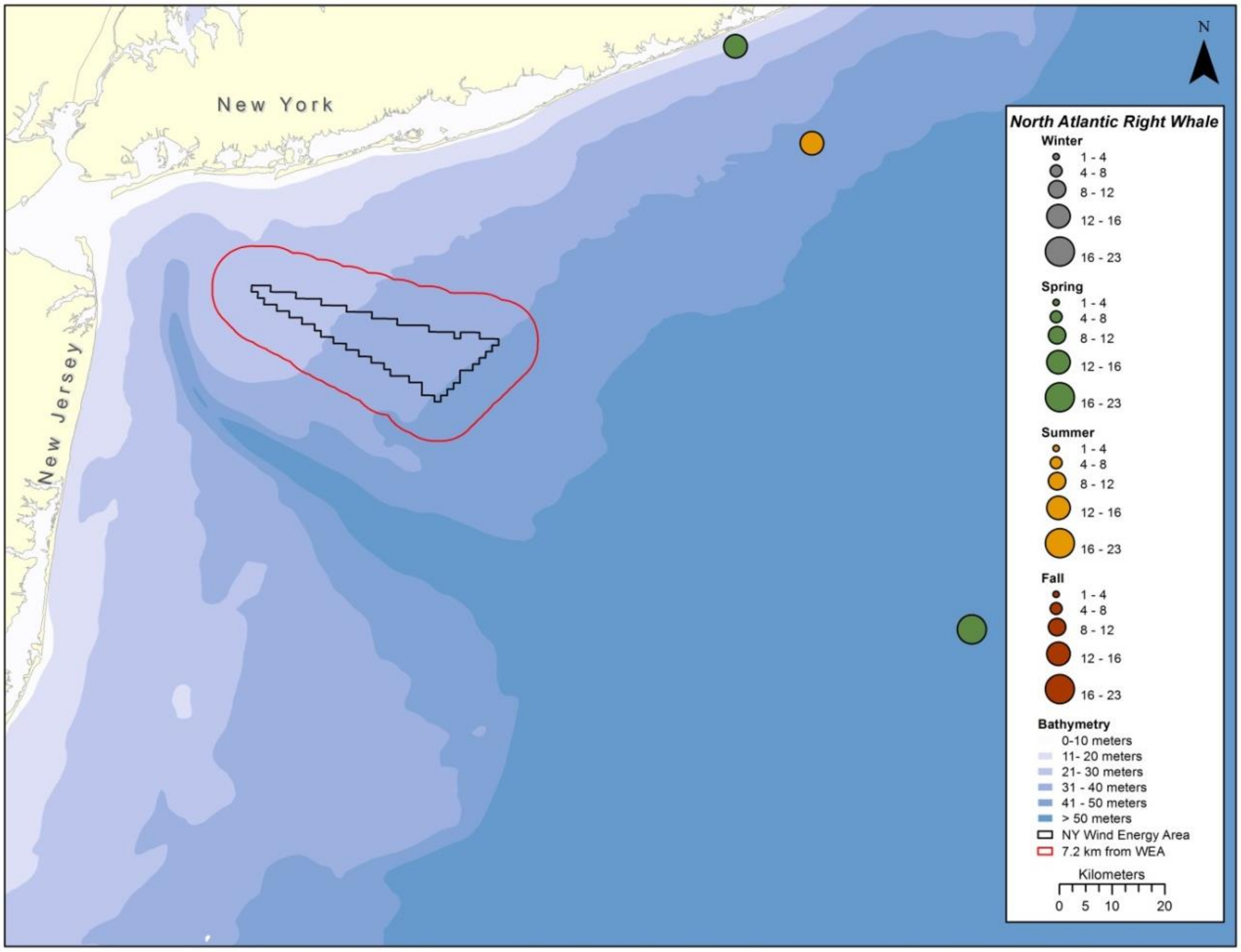


Figure 4-13 SPUE (whales per 621 mi [1,000 km] surveyed) for North Atlantic Right Whales in the Vicinity of the WEA from 1979 through 2014

Source: Right Whale Consortium, 2015 (map prepared by Normandeau Associates, Inc.)

The raw sightings data indicate that North Atlantic right whales may occur in the action area in all seasons, while the SPUE data only indicate right whale occurrence in three blocks: two in the spring and one in the summer (Right Whale Consortium, 2015). Coincidentally, those three non-zero SPUE values were derived from one sighting each—one whale nearshore and two whales farther offshore in spring and one whale in summer (Figure 4-13; Right Whale Consortium, 2015). Within the sightings dataset, this species occurred in the action area during all seasons (Appendix E; Right Whale Consortium, 2015). Part of the inconsistency between these two maps is because this species is more difficult to observe when migrating compared to when the whales are skim-feeding or socializing at the surface (Hain et al., 1999; Clark et al., 2010). Hain et al. (1999) concluded that diving behavior and time submerged were the principal factors affecting observability in the calving ground. Additionally, a higher percentage of whales are likely to be observed when whales remain in the survey area for extended periods, in good weather, and when multiple flights are flown. When animals are transitory, the weather is poor, and/or single flights are flown, many whales will be missed (Hain et al., 1999). Because of these factors, the distribution of North Atlantic right whales in the vicinity of the WEA gleaned from both SPUE and opportunistic sightings data should be considered conservatively low.

The most recent minimum count for the Western North Atlantic population of right whales was at least 465 individuals in 2011 (Waring et al., 2015). From 2008 to 2012, the mean annual minimum rate of human-caused mortality and serious injury to this species was 4.55 whales per year from two sources: incidental fisheries entanglements (3.65 per year) and ship strikes (0.9 per year) (Waring et al., 2015). These rates are minimum estimates and biased low, but thought to indicate a slowly increasing population (Waring et al., 2015). However, more recent data analysis indicates a decrease in calf productivity in the past 5 years, an increase in the number of severe injuries from entanglements and a significant decrease in the number of individuals sighted in all habitats in recent years (Knowlton et al., 2015; Pettis and Hamilton, 2015; Robbins et al., 2015). It is currently unclear how these notable habitat shifts are affecting population estimates, but researchers are concerned that all these factors may be indicative of a decreasing population. At this time, there is no critical habitat designation in the New York Bight.

North Atlantic right whales are known to migrate from the calving/wintering grounds off the southeast United States to the feeding grounds of the Great South Channel and Cape Cod Bay coast beginning in early spring. They then move farther north to the Bay of Fundy and Scotian Shelf in the summer and fall. In the fall, they begin the southward migration back to the waters of the southeast United States and to as yet unknown wintering locations (LaBrecque et al., 2015). A Seasonal Management Area (SMA) has been established off New York Harbor from November 1 to April 30 to coincide with these movements. SMAs, implemented by NOAA to reduce ship strikes to North Atlantic right whales, require mandatory vessel speed restrictions whereby all vessels 65 ft (20 m) or longer must travel 10 knots or less within a 20 nm (37 km) radius of, in this case, New York Harbor. The New York Harbor SMA is inshore of, and does not overlap with, the WEA. Although North Atlantic right whales are known to travel along the continental shelf of the United States (Whitt et al., 2013), whether they use the entire shelf area during migration or restrict their movements to nearshore waters is not known (LaBrecque et al., 2015).

Additionally, LaBrecque et al. (2015) have identified the coastal waters from Massachusetts to Florida as a North Atlantic right whale migratory corridor Biologically Important Area during the species' migration south to calving grounds in November and December and north to feeding grounds in the Bay of Fundy and unknown areas in March and April. Biologically Important Areas are region-, species-, and time-specific delineations identified by an expert elicitation process for the purpose of providing the best available science to help inform regulatory and management decisions (Ferguson et al., 2015).

Impact Analysis of Alternative A

Factors that could potentially have an impact on marine mammals from Alternative A are shown in Table 4-7. BOEM has developed SOCs for lessees and operators that are designed to prevent or reduce possible impacts to marine mammals during site characterization and site assessment activities. These SOCs are described in detail in Appendix B.

Table 4-7
Alternative A Activities and Events, Potential Impact-Producing Factors and Potential Impacts on Marine Mammals

Phase of the Proposed Action	Activity	Impact-Producing Factor	Potential Impact
Site Characterization and Site Assessment	Vessel operation	Vessel traffic	Vessel strike
		Vessel noise	Acoustic impacts
Site Characterization	Geophysical surveying	HRG active acoustic sources	Acoustic impacts
	Geotechnical sampling	Equipment noise	Acoustic impacts
		Seafloor disturbance	Water quality effects (e.g., turbidity)
Site Assessment	Installation of monopiles	Pile driving noise	Acoustic impacts
	Installation or removal of tower or buoy	Equipment noise	Acoustic impacts
		Seafloor disturbance	Water quality effects (e.g., turbidity)
		Ducted propeller thruster use during vessel positioning	Entrainment or physical disturbance
Site Characterization and Site Assessment	Any activity	Release of trash or debris	Entanglement, ingestion
		Accidental fuel spill	Water quality effects (e.g., contaminants)

In the following discussion, marine mammals listed as federally endangered or threatened under the ESA (i.e., listed) and marine mammals protected under the MMPA (i.e., non-listed) are discussed together because the potential impact mechanisms are the same for all marine mammals.

Site Characterization

Impacts on marine mammals from site characterization were analyzed in the G&G Final PEIS (BOEM, 2014a) and are incorporated herein by reference and summarized below. Although the geographic boundary in the G&G Final PEIS was outside of the WEA (it included BOEM's Mid-Atlantic and South Atlantic planning areas: Delaware to Florida), many of the same species occur in the New York Bight area, and the conclusions on impact levels are applicable to this EA. The following conclusions for site characterization that were made in the G&G Final PEIS for BOEM's Mid-Atlantic and South Atlantic planning areas are expected to be the same in the New York WEA:

- Impacts from HRG survey sound sources are expected to be **minor** because acoustic signals from electromechanical survey equipment are within the hearing range for marine mammals, and may cause Level B harassment. However, SOCs implemented to minimize acoustic impacts would include monitoring by a PSO of a 1,640 ft (500 m) exclusion zone for North Atlantic right whales and a 656 ft (200 m) exclusion zone for all other marine mammals, clearance of the exclusion zone 60 minutes prior to equipment start-up, “ramp up” of equipment, and immediate shutdown if a non-delphinoid cetacean (large whale) is sighted at or within the exclusion zone (Appendix B). If a delphinoid cetacean (dolphin or porpoise) or pinniped (seal) is sighted at or within the exclusion zone, the survey equipment must be powered down to the lowest power output feasible until the exclusion zone is clear.

- Impacts from vessel and equipment noise, including geotechnical sampling (e.g., coring) are expected to be **negligible** to **minor**. BOEM based the impact level on the basis that vessel and equipment source levels can be high enough to exceed threshold criteria for behavioral disturbance and undetected marine mammals may occur in the ensonified area during sampling activities. The following SOCs would minimize acoustic impacts: monitoring of the 656 ft (200 m) exclusion zone by a PSO, clearance of the 656 ft (200 m) exclusion zone 60 minutes prior to activity, and immediate shutdown if a non-delphinoid cetacean is sighted at or within the exclusion zone. Subsequent restart of geotechnical survey equipment may only follow clearance of exclusion zone for at least 60 minutes for all marine mammals (Appendix B).
- Impacts from project-related vessel traffic are expected to be **negligible** because SOCs require that all vessel operators and crew maintain a vigilant watch for marine mammals, with separation of 1,640 ft (500 m) from a sighted North Atlantic right whale and 328 ft (100 m) from all other non-delphinoid cetaceans (Appendix B). Additional vessel strike avoidance measures for North Atlantic right whales apply from November 1 to July 31. SOCs also require that all vessels underway do not divert to approach a delphinoid cetacean or pinniped.

Therefore, these impacts to marine mammals will not be discussed further in this EA.

Site Assessment

Impacts on marine mammals from site assessment activities are divided into two categories: underwater noise impacts and non-acoustic impacts. Impacts are assessed by relative potential of overlap, both spatially and temporally, between marine mammal species and impact-producing factor.

Underwater Noise Impacts

Marine mammals use sound for vital biological functions, including socialization, foraging, responding to predators, and orientation. It has been documented that some anthropogenic noise can negatively impact the biological activities of marine mammals in some instances (Southall et al., 2007). The response of marine mammals to sound depends on a range of factors, including (1) the SPL; frequency, duration, and novelty of the sound; (2) the physical and behavioral state of the animal at the time of perception; and (3) the ambient acoustic features of the environment (Hildebrand, 2004; Nowacek et al., 2004; Southall et al., 2011).

Noise can cause behavioral disturbance, including changes in feeding, vocalization, and dive patterns, or avoidance of the ensonified area (i.e., the area filled with sound). Auditory masking, defined as the obscuring of sounds of interest by interfering sounds, generally at the same or similar frequency, may also cause important behavioral changes to marine mammals exposed to sound. In addition to behavioral disturbance, underwater noise can result in two levels of potential injury to marine mammal hearing: (1) Temporary Threshold Shift (TTS), a non-permanent decrease in hearing sensitivity, and (2) Permanent Threshold Shift (PTS), a physical injury that results in a permanent decrease in hearing sensitivity. Detailed discussions on underwater sound and its importance to marine mammals and their hearing capabilities can be found in the G&G Final PEIS and the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts Revised Environmental Assessment* (BOEM, 2014a; BOEM, 2014b).

NMFS interim threshold criteria, based on received levels of sound for marine mammals during acoustic activities, are defined as follows:

- 120 dB re 1 μPa root mean square (RMS) for the potential onset of behavioral disturbance or harassment (Level B) from a *continuous* source of sound (e.g., vessel noise, geotechnical drilling, or vibratory pile driving)
- 160 dB re 1 μPa RMS for the potential onset of behavioral disturbance (Level B) from a *non-continuous* source (e.g., impact pile driving, HRG surveys)
- Potential injury (Level A) from received levels of 180 dB re 1 μPa RMS for cetaceans, and 190 dB re 1 μPa RMS for pinnipeds

Although distinct exposure thresholds can be determined for injury, behavioral reactions follow a wider spectrum of variable responses, some which may be negligible, while others can have more severe consequences. The traditional threshold level to predict behavioral reactions are 160 dB (RMS) for impulsive noise and 120 dB (RMS) for continuous noise where only animals exposed to levels above the threshold have the potential to be disturbed. An increasing number of studies indicate that the effect of underwater sound on marine mammal behavior is quite variable between species, individuals, life history stage, and behavioral state. Additionally, some species (e.g., beaked whales and porpoises or migrating baleen whales) or animals in certain behavioral states may be more sensitive to disturbance, while other species may be more tolerant to environmental noise.

A model proposed by Wood et al. (2012**)** applies a probabilistic approach that predicts the percentage of animals exposed that may be disturbed by sound. The model proposes that marine mammals will generally show a gradually increasing behavioral response to mammal hearing weighted (M-weighted) sound levels (L_{rms}) according to Table 4-8.

Table 4-8
Probabilistic Sound Level Thresholds for Marine Mammals

	Probabilistic L_{rms} Thresholds (M-weighted dB re 1 μPa)			
Marine Mammal Group	**120**	**140**	**160**	**180**
Porpoises/beaked whales	50%	90%	--	--
Migrating mysticetes	10%	50%	90%	--
All other species and behaviors	--	10%	50%	90%

Source: Wood et al. (2012)
L_{rms} = mammal hearing weighted (M-weighted) sound levels

Some marine mammal species may show tolerance of some noise in certain frequency bands while different frequency contents may elicit stronger responses (Nowacek et al., 2004) that should be accounted for when such information is available. For a generalized approach to evaluating impacts to marine mammals, a graded probability of response with exposures to different levels of noise (the step function) can be used to calculate the percentage of animals in an area that may be disturbed over a period of time underwater sounds are present.

Considering the non-behavioral, auditory effects on marine mammals, studies indicate that the onset of TTS and PTS are more closely correlated with received SEL than with sound pressure (RMS) levels, and that received sound energy over time should be the primary measure of potential impact, not just the single strongest pulse (Southall et al., 2007; NMFS, 2013a). Assessment of potential noise impacts on marine mammals in this EA is based on proposed weighted SEL using the threshold criteria summarized in Table 4-9. These threshold criteria are provided for both multiple pulse (e.g., impact pile driving, HRG surveys) and continuous (e.g., vessel, geotechnical drilling, vibratory pile driving) sound types. NMFS is in the process of updating threshold criteria and is currently using the RMS values above for consultation (NMFS, 2015).

Table 4-9
Summary of Weighted SEL Threshold Criteria
for Physical Injury (PTS) for Marine Mammals

		Sound Type	
		Impulsive	**Non-impulsive**
Low-Frequency Cetaceans (LF)	Peak	$L_{pk,flat}$: 230 dB re 1 µPa	[(1)] $L_{pk,flat}$: 230 dB re 1 µPa
	SEL	$L_{E,LF,24h}$: 187 dB re 1 µPa^2-sec	$L_{E,LF,24h}$: 198 dB re 1 µPa^2-sec
Mid-Frequency Cetaceans (MF)	Peak	$L_{pk,flat}$: 230 dB re 1 µPa	[(1)] $L_{pk,flat}$: 230 dB re 1 µPa
	SEL	$L_{E,MF,24h}$: 187 dB re 1 µPa^2-sec	$L_{E,MF,24h}$: 198 dB re 1 µPa^2-sec
High-Frequency Cetaceans (HF)	Peak	$L_{pk,flat}$: 201 dB re 1 µPa	[(1)] $L_{pk,flat}$: 230 dB re 1 µPa
	SEL	$L_{E,HF,24h}$: 161 dB re 1 µPa^2-sec	$L_{E,HF,24h}$: 172 dB re 1 µPa^2-sec
Phocid Pinnipeds (PW)	Peak	$L_{pk,flat}$: 218 dB re 1 µPa	$L_{pk,flat}$: 218 dB re 1 µPa
	SEL	$L_{E,PW,24h}$: 192 dB re 1 µPa^2-sec	$L_{E,PW,24h}$: 197 dB re 1 µPa^2-sec

Source: Southall et al., 2007; Finneran and Jenkins, 2012

[(1)] Finneran and Jenkins (2012) do not provide peak SPL for continuous noise. Peak SPL are provided from Southall et al., 2007

µPa = micropasal

µPa^2-sec = micropascal squared second

dB = decibel

$L_{pk,flat}$ = the maximum absolute value of instantaneous pressure during a specified time

$L_{E,LF,24h}$ = the cumulative sum-of-square pressures over the duration of a sound, 24h indicates the reset period or the level over which cumulative noise exposure is evaluated (daily)

SEL = sound exposure level

SPL = sound pressure level

Pile Driving

Among all acoustic activities during site assessment, pile driving has the potential to produce the highest noise levels. Sound levels from pile driving are highly variable depending on site location, type of pile, type and size of hammer, water depth, and bottom type (Madsen et al., 2006). There are two methods of pile driving that may be used in the WEA, vibratory pile driving and impact pile driving, and each has different potential impacts. BOEM anticipates that pile driving would occur for 3 to 8 hours per day for up to 3 consecutive days, and that pile diameters would be approximately 3 ft (1 m) to 10 ft (3 m) depending on the structural design of the meteorological tower.

Vibratory Pile Driving

Vibratory hammers use a combination of vibration and a heavy weight to force the pile into the sediment, producing a more continuous low-frequency sound compared to impact hammering (Hanson et al., 2003; Nedwell and Howell, 2004). Peak SPLs can be more than 180 dB, but are generally 10 to 20 dB lower than impact pile driving (Caltrans, 2009). Compared to impact hammers, the sounds produced by vibratory hammers are of longer duration (minutes vs. ms) and have more energy in the lower frequencies (Caltrans, 2009).

Underwater sound measurements were taken during vibratory hammering at Naval Base Kitsap at Bangor, Washington, using American Piledriving Equipment, Inc. 200 and 600 hammers. Average near-source sound levels for two sizes of piles, 24 inch and 36 inch (0.6 m and 0.9 m), ranged from 159 to 169 dB RMS (Illingworth and Rodkin, Inc., 2013). Average measurements to the behavioral harassment threshold criterion (120 dB RMS) taken from a mid-depth hydrophone (approximately 33 ft [10 m] deep) ranged from 6,825 to 31,053 ft (2,080 to 9,465 m), and from a deep hydrophone (at a 66 to 98 ft [20 to 30 m] water depth, or 7 to 10 ft [2 to 3 m] above the bottom) ranged from 10,745 to 37,730 ft (3,275 to 11,500 m) (Illingworth and Rodkin, Inc., 2013). Pile diameters for the meteorological tower are expected to range from 3 to 10 ft (1 to 3 m) (Table 3-6). The near-source sound levels for driving these larger piles would be higher than for those studied by Illingworth and Rodkin, Inc. (2013).

Under BOEM's SOCs (Appendix B, Section B.4), which require that pile driving be conducted from May 1 to October 31, a monitoring zone of 3,280 ft (1,000 m), and implementation of "soft start," no marine mammals are expected to experience Level A noise (>180 dB re 1 μPa). However, measurements from Illingworth and Rodkin, Inc. (2013) indicate that source levels above Level B harassment (120 dB RMS) could occur from 6,824 to 31,053 ft (2,080 to 9,465 m) from the source at a 33 ft (10 m) water depth, and from 10,745 to 37,730 ft (3,275 to 11,500 m) at a 66 to 98 ft (20 to 30 m) water depth. Therefore, because marine mammals may occur in or near the WEA during times of the year when pile driving may take place, behavioral impacts may occur.

The requirements under BOEM's SOCs are expected to reduce the potential impacts to marine mammals from vibratory pile driving activities. Nonetheless, the potential for behavioral impacts remains. Overall, impacts from vibratory pile driving activities are expected to be **minor** to **moderate** for both non-ESA-listed marine mammals and for ESA-listed fin, humpback, and North Atlantic right whales that could occur in the WEA.

Impact Pile Driving

MacGillivray et al. (2011) provided estimated source level spectra in 1/3 octave bands for the impact pile driving of large diameter (4 to 6 ft [1.2 to 1.8 m]) piles. These pile sizes are comparable to those that would be used for a meteorological tower under the proposed action, and are thus considered to be appropriate surrogates. MacGillivray et al. (2011) found that the broadband source level of the impact pile driving process depends on both the pile diameter and the impact energy of the pile driver. SPLs during impact pile driving can be greater than 200 dB re 1 µPa RMS (Madsen et al., 2006). Modeled SPLs from proposed wind projects offshore Delaware and New Jersey were variable (BOEM, 2012b). Received sound levels above the Level A threshold criteria (180 dB re 1 µPa (RMS)) ranged from 1,640 to 3,280 ft (500 to 1,000 m) from the source, and for Level B, threshold criteria (160 dB re 1 µPa (RMS) ranged from 11,200 to 24,000 ft (3,414 to 7,315 m) from the source (BOEM, 2012b). A detailed discussion on impact pile driving can be found in the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts, Revised Environmental Assessment* (BOEM, 2014b). Potential acoustic effects from impact pile driving for marine mammal groups are discussed under the separate subsections below.

Actual measured underwater sound levels during the installation of a 3 ft (1 m) foundation monopile for the Cape Wind meteorological tower in 2003 were 145 to 167 dB (RMS) at 1,640 ft (500 m) with peak energy at around 500 Hz (MMS, 2009b), which is in line with the modeled estimates for the Cape Wind project in Table 4-10. In addition, empirical data collected for the

Table 4-10
Modeled and Measured Range at Three Sound Pressure Levels within the Ensonification Area Produced by Pile Driving

Proposed Action (Modeled)	Additional Information	180 dB re 1 µPa (RMS)	160 dB re 1 µPa (RMS)	120 dB re 1 µPa (RMS)
[1]Bluewater Wind (Interim Policy Lease offshore Delaware)	3 m (10 ft) diameter monopile; 900 kJ hammer	760 m (2,493 ft)	7,230 m (23,721 ft)	N/A
[1]Bluewater Wind (Interim Policy Lease offshore New Jersey)	3 m (10 ft) diameter monopile; 900 kJ hammer	1,000 m (3,281 ft)	6,600 m (21,654 ft)	N/A
[1]Cape Wind Energy Proposed Action (Lease in Nantucket Sound)	5.05 m (16.57 ft) diameter monopile; 1,200 kJ hammer	500 m (1,640 ft)	3,400 m (11,155 ft)	N/A
Deepwater Wind, Block Island Wind Farm (Deepwater Wind, 2016b)	1-1.4 m (3.3–4.6 ft); 600 kJ hammer	22–428 m (72–1,404 ft)	1,780–4,640 m (5,840–15,223 ft)	N/A
Naval Facilities Engineering Command (2013) page 40; California Dept. of Transportation (2009) (Appendix 1)	0.6–1.8 m (2–6 ft) diameter monopiles; vibratory hammer	≤10 m (33 ft)	N/A	>7,000 m (22,966 ft)

[1] Source: BOEM, 2012b
µPa = micropascal
dB = decibel
kJ = kilojoule
RMS = root mean square

Block Island Wind Farm project show that it took an average of 4,848 hammer strikes over 3 non-continuous hours to install a 4 ft to 4.5 ft (1.2 m to 1.4 m) pile, consisting of three sections, in waters approximately 65 ft (20 m) deep (Deepwater Wind, 2016b).

Mysticetes

The three ESA-listed threatened and endangered mysticete species that are most likely to occur in the WEA are fin, humpback, and North Atlantic right whales. The only other non-listed mysticete that may occur in the New York Bight area, and thus the action area, is the minke whale. Pile driving activities are expected to be **minor** for minke whales because SPUE data suggest that these whales do not typically occur within 25 mi (40 km) of the WEA (Right Whale Consortium, 2015).

BOEM's SOCs (Appendix B, Section B.4), which require a lessee to limit pile driving between May 1 and October 31, a monitoring zone of 3,281 ft (1,000 m), and implementation of "soft start," are expected to minimize Level A noise (>180 dB re 1 μPa) exposures to ESA-listed marine mammals. However, it is possible that some endangered whales may experience Level A or Level B harassment. For example, recent acoustic data indicate the possible presence of North Atlantic right whales in the New York Bight at any time during the year (Whitt et al., 2013). Large whales engaged in migration are known to be more sensitive to relatively low levels of noise (lower than Level B harassment threshold levels), and this sensitivity may cause them to avoid the area (Southall et al., 2007; 2011).

Considering the short duration of impact pile driving activities (anticipated to be approximately 3 to 8 hours per day for up to 3 consecutive days), impacts from impact pile driving on fin, humpback, and North Atlantic right whales are expected to be **minor** to **moderate**.

Odontocetes

There are no ESA-listed odontocete species occurring in the WEA. However, non-listed marine mammal species are expected to occur. There are limited data on behavioral impacts for odontocetes from pile driving (Southall et al., 2007). Disruption to resting, communication, nursing, swimming, and diving behavior are some possible effects depending on the species, time of year, location, sound level, and duration of the pile driving activity. For bottlenose dolphins (mid-frequency cetaceans), Bailey et al. (2010) predicted behavioral reactions at an SPL of 140 dB re 1 μPa, which may occur at 31 mi (50 km) from the source, and for harbor porpoises (high-frequency cetaceans), behavioral reactions may occur at an SPL of 90 to 155 dB re 1 μPa at the 12 to 43 mi (20 to 70 km) range. These received levels would be capable of masking vocalizations by bottlenose dolphins from 6 to 25 mi (10 to 40 km).

Harbor porpoises forage by using echolocation, with critical frequencies at the 10 kHz band around 125 kHz (Kastelein et al., 2013). Harbor porpoises are expected to fully recover from small TTSs caused by noise bands centered at 4 kHz, so there would be relatively low-level impacts on harbor porpoises. However, little is known about the long-term effects of multiple and large TTSs and their effects on echolocation. The overall effect of hearing disruption on echolocation (and therefore foraging) may be critical (Kastelein et al., 2013).

Under BOEM's SOCs (Appendix B, Section B.4), which require a lessee to limit pile driving from May 1 to October 31, a monitoring zone of 3,281 ft (1,000 m), and implementation of "soft start," no odontocetes are expected to experience Level A noise (>180 dB re 1 μPa). However, because some dolphins and harbor porpoises may occur within the WEA and surrounding waters, behavioral impacts may occur for the common dolphin in the spring, Atlantic white-sided dolphin in the fall, bottlenose dolphin in the summer and fall, and harbor porpoise in the spring and summer (Right Whale Consortium, 2015).

Considering the short duration of impact pile driving activities (anticipated to be approximately 3 to 8 hours per day for up to 3 consecutive days), impacts to odontocetes are expected to be **minor** to **moderate**.

Pinnipeds

Results from studies on behavioral reactions of seals to pile driving have revealed responses at varying distances from the source. For example, results from Bailey et al. (2010) indicated a behavioral response in grey and harbor seals at predicted received levels of 143 dB re 1 μPa at 705 ft to 9 mi (215 m to 14 km) from the source. In another study on seals in the German Bight, peak SPLs from pile driving measuring 189 dB re 1 μPa at 1,312 ft (400 m), caused behavioral responses up to 12 mi (20 km) from the source and masking up to 50 mi (80 km) (Thomsen et al., 2006).

Hastie et al. (2015) fitted harbor seals with GPS/GSM tags to measure movements and proximity of seals at sea during pile driving for the installation of 17.1 ft (5.2 m) diameter steel wind turbine monopiles offshore of England. Acoustic exposure from pile driving for each seal was predicted using source characteristics of the pile that were derived from existing literature and a series of modeling approaches. Modeled received maximum cumulative sound exposure levels (SEL_{cum}) ranged from 170.7 to 195.3 dB re 1 micropascal squared second (μPa^2-s) for individual seals (Hastie et al., 2015). These authors extrapolated that approximately 50 percent (12 of 24) of seals received SELs that exceeded the threshold levels predicted to cause PTS (186 dB re 1 μPa^2-s). Horizontal distances at which threshold levels were exceeded were not included in Hastie et al. (2015), but the closest distances of individual seals to the active pile driving location ranged from 2.9 to 25.2 mi (4.7 to 40.5 km). In this case, the horizontal distance alone was not always indicative of exposure level. Received levels were variable and dependent not only on the distance of the seal from the source when pile driving was taking place, but also on the dive behavior at the time (e.g., predicted received levels were higher at deeper dive depths), where the seal was geographically in relation to the pile driving, and the force of the pile driving at the time (Hastie et al., 2015). It should be noted that received levels were reported using the SEL metric, and not the peak level (RMS) used in NMFS criteria. Information on how these levels would translate into the number of seals predicted to be exposed to noise exceeding the 190 dB RMS threshold criterion was not included in Hastie et al. (2015).

Additionally, the amount of time to recover from TTS depends on the level of threshold shift incurred; in general, the greater the shift, the longer the recovery period (Hastie et al., 2015). For example, for a seal with a mean TTS of 2 to 12 dB, a full recovery was observed within 24 hours (Kastak et al., 2005). In a separate study, a harbor seal exposed to a much higher SPL of 163 dB re 1 μPa at 3 ft (1 m) with frequency centered at 4 kHz for 60 minutes resulted in a TTS of 44 dB, from which it took 4 days for the seal to recover (Kastelein et al., 2013). A TTS of this level is considered severe for seals, and it suggests that the critical level (above which TTS increases rapidly with increasing SPL) is between 150 and 160 dB re 1 μPa for a 60-minute exposure to octave band noise centered at 4 kHz (Kastelein et al., 2013). If a seal is in the area with received levels of 150 to 160 dB re 1 μPa (11,155 to 23,721 ft [3,400 to 7,230 m] from the source), a TTS of this level may occur.

Recent studies also indicate that hearing loss induced by noise does not depend solely on the total amount of energy, but on the interaction of several factors, such as the level and duration of the exposure, the rate of repetition, and the susceptibility of the animal (Kastelein et al., 2013). The TTS caused by noise bands centered at 4 kHz is likely to reduce the audibility of ecologically and socially important sounds for seals. More specifically, a TTS of 6 dB would decrease by half the distance at which a seal could detect another seal, a fish, or a predator (assuming spherical spreading, no absorption, no noise, and no reverberation [Kastelein et al., 2013]). The authors also indicate that it is debatable whether a small PTS is more harmful than severe TTS from which recovery may take days. Long-lasting severe TTS may hamper behaviors such as courtship, navigation, foraging, and predator avoidance, and may thus reduce an animal's chances of survival and reproduction (Kastelein et al., 2013).

These data suggest pile driving may cause TTS and PTS for seals (and other marine mammals) for greater horizontal distances near the bottom than at the surface, that long-lasting TTS may cause more impacts than previously thought, and that the exclusion zone of 3,280 ft (1,000 m) at the surface may not be protective for these animals at depth, where they are not detectable.

According to Riverhead Foundation for Marine Research and Preservation (2015), gray, harbor, harp, and hooded seals may occur in the New York Bight area year-round; however, pile driving activities will only take place from May 1 to October 31. This seasonal restriction would eliminate impacts during the winter and spring, resulting in a small potential for exposure to pile driving noise in the summer. SOCs require an exclusion zone of 3,280 ft (1,000 m) and the use of "soft start," and are expected to reduce the likelihood of acoustic impacts from pile driving for seals in the WEA from May 1 to October 31. Ringed Seals are not likely to be affected by pile driving, as they typically occur during the winter off the New York coast.

Considering the short duration of impact pile driving activities (anticipated to be approximately 3 to 8 hours per day for up to 3 consecutive days), impacts from impact pile driving activities are expected to be **minor** for harbor, harp, hooded, and gray seals, and **negligible** for Ringed Seals.

Ducted Propeller Thruster Use for Dynamic Positioning Vessels

Although it is more likely that a jack-up barge would be used, a dynamic positioning vessel with ducted propellers (DPs) may be used for aspects of the foundation installation for the meteorological tower. DP thrusters and trenching activities over 8 weeks were modeled for a project offshore of Virginia (BOEM, 2015b). The sound source-level assumption employed in the underwater acoustic analysis was 177 dB re 1 μPa at 3 ft (1 m) and a vessel draft of 8 ft (2.5 m) for placing source depth. For Level A harassment threshold (180 dB re 1 μPa [RMS]) for marine mammals and the behavioral threshold of 166 dB re 1 μPa (RMS) for sea turtles, it was concluded that the distance would be negligible; therefore, no injury is anticipated for marine mammals. Distances to the Level B harassment threshold for marine mammals would be approximately 0.9 to 2 mi (1.4 km to 3.2 km). However, since impact pile driving activities for the proposed action are anticipated to take approximately 3 to 8 hours per day for up to 3 consecutive days, the fact that most marine mammals are highly mobile and therefore likely to spend only a small proportion of their time within the effective range of operations, and with implementation of the SOCs contained in Appendix B, behavioral impacts to marine mammals are expected to be mi**nor**.

Non-Acoustic Impacts to Marine Mammals

Vessel Strike

Potential impacts to marine mammals include strikes from vessels used during the construction, operation, and decommissioning phases of the tower or buoy installation. BOEM anticipates that between approximately 144 and 468 round trips of various vessel types may occur during site assessment activities (see section 3.2.4 *Vessel Traffic*).

While the number of vessel trips anticipated is relatively low compared to the existing level of vessel traffic in the area, it is possible that underwater noise (e.g., pile driving) may cause behavioral changes for some whale species that could increase the chances for a collision between a marine mammal and a vessel. This is especially important for endangered whales (North Atlantic right, fin, and humpback whales) for which vessel strike is a major cause of mortality (Waring et al., 2015). Southall et al. (2011) indicate that the behavioral response of some whale species to noise may secondarily increase the risk of vessel strike to large whales (e.g., changes in ascent behavior and rapid acceleration away from the source). Recent studies have also indicated that some whale species are more sensitive to sound during migration than during feeding (Southall et al., 2007; 2011) and may show avoidance responses at greater distances if the noise can be heard by the animal. These studies suggest that North Atlantic right whales, known to migrate through the New York Bight could be susceptible to such behavioral reactions from project-related noise. However, considering the existing levels of vessel traffic noise generated in the general area of the WEA (between the two TSSs surrounding the WEA), it is unlikely that noise related to the construction, operation or decommissioning phases of a meteorological tower or buoy would be detected at levels or durations that might result in an increase in risk of vessel strike to North Atlantic right whales.

BOEM's SOCs were designed to minimize potential vessel strikes to marine mammals (Appendix B, Section B.1.1). NMFS (2013c) concluded that during site assessment activities, the potential for construction- and maintenance-related vessel strike to marine mammals is extremely low. Potential impacts to marine mammals from vessel strikes during site assessment activities are therefore expected to be **negligible** because of the low probability of such an event. Nonetheless, if vessel strikes did occur they could result in **minor** to **moderate** impacts to ESA-listed marine mammal species.

Entrainment in Ducted Propeller Thrusters of Dynamic Positioning Vessels

Although it is more likely that a jack-up barge would be used, a dynamic positioning vessel may be used for aspects of the foundation installation for the meteorological tower. Both harbor (*Phoca vitulina*) and grey (*Halichoerus grypus*) seals were found on the coasts of Scotland, England, Northern Ireland, and Canada with injuries consisting of a single continuous curvilinear skin laceration spiraling down the body (Thompson et al., 2010). Based on the pathological findings, it was concluded that mortality was caused by a sudden traumatic event involving a strong rotational shearing force. The injuries were consistent with the animals being drawn through the DPs of marine vessels (Bexton et al., 2012). DP and azimuth thrusters are used for the dynamic positioning of vessels, towing, and for general low-speed maneuvering where high thrust is needed at low speeds. These boats maintain their position by altering the speed and direction of their thrust. This can involve an almost-stationary vessel repeatedly starting or reversing its rapidly rotating propellers, a situation that used to be relatively rare. This may increase the opportunities for animals to approach propellers and be drawn into them (Thompson et al., 2013). Harbor porpoises (*Phocoena phocoena*) exhibiting large lacerations have stranded around the United Kingdom and southern North Sea in recent years. In the light of the seal strandings, photographic records of these harbor porpoise strandings are being re-examined (Thompson et al., 2013). However, more recently, researchers have found evidence that an adult male gray seal had killed young gray seals and left distinctive spiral lacerations around their bodies and that DPs may not be responsible for corkscrew injuries (Thompson et al., 2015). To date, there have been no reported incidents of cetaceans becoming entrained in DPs.

Considering that pinnipeds generally occur in the New York Bight area during winter and spring months and that pile driving would be prohibited from November 1 to April 30, it is unlikely that any DP thruster use would take place when pinnipeds are generally present. In addition, the short duration (approximately 3 to 8 hours per day for up to 3 consecutive days) of potential DP thruster use, and the simultaneous application of SOCs for pile driving activities described in Appendix B, in addition to power downs when technically feasible, the entrainment impacts of DP thruster use to marine mammals are expected to be **negligible**.

Water Quality Effects

Details on impacts to water quality from site assessment activities can be found in Michel et al. (2007) and are incorporated by reference and summarized here. These water quality effects would occur during the installation and/or decommissioning of a tower and/or buoys. Potential impacts during tower and/or buoy installation or decommissioning may include an increase in suspended sediment, resulting in elevated turbidity levels and also the release of contaminants that may be in the sediment. Increased turbidity may cause temporary displacement of prey, and thus of marine mammals. However, these impacts would be short-term and temporary, and would take place in a very small area compared to the available foraging habitat. Prey species and marine mammals would be expected to return to the area shortly after installation was completed.

Potential impacts to marine mammals from water quality effects of installing and operating a meteorological tower and/or buoys are therefore expected to be **negligible**.

Entanglement

A potential impact on marine mammals during meteorological tower or buoy operation is entanglement with physical structures in the water column. The potential for marine mammals to interact with the buoy and to become entangled in the buoy or mooring system is extremely unlikely given the low probability of a marine mammal encountering one buoy or mooring system within the expanse of the WEA, and the high tension of the chain, which further reduces risk of entanglement (NMFS, 2013a). Potential impacts on marine mammals from entanglement related to meteorological tower and buoy operation are thus expected to be **negligible**.

Loss of Habitat, Prey Abundance, and Distribution Effects

Meteorological tower or buoy installation and decommissioning would result in a temporary disturbance of benthic habitat. The presence of a tower foundation or buoy mooring system, along with scour control mats and rock armoring, would result in a loss of benthic habitat over a very small area in the WEA. In the case of a tower, there would be a shift from a soft horizontal bottom to a hard, vertical substrate, which may attract finfish and benthic organisms, which may in turn attract seals, dolphins, and some whale species. However, a single meteorological tower within the total area of the WEA is unlikely to alter distribution of forage species for marine mammals. The anchor and chain sweep for the buoy mooring is expected to denude a small area around the anchor, but the area of benthic habitat loss would be very small compared to the available habitat in the entire WEA, and is not expected to have a negative impact on foraging abilities for marine mammals.

Potential impacts on marine mammals due to loss of habitat, and changes to prey abundance and distribution from a meteorological tower or buoy, are expected thus to be **negligible**.

Non-Routine Events

The following conclusions for non-routine events that were made in the G&G Final PEIS for BOEM's Mid-Atlantic and South Atlantic planning areas (2014a) are expected to be the same for the New York WEA (see discussion of the applicability of the G&G Final PEIS for this impact analysis in Section 4.4.2.5, above). These conclusions are applicable to the proposed action because the same species of marine mammals occur in the New York Bight area, and would be engaged in the same activities.

- Impacts from trash and debris are expected to be **negligible**.
- Potential impacts on marine mammals from fuel spills are expected to range from **negligible** (if the fuel does not contact individual marine mammals) to **minor** (if individual marine mammals encounter the slick).

Therefore, these impacts to marine mammals will not be discussed further in this EA.

Conclusion

Overall, impacts to marine mammals are expected to be **moderate** due to potential acoustic impacts during site assessment activities that involve pile driving; however, potential impacts covering site characterization and other site assessment activities would range from **negligible** to **minor,** depending on the activity being conducted. Vessel strike and noise are two of the most important factors that may affect marine mammals. Implementing the vessel strike avoidance measures in the SOCs (Appendix B, Section B.1.1) would minimize the potential for vessel strikes. BOEM's SOCs related to site characterization surveys (Appendix B, Section B.3) and site assessment (Appendix B, Section B.4) would minimize the potential for noise impacts to marine mammals.

4.4.2.6 Sea Turtles

Description of the Affected Environment

Four species of sea turtles occur in the New York Bight: loggerhead, green, Kemp's ridley, and leatherback (Table 4-11). All four species are listed as threatened or endangered under the ESA. Of the four species, loggerhead turtles are sighted more frequently than any other sea turtle species in the vicinity of the WEA (Appendix E).

Table 4-11
ESA Listing Status, Relative Occurrence, and Seasonality of Sea Turtles in the New York Bight

Common Name	Scientific Name	Federal Status	Potential Occurrence in the Action Area
Loggerhead turtle	*Caretta caretta*	Threatened (Northwest Atlantic DPS)	Most common sea turtle; found in bays and along the coast up to 40 mi (64 km) or greater offshore in late spring to early fall (May–October)
Green turtle	*Chelonia mydas*	Threatened (North Atlantic DPS)	Regular; distribution related to vegetative forage off eastern side of Long Island from July–November
Kemp's ridley turtle	*Lepidochelys kempii*	Endangered	Common to abundant in summer to early fall (June–October)
Leatherback turtle	*Dermochelys coriacea*	Endangered	Common; found in near coastal waters from May–November

Source: USFWS, 1997; BOEM, 2011c; Right Whale Consortium, 2015; NMFS OPR, 2015; NMFS, 2013a; NYSDEC, 2015b

DPS = distinct population segments

The hawksbill sea turtle, which is listed as endangered under the ESA, is typically found in tropical and subtropical waters and is considered rare in New York. The likelihood of the species occurrence in the WEA is so low, that the potential for any effects to hawksbills from the activities in this EA is negligible. Therefore, the species will not be discussed further in this EA.

Green turtles are more likely to be found in New York state waters than in the federal waters of the WEA, with distribution of this species generally restricted to shallow areas with aquatic vegetation (Table 4-11). Loggerhead, leatherback, and Kemp's ridley are the most abundantly occurring species in nearshore waters of the New York Bight. SPUE data for each of these species are presented in Appendix E, and Figure 4-14 presents seasonal SPUE data for all three species combined. These species occur only seasonally, in relatively widespread abundance during the summer and fall, with a few sightings in the spring (Right Whale Consortium, 2015; Figure 4-14). Detailed information on sea turtles, including life history, behavioral ecology, and hearing abilities, are available in Kenney and Vigness-Raposa (2010), BOEM (2011c), and the G&G Final PEIS (BOEM, 2014a), which are incorporated herein by reference.

Impact Analysis of Alternative A

Impact-producing factors associated with the proposed action that could have potential impacts on Kemp's ridley, loggerhead, leatherback, and green sea turtles are shown in Table 4-12. BOEM has developed SOCs for sea turtles that are designed to prevent or reduce any possible impacts during both site characterization and site assessment activities. These SOCs are described in detail in Appendix B.

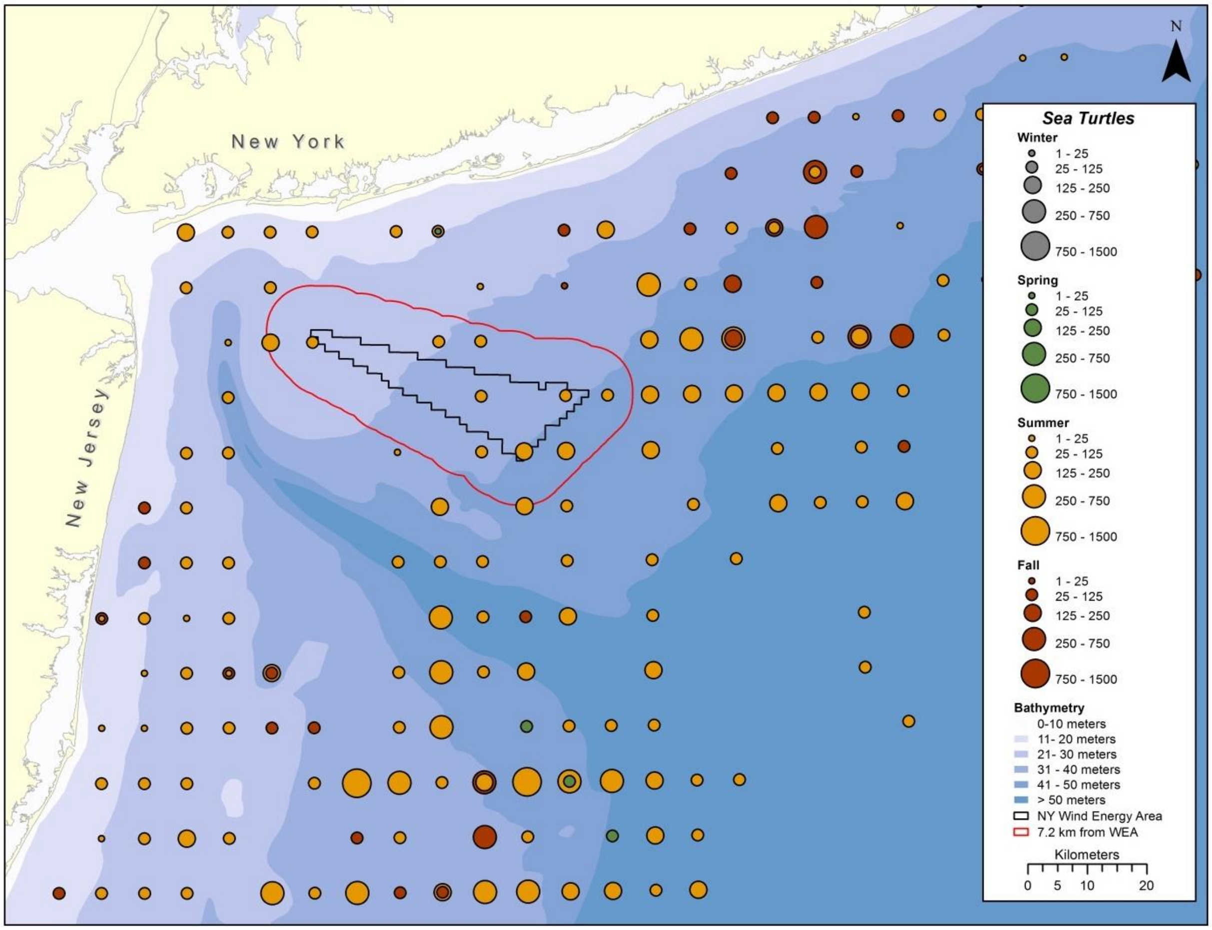


Figure 4-14 SPUE (turtles per 621 mi [1,000 km] surveyed) for Sea Turtles (loggerhead, leatherback, and Kemp's ridley) in the Vicinity of the WEA from 1979 through 2014

Notes: SPUE calculation methods provided in Appendix E; figure prepared by Normandeau Associates, Inc.
Source: Right Whale Consortium, 2015

Table 4-12
Activities with Potential Impact-Producing Factors on Sea Turtles from Alternative A

Proposed Action Phase	Activity	Impact-Producing Factor	Potential Impact
Site Characterization and Site Assessment	Vessel operation	Vessel traffic	Vessel strike
		Vessel noise	Acoustic impacts
Site Characterization	Geophysical surveying	HRG active acoustic sources	Acoustic impacts
	Geotechnical sampling	Equipment noise	Acoustic impacts
		Seafloor disturbance	Water quality effects (e.g., turbidity)
Site Assessment	Installation of monopiles	Pile driving noise	Acoustic impacts
	Installation or removal of tower or buoy	Equipment noise	Acoustic impacts
		Seafloor disturbance	Water quality effects (e.g., turbidity)
		DP thruster use during vessel positioning	Entrainment or physical disturbance
Site Characterization and Site Assessment	Any activity	Release of trash or debris	Entanglement, ingestion
		Accidental fuel spill	Water quality effects (e.g., contaminants)

DP = ducted propeller

Site Characterization

Impacts from site characterization have been analyzed in the NMFS Biological Opinion (NMFS, 2013a) and the G&G Final PEIS (BOEM, 2014a), which are incorporated herein by reference and summarized below. Although the geographic boundary for the G&G Final PEIS was outside of the WEA (it included BOEM's Mid-Atlantic and South Atlantic planning areas: Delaware to Florida), the conclusions on impact levels are applicable to this EA. The conclusions are applicable because the four species of sea turtles that occur in the New York Bight area also occur in BOEM's Mid- and South Atlantic planning areas, and would be engaged in the same activities (e.g., feeding and diving). No critical habitat for sea turtles is designated in the WEA. The following conclusions for site characterization that were made in the G&G Final PEIS for BOEM's Mid-Atlantic and South Atlantic planning areas are expected to be the same in the WEA:

- Impacts from HRG active acoustic sound sources are expected to be **minor.** Acoustic signals from boomers are the only HRG equipment that operate within the hearing range for sea turtles, and may be audible to sea turtles. As such, BOEM would require a lessee to implement SOCs to minimize acoustic impacts. These SOCs include monitoring of the 656 ft (200 m) exclusion zone by a PSO, clearance of the exclusion zone 60 minutes prior to electromechanical survey equipment start-up, "ramp up" of equipment, and immediate shutdown if a sea turtle is sighted at or within the exclusion zone (Appendix B).

- Impacts from vessel and equipment noise, including geotechnical sampling (e.g., coring), are expected to be **negligible** to **minor**. BOEM based the impact level on the basis that vessel and equipment source levels could be high enough to exceed the threshold criteria for behavioral disturbance and undetected sea turtles may occur in the ensonified area during sampling. BOEM would require a lessee to implement the following SOCs to minimize acoustic impacts: monitoring of the 656 ft (200 m) exclusion zone by a PSO, clearance of the 656 ft (200 m) exclusion zone 60 minutes prior to activity, and immediate shutdown if a sea turtle is sighted at or within the exclusion zone (Appendix B).
- Impacts from project-related vessel traffic are expected to be **negligible** because SOCs require that all vessel operators and crew maintain a vigilant watch for sea turtles, and a separation of 164 ft (50 m) from a sighted sea turtle (Appendix B).

Therefore, these impacts to sea turtles will not be discussed further in this EA.

Site Assessment

Impacts on sea turtles from site assessment activities are divided into two categories: potential impacts of underwater noise and non-acoustic impacts. Impacts are assessed by relative potential of overlap, both spatially and temporally between sea turtle species and impact-producing factors.

Underwater Acoustic Impacts

Noise is one of the most important factors that may affect sea turtles. Studies show that sea turtles are particularly sensitive to low-frequency sounds, so they hear much of the low-frequency and high-intensity man-made noise in the ocean such as vessel traffic and offshore oil and gas exploration activities (Dow Piniak et al., 2012). Although BOEM's SOCs (Appendix B, Section B.4) have incorporated the best known measures designed to minimize potential impacts on sea turtles, there are large data gaps regarding their behavioral and physiological responses to sound (Nelms et al., 2016). For example, when avoiding a noise, it is not known whether turtles move vertically (by surfacing or diving) or horizontally. By diving, sea turtles may be more vulnerable to acoustic exposures, and by surfacing, they may be more vulnerable to vessel strike. Sea turtles moving horizontally away from an acoustic source may be temporarily displaced from habitat being used while an active acoustic source is present. Observing turtles at the surface when the sea is not calm or with only light ripples (i.e., in sea states above Beaufort 1) is unreliable, and observation becomes more difficult with increased distance from the observation vessel (Nelms et al., 2016). It is also not possible to detect sea turtles below the surface, where they may be most exposed to sound (Nelms et al., 2016). Dow Piniak et al. (2012) indicated that repeated exposures to sound sources can cause habituation or sensitization (decreases or increases in behavioral response), which would increase long-term physiological effects. The authors recommend future studies to investigate the potential physiological (critical ratios, TTS, and PTS) and behavioral effects of exposing sea turtles to these sound sources.

Impact and Vibratory Pile Driving

Impact or vibratory pile driving may be used for the installation of a meteorological tower. Differences between impact and vibratory pile driving are discussed in Section 4.4.2.5 *Marine Mammals*. Data for impacts to sea turtles from pile driving are lacking. However, as indicated by

NSF and USGS (2011), sea turtles would likely react in the same way they do to seismic sounds at the same frequency, with behavioral changes including a startle response, increased swim speed, diving responses, and avoidance of the sound source.

Although pile driving for one meteorological tower would take a relatively short time (approximately 3 to 8 hours per day for up to 3 consecutive days), it would occur from May 1 to October 31, which is when sea turtles are known to be in the WEA and surrounding waters in relatively high densities. The SOCs include monitoring the exclusion zone (3,281 ft [1,000 m]), limiting pile driving activities to daylight hours, implementing "soft start" to warn sea turtles away from the immediate area, and requiring a 60-minute observation period before beginning activities. While these measures are designed to minimize hearing injury impacts, some sea turtles may still be exposed to PTS levels (> $L_{pk,flat}$ 207 dB or > $L_{E,24h}$ 210 dB; Popper et al., 2014) or behavioral disturbance at L_{rms} 166 dB SELs (McCauley et al., 2000) if individuals are not sighted.

Potential impacts on sea turtles during impact and vibratory pile driving are expected to be **negligible** to **moderate** depending on the turtle's distance from the source and the source level of the driven piles.

Ducted Propeller Thruster Use for Dynamic Positioning Vessels

Although it is more likely that a jack-up barge will be used, a dynamic positioning vessel with DPs may be used for certain aspects of the foundation installation for the meteorological tower. DP thrusters and trenching activities over 8 weeks were modeled for a project offshore of Virginia (BOEM, 2015b). The sound source-level assumption employed in the underwater acoustic analysis was 177 dB re 1 μPa at 3 ft (1 m) and a vessel draft of 8 ft (2.5 m) for placing source depth. For the behavioral threshold of 166 dB re 1 μPa (RMS) for sea turtles, it was concluded that the distance would be **negligible**; therefore, no injury or behavioral harassment is expected for sea turtles.

Potential acoustic impacts caused to sea turtles due to DP thrusters are expected to be **negligible**.

Non-Acoustic Impacts

Operation of Meteorological Tower/Buoy

Potential impacts on sea turtles during meteorological tower or buoy operation include operational noise, associated vessel traffic for routine maintenance of the tower or buoy and the presence of the physical structure in the water column. An increase in vessel traffic may cause an increase in sea turtle collisions or boat-related injuries, behavioral changes, or displacement from the area (NMFS, 2013a). However, with the implementation of the vessel strike avoidance measures required by the SOCs (Appendix B, Section B.1.1), the potential for construction- and maintenance-related vessels to strike sea turtles would be extremely low. The potential for sea turtles to interact with the buoy and to become entangled in the buoy or mooring system is extremely unlikely given the low probability of a sea turtle encountering one buoy or mooring system within the expanse of the WEA, and the high tension of the chain, which further reduces risk of entanglement (NMFS, 2013a).

Potential impacts to sea turtles from meteorological tower and buoy operation are expected to be **negligible**.

Entrainment in Ducted Propeller Thrusters of Dynamic Positioning Vessels

Although it is more likely that a jack-up barge would be used, a dynamic positioning vessel with DPs may be used for aspects of the foundation installation for the meteorological tower. Potential incidences of gray seal entrainment in DP thrusters have been attributed to wounds inflicted by adult male gray seals (Thompson et al., 2015). Other than this study, to date, there have been no other reports of seal entrainment in DP thrusters. No reports of incidences of dolphins or sea turtles being injured by DP thrusters are currently available. If, however, entrainment of sea turtles in DP thrusters is possible, due to the SOCs, the impact caused by entrainment of sea turtles in DP thrusters is expected to be **minor**.

Water Quality Effects

Meteorological tower and/or buoy installation would occur from May through October (SOCs require that no pile driving occurs from November 1 through April 30; Appendix B, Section B.4). During meteorological tower or buoy installation, disturbance of the sediment can cause elevated levels of turbidity and release of contaminants that may negatively affect foraging sea turtles. However, water quality effects from tower/buoy installation are anticipated to be short-term, temporary, and highly localized compared to the available forage habitat for sea turtles.

Potential impacts on sea turtles caused by water quality effects as a result of meteorological tower/buoy installation are therefore expected to be **negligible**.

Loss of Habitat, Prey Abundance, and Distribution Effects

The installation and presence of a meteorological tower or buoy, scour control mats, and rock armoring would result in a temporary disturbance and a permanent loss of benthic habitat over a very small area in the WEA. In the case of a tower, there would be a shift from a soft horizontal bottom to a hard, vertical substrate, which may attract finfish and benthic organisms. It is possible that some of these benthic organisms would be prey species for loggerhead and Kemp's ridley sea turtles. Additionally, all four sea turtle species addressed in this EA may be attracted to the meteorological tower structure for shelter (NMFS, 2013a). However, a single meteorological tower within the total area of the WEA is unlikely to alter distribution of any forage species for sea turtles. The chain sweep area around the anchor is expected to be denuded of benthos, but this is a very small area compared to the available benthic habitat in the entire WEA, and thus not likely to negatively affect sea turtle foraging habitat.

Potential impacts to sea turtles due to loss of habitat, changes to prey abundance, and distribution from installation and operation of a meteorological tower or buoy are expected to be **minor**.

Meteorological Tower or Buoy Decommissioning

During meteorological tower or buoy decommissioning, disturbance of the sediment can cause elevated levels of turbidity and release of contaminants that may negatively affect foraging sea turtles. However, impacts would be of lower magnitude than those resulting from installation activities. Water quality effects from tower/buoy decommissioning are expected to be short-term, temporary, and highly localized compared to the available forage habitat for sea turtles.

Potential impacts to sea turtles from meteorological tower or buoy decommissioning are expected to be **negligible**.

Non-Routine Events

Non-routine events could affect sea turtles during both site characterization and site assessment. The following conclusions for non-routine events that were made in the G&G Final PEIS for BOEM's Mid-Atlantic and South Atlantic planning areas (BOEM, 2014a) are expected to be the same in the New York WEA. These conclusions are applicable to the proposed action because the same species of sea turtles occur in the New York Bight area, and would be engaged in the same activities (e.g., feeding and diving). No critical habitat for sea turtles is designated in the WEA.

- Impacts from trash and debris are expected to be **negligible** because the SOCs require a briefing on marine trash and debris awareness and elimination (Appendix B).
- Potential impacts on sea turtles from fuel spills are expected to range from **negligible** (if the fuel does not contact individual turtles) to **minor** (if individual turtles encounter the slick). Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills.

Therefore, these impacts to sea turtles will not be discussed further in this EA.

Conclusion

Overall, impacts to sea turtles are expected to be **moderate**, although potential impacts to sea turtles would range from **negligible** to **moderate** depending on the activity being conducted during site characterization and site assessment. Vessel strike and noise are two of the most important factors that may affect sea turtles. However, implementing the vessel strike avoidance measures in the SOCs (Appendix B, Section B.1.1) would minimize the potential for vessel strikes and adverse impacts on sea turtles. There are large data gaps regarding behavioral and physiological responses of sea turtles to sound, and recommendations for future studies include the potential physiological (critical ratios, TTS, and PTS) and behavioral effects of exposure to sound sources.

Although implementation of the SOCs is expected to minimize the potential of hearing injury impacts and disruption the behavior of sea turtles, pile driving from May 1 to October 31 (Appendix B, Section B.4), coincides with the time of year that sea turtles are known to occur in the WEA. However, pile driving of one meteorological tower would take a relatively short time (approximately 3 to 8 hours per day for up to 3 days), which would limit the turtles' exposure to the sound to periodic disruptions over a 1-day to 3-day period. Sea turtles that avoid the area are expected to successfully forage in nearby habitats with similar prey availability. There are no critical or otherwise important foraging habitats known to occur in the area of the WEA.

4.4.2.7 Finfish, Invertebrates, and Essential Fish Habitat

Description of the Affected Environment

Finfish

As a result of its seasonal water temperatures and unique bathymetry, the New York Bight contains a wide range of habitats that vary in physical and biological properties. The ridge and swale topography and the Hudson River Canyon, which nearly bisects this area of the northern

Mid-Atlantic Bight and south of the WEA, contribute to the diverse biological habitat. The oceanographic and biological processes of this area have been described by Steves et al. (1999) and Stevenson et al. (2004). Finfish distribution patterns and assemblages for larval, juvenile, and adult life stages in the Mid-Atlantic Bight have been characterized in a number of publications, including Colvocoresses and Musick (1984), Morse et al. (1987), Gabriel (1992), Cowen et al. (1993), Mahon et al. (1998), and Steves et al. (1999). Table 4-13 summarizes the dominant demersal finfish species observed in the New York Bight during spring and fall NMFS Groundfish Surveys conducted from 1967 through 1976. Many of the fish species found in the WEA are important because of their value as commercial and recreational fisheries.

Table 4-13
Dominant Demersal Finfish Species in the New York Bight

Season	Species Assemblage			
	Boreal	**Warm Temperate**	**Inner Shelf**	**Outer Shelf**
Spring	• Atlantic Cod • Little Skate • Longhorn Sculpin • Monkfish • Ocean Pout • Red Hake • Silver Hake • Spiny Dogfish • Winter Flounder • Yellowtail Flounder	N/A	Windowpane	Fourspot Flounder
Fall	• Little Skate • Red Hake • Silver Hake • Spiny Dogfish • Winter Flounder • Yellowtail Flounder	• Black Sea Bass Butterfish • Northern Searobin • Scup • Smooth Dogfish • Spotted Hake • Summer Flounder	Windowpane	Fourspot Flounder

Source: Colvocoresses and Musick, 1984

The affected environment encompasses demersal and pelagic habitats in the open ocean that provide habitat for over 300 fish species (Jones et al., 1978). A general description of the affected environment for this section of the Atlantic OCS is provided in the *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (MMS, 2007a). Mid-Atlantic Bight hardbottom and soft-bottom demersal fishes, pelagic fishes (i.e., coastal pelagic, epipelagic, and mesopelagic fishes), and ichthyoplankton are discussed in the G&G Final PEIS (BOEM, 2014a). These descriptions of the affected environment for fish are hereby incorporated by reference.

Invertebrates

Several managed invertebrate species occur in the New York Bight and are known to occur or could occur in the WEA, including longfin inshore squid (*Loligo pealeii*), Atlantic sea scallop

(*Placopecten magellanicus*), Atlantic surfclam (*Spisula solidissima*), ocean quahog (*Artica islandica*), horseshoe crabs (*Limulus polyphemus*), and American lobster (*Homarus americanus*). These species are briefly discussed below.

Longfin Inshore Squid

Longfin inshore squid is a pelagic schooling species that occurs from Newfoundland to the Gulf of Venezuela along continental shelf and slope waters. Commercial exploitation occurs from southern Georges Bank to Cape Hatteras, and longfin inshore squid are considered to be a single stock in this range (Jacobson, 2005). Longfin inshore squid eggs are demersal and generally spawned in water depths < 164 ft (50 m) (Lange, 1982), at temperatures of 10 to 23 degrees Celsius (°C), and salinities of 30 to 32 parts per thousand (McMahon and Summers, 1971). Egg clusters are often found attached to rocks and small boulders, on sandy/muddy bottoms, and on aquatic vegetation (Jacobson, 2005). Larvae are pelagic and occur in near surface water at temperatures of 10 to 23 °C and salinities of 31.5 to 34.0 parts per thousand (Vecchione, 1981). Squid shift from inhabiting surface waters to a demersal lifestyle at 1.75 in. (45 millimeters [mm]) mantle length (Vecchione, 1981). The population makes seasonal migrations that appear to be based on water temperatures, moving offshore during late autumn to overwinter in warmer waters along the continental shelf and returning inshore during the spring and early summer to spawn (Black et al., 1987; MAFMC, 1998). Larger individuals (> 7 in. [18 cm] mantle length) migrate inshore during April and May, while smaller individuals (3 to 4 in. [8 to 10 cm] mantle length) move inshore in the summer (Lange, 1982). Longfin squid are known to occur in the WEA (NEFSC, 2011). Squid abundance in the WEA during the NEFSC 1975–2008 bottom trawl surveys ranged from 0 to 1 to 300 squid per tow in the spring and from 301 to 2,500 to 5,001 to 27,589 squid per tow in the fall (NEFSC, 2011). Catch data for NMFS statistical area 612 (New York Bight) for 2000–2014 show most of the squid catch occurs in the summer between June and August. (Source: NMFS NEFSC Vessel Trip Report Records 2000–2014 for Statistical Area 612).

Atlantic Sea Scallop

The Atlantic sea scallop is a bivalve mollusk that ranges from the Strait of Belle Isle, Newfoundland, to Cape Hatteras, NC at depths from the low tide level to approximately the 328 ft (100 m). Sea scallops in the Mid-Atlantic Bight are generally found at depths between 88 to 262 ft (27 to 80 m) (Hart and Chute, 2004). Sea scallop eggs are not buoyant and remain on the seafloor until they develop into free-swimming pelagic larvae (Merrill, 1961; Culliney, 1974; Langton et al., 1987; Hart and Chute, 2004). At the end of the pelagic larval stage, larvae settle on areas of gravelly sand with shell fragments, pebbles, or substrates covered with a biofilm (Culliney, 1974; Parsons et al., 1993; Hart and Chute, 2004). Scallops end their pelagic existence when they enter the pediveliger stage (spat), developing a foot and secreting threads (byssus) which are used to attach to hard surfaces (Merrill, 1961; Culliney, 1974). Juvenile scallops (0.2- to 0.5-inch [5- to 12-mm] shell height) leave the substrate they originally settled on and attach themselves to gravel, small rocks, shells, and branching organisms (Thouzeau et al., 1991; Stokebury and Himelman, 1995; Hart and Chute, 2004). Adult scallops prefer coarse substrate such as gravel, shell, and rocks with some water movement and often occur in dense aggregations called beds (Thouzeau et al., 1991; Hart and Chute, 2004). Atlantic sea scallops occur in the WEA at densities that range from zero to one scallops per station (zero to 0.08 scallops per m^2) to one to four scallops per station (0.08 to 0.31 scallop per m^2) based on observations made during the 2011 School for Marine Science and Technology (SMAST) video survey (Figure 4-15) (Stokesbury et al., 2004; Stokesbury et al., 2015). A density of 0.08 scallops per m^2 is considered to be the minimum commercially viable density (Stokesbury, 2002; Adams et al., 2008).

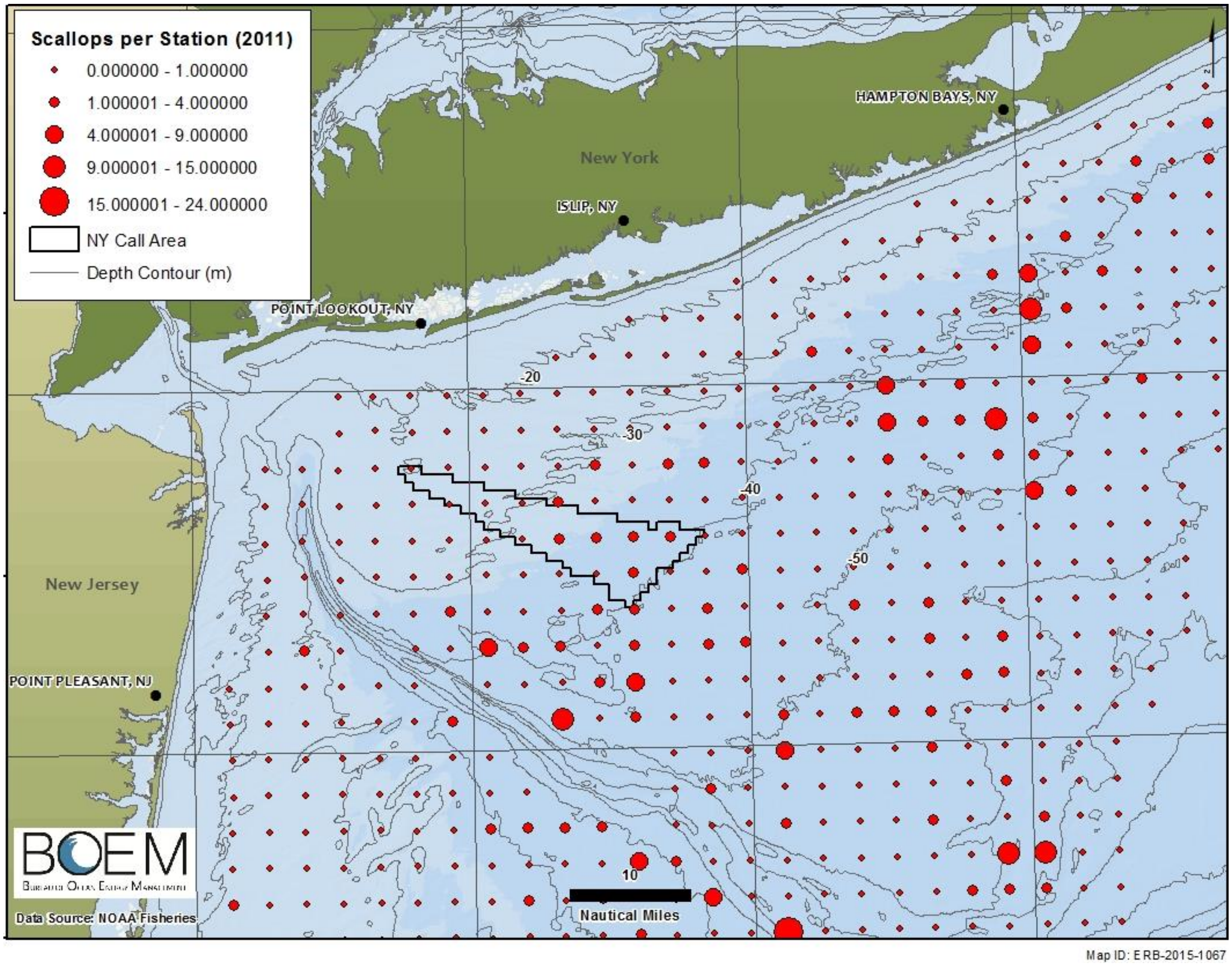


Figure 4-15 Atlantic Sea Scallops Abundance in the New York Bight Recorded during the 2011 SMAST Video Survey.

Note: The sampled bottom area was approximately 12.94 m^2 per station (Stokesbury et al., 2015). The New York WEA is outlined in black.

Atlantic Surfclam

The Atlantic surfclam is a bivalve mollusk that inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, NC (Merrill and Ropes, 1969). Major concentrations of surfclams are found in the United States on Georges Bank, south of Cape Cod, and off Long Island, southern New Jersey, and the Delmarva Peninsula (Merrill and Ropes, 1969; Ropes, 1980). Surfclam eggs and larvae are planktonic and drift with the currents until the larvae metamorphose through several stages into juveniles and settle to the bottom (Ropes, 1980; Loosanoff and Davis, 1963; Ropes, 1980; Fay et al., 1983). Juveniles and adults burrow in medium to coarse sand and gravel, and in silty to fine sand substrates at depths of 26 to 217 ft (8 to 66 m) in the turbulent areas beyond the breaker zone (Fay et al., 1983; Cargnelli et al., 1999a).

Surfclam concentrations in the WEA appear to be moderate or secondary (<1 bushel) concentrations (Ropes, 1980; Fay et al., 1983). The NEFSC 2011 clam dredge survey data showed low catch rates (0 and 1 to 50 clams per tow) of total surfclams and pre-recruits in the WEA (NEFSC, 2013).

Ocean Quahog

Ocean quahog is a long-lived, slow growing bivalve mollusk that inhabits temperate and boreal waters on both sides of the North Atlantic (Cargnelli et al., 1999b). In the western Atlantic it is found on the continental shelf from Newfoundland to Cape Hatteras, NC, with the greatest concentrations occurring south of Nantucket to the Delmarva Peninsula (Merrill and Ropes, 1969; Serchuk et al., 1982). Ocean quahog eggs and larvae are planktonic and drift with the currents until the larvae metamorphose into juveniles and settle to the bottom (Cargnelli et al., 1999b). Juveniles and adults occur in medium to fine sand, sandy mud, and silty sand substrates with temperatures remaining below 20 ºC at depths between 46 to 269 ft (14 to 82 m) (Cargnelli et al., 1999b). Ocean quahog concentrations in the WEA during the NEFSC 2008 clam survey ranged from 1 to 50 to 251 to 750 clams per tow for quahogs greater than 2.75 in. (70 mm) and from 0 to 1 to 50 clams per tow for quahogs less than 2.75 in. (70 mm) (NEFSC, 2009).

Horseshoe Crab

Horseshoe crabs are benthic arthropods that occur in western Atlantic estuaries and on the continental shelf from Maine to the Yucatan peninsula (Shuster, 1982). They are most abundant from New Jersey to Virginia (ASMFC, 1998). Horseshoe crabs are ecological generalists and occur in a wide range of habitats. They are generally found in waters shallower than 66 ft (20 m), although they have been observed 35 mi (56 km) offshore (Botton and Ropes, 1987; ASMFC, 1998). Adult horseshoe crabs in the Mid-Atlantic migrate from deep bay waters and the continental shelf to spawn on sheltered intertidal sandy beaches (Shuster and Botton, 1985). Horseshoe crabs feed on a wide variety of benthic organisms, including mollusks, annelids, arthropods, and nemertean worms (Botton, 1984; Botton and Haskin, 1984).

American Lobster

The American lobster is a commercially important, long-lived, epibenthic crustacean that occurs in the western Atlantic from Labrador to North Carolina from the intertidal zone to 2,362 ft (720 m) (MacKenzie and Moring, 1985). American lobster prefer rocky habitat and sand-mud burrowing areas that provide sheltering habitats. They occur in clay, mud-silt, mud-rock, sand-rock, and rock-bedrock substrates (Cooper and Uzmann, 1980; MacKenzie and Moring, 1985; Lawton and Lavalli, 1995). Inshore lobsters tend to be solitary and territorial with a home range of 0.77 to 3.1 mi^2 (2 to 8 km^2). Large offshore lobsters share shelters and make seasonal migrations inshore to reproduce (MacKenzie and Moring, 1985). Lobster diet is omnivorous consisting of a variety of benthic invertebrates (crabs, bivalves, sea urchins, and polychaetes), fish, and plants (MacKenzie and Moring, 1985). The WEA is located within the NOAA Statistical Area 612 and lobsters in the WEA are managed under the Southern New England stock by NMFS. This stock is currently in a severely depleted condition (ASMFC, 2015). The Southern New England 2011–2012 spring and fall trawl survey data show low catch rates (0 and 1–50 lobsters) in Statistical Area 612, with no large lobster (≥ 5 in. [127 mm]) collected (ASMFC, 2015).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act of 1976, amended in 1996 by the U.S. Congress under the Sustainable Fisheries Act, and reauthorized in 2006, recognized that many fisheries depend on marine, nearshore, and estuarine habitats for at least part of their lifecycles. It introduced requirements to protect estuarine and marine ecosystems through identification and conservation of Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan. NMFS is mandated by the Sustainable Fisheries Act to coordinate with other federal agencies to avoid, minimize, mitigate, or offset adverse effects on EFH that could result from proposed activities. EFH is defined as waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (50 CFR 600.10; 16 U.S.C. 1802(10)). Fish are defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds (NMFS, 2007; 50 CFR 600.10). The EFH procedure involves the identification and designation of Habitat Areas of Particular Concern (HAPC) within fishery management plans. HAPC are discrete subsets of EFH that provided especially important ecological function or are particularly vulnerable to degradation (50 CFR 600.10).

EFH has been designated for 37 species in the WEA (Table 4-14). No HAPC have been designated in the WEA. EFH descriptions for several of the designated species in the WEA are provided in the G&G Final PEIS (BOEM, 2014a) and are hereby incorporated by reference. EFH descriptions for species and life stages that were not discussed in the G&G Final PEIS (BOEM, 2014a) are summarized in Table 4-14.

Impact Analysis of Alternative A

The *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (MMS, 2007a) identified potential impacts to fish resources and EFH that could occur in OCS WEAs in the Atlantic region during site characterization, including G&G surveys; vessel and equipment noise; and meteorological tower/buoy installation, operation, and decommissioning. The potential impacts of renewable energy site characterization on finfish resources and EFH have been analyzed in the G&G Final PEIS (BOEM, 2014a) and are incorporated herein by reference and summarized below. Although the geographic boundary in the G&G Final PEIS is outside of this WEA (it included BOEM's Mid-Atlantic and South Atlantic planning areas: Delaware to Florida), many species occur in both areas, and the conclusions on impact levels are applicable to this EA. The following conclusions for site characterization that were made in the G&G Final PEIS are expected to be the same in the WEA:

- Impacts from acoustic sound sources from HRG surveys and geotechnical exploration are expected to be **negligible**. A boomer sub-bottom profiler is the only sound source expected to produce sounds within finfish and invertebrate hearing ranges (see Table 3-3 in Section 3.2.1.1 *High-Resolution Geophysical Surveys* and Table 4-15 showing acoustic thresholds).
- Impacts from vessel and equipment noise are expected to be **negligible.**
- Impacts from seafloor disturbances are expected to be **negligible.**

Table 4-14
Species and Life Stages with Essential Fish Habitat Designated in the WEA

Species	Life Stages			
	Eggs	**Larvae**	**Juveniles**	**Adults**
New England Species				
Atlantic Cod (*Gadus morhua*) References: Lough, 2004; NEFSC HCD, 2014	Not in AOI	Not in AOI	Not in AOI	Rocky, pebbly, or gravelly bottom substrates at depths from 33 to 492 ft (10 to 150 m) with salinities of 29–34 ppt and temperatures of <10 °C.
Atlantic Sea Herring (*Clupea harengus*) References: Stevenson and Scott, 2005; NEFSC HCD, 2014	Not in AOI	Pelagic estuarine, coastal, and offshore waters from the Bay of Fundy to New Jersey. Larvae occur in very shallow water to 656 ft (200 m), at salinities of 2.5–52.5 ppt, and temperatures of −1.8 to 24 ºC.	Designated*	Designated*
Haddock (*Melanogrammus aeglefinus*) References: Brodziak, 2005; NEFSC HCD, 2014	Not in AOI	Pelagic larvae drift with surface currents at depths of 33 to 164 ft (10 to 50 m) and temperatures between 5 to 9 °C. Larvae occurring in the New York Bight have been swept off Georges Bank.	Not in AOI	Not in AOI
Little Skate (*Leucoraja erinacea*) Reference: Packer et al., 2003a	Insufficient information	Does not apply	Sand, mud, or gravel substrates at depths from 3 to 1,312 ft (1 to 400 m) with salinities of 26–36 ppt, and temperatures of 1–22 °C. Little skate move seasonally onshore and offshore, generally into shallow water during the spring and deeper water in the winter.	
Monkfish (*Lophius americanus*)	Designated*	Designated*	Designated*	Designated*

Species	Life Stages			
	Eggs	Larvae	Juveniles	Adults
Ocean Pout (*Macrozoarces americanus*) References: Steimle et al., 1999a; NEFSC HCD, 2014	Sheltered nests in holes or crevices at depths of < 164 ft (50 m) with salinities 32–34 ppt, and temperatures < 10 °C.	Demersal habitats in close proximity to bottom and nest areas at depths of < 164 ft (50 m) with salinities > 25 ppt and temperatures < 10 °C.	Bottom habitats that provide shelter (rocks, algae, and shells) at depths from 3 to 656 ft (1 to 200 m) with salinities > 25 ppt, and temperatures of 3–14 °C.	Sand, gravel, rough bottom, and other substrates that allow fish to dig depressions at depths of < 1191 ft (363 m), with salinities of 32–34 ppt, and temperatures of 3–14 °C.
Red Hake (*Urophycis chuss*)	Designated*	Designated*	Designated*	
Silver Hake (*Merluccius bilinearis*)	Designated*	Designated*	Designated*	Designated*
Windowpane Flounder (*Scophthalmus aquosus*)	Designated*	Designated*	Designated*	Designated*
Winter Flounder (*Pseudopleuronectes americanus*) References: Pereira et al., 1999; NEFSC HCD, 2014	Demersal eggs spawned on sand, muddy sand, mud, and gravel bottom substrates at depths from 1 to 16 ft (0.3 to 5 m) inshore and < 295 ft (90 m) on Georges Bank at salinities of 10–32 ppt and temperatures of 1–10 °C.	Larvae are found in pelagic and bottom waters over fine sand and gravel, at depths from 3 to 16 ft (1 to 5 m) inshore at salinities of 3.2–30 ppt and temperatures of 2–20.5 °C.	Sand with shell or leaf debris, muddy sand, and mud bottom substrates at depths from 1.6 to 59 ft (0.5 to 18 m) inshore and < 328 ft (100 m) offshore with salinities of 10–33 ppt and temperatures of 2–25 °C.	Sand, mud, gravel, cobble, and boulder bottom substrates at depths from 3 to 98 ft (1 to 30 m) inshore and < 328 ft (100 m) offshore with salinities of 15–33 ppt and temperatures of 1–25 °C.
Winter Skate (*Leucoraja ocellata*) Reference: Packer et al., 2003b	Insufficient information	Does not apply	Sand and gravel bottom substrates at depths from 3 to 1,312 ft (1 to 400 m) with salinities of 20–35 ppt and temperatures of 0–21 °C.	Not in AOI
Witch Flounder (*Glyptocephalus cynoglossus*)	Designated*	Designated*		

Species	Life Stages			
	Eggs	**Larvae**	**Juveniles**	**Adults**
Yellowtail Flounder (*Limanda ferruginea*) References: Johnson et al., 1999; NEFSC HCD, 2014	Pelagic eggs are found in surface waters at depths from 33 to 2,461 ft (10 to 750 m), with salinities of 32.4–33.5 ppt, and temperatures of 2–15 °C.	Pelagic larvae are found in surface waters at depths from 33 to 4,100 ft (10 to 1,250 m) with salinities of 32.4–33.5 ppt and temperatures of 5–17°C.	Sand or sand mud bottom substrates at depths from 29.5 to 942 ft (9.0 to 287 m) with salinities of 32.4–33.5 ppt and temperatures of 2–18°C.	Sand or sand mud bottom substrates at depths from 29.5 to 780 ft (9.0 to 238 m) with salinities of 32.4–33.5 ppt and temperatures of 2–18°C.
Mid-Atlantic Species				
Atlantic Butterfish (*Peprilus triacanthus*)	Designated*	Designated*	Designated*	
Atlantic Mackerel (*Scomber scombrus*)	Designated*	Designated*	Designated*	
Black Sea Bass (*Centropristis striata*)	Insufficient information	Designated*	Designated*	Designated*
Bluefish (*Pomatomus saltatrix*)	Designated*	Designated*	Designated*	Designated*
Longfin Inshore Squid (*Loligo pealeii*)	Designated*	N/A	Designated*	Designated*
Ocean Quahog (*Artica islandica*)	N/A	N/A	Designated*	Designated*
Scup (*Stenotomus chrysops*) References: Steimle et al., 1999b; NEFSC HCD, 2014	Insufficient information	Insufficient information	Sand and mud substrates, and mussel and eel grass beds in estuarine and coastal areas from the intertidal to 125 ft (38 m) at temperatures from 7 to 27 °C.	Designated*
Spiny Dogfish (*Squalus acanthias*)	Does not apply	Does not apply	Designated*	Designated*
Summer Flounder (*Paralichthys dentatus*)	Designated*	Designated*	Designated*	Designated*

Species	Life Stages			
	Eggs	Larvae	Juveniles	Adults
Surfclam (*Spisula solidissima*)	N/A	N/A	Designated*	Designated*
South Atlantic Coastal Migratory Pelagic Species				
Cobia (*Rachycentron canadum*)	Designated*	Designated*	Designated*	Designated*
King Mackerel (*Scomberomorus cavalla*)	Designated*	Designated*	Designated*	Designated*
Spanish Mackerel (*Scomberomorus maculatus*)	Designated*	Designated*	Designated*	Designated*
Highly Migratory Species				
Atlantic Bluefin Tuna (*Thunnus thynnus*)	Not in AOI.	Not in AOI.	Designated*	Not in AOI.
Basking Shark (*Cetorhinus maximus*) References: NMFS, 2006; NMFS, 2009	Does not apply	Not in AOI.	Atlantic east coast from the Gulf of Maine to the northern Outer Banks of North Carolina. Continental shelf in waters 164 to 656 ft (50 to 200 m) deep, where high abundances of zooplankton are created by water column physical conditions.	
Blue Shark (*Prionace glauca*) Reference: NMFS, 2009	Does not apply	Neonate/YOY ≤90 cm total length. Atlantic Ocean areas off of Cape Cod through New Jersey.	91 to 220 cm total length. New England to Cape Hattaras, and localized areas in the Gulf of Maine, off South Carolina and the mid-east coast of Florida.	≥221 cm total length. The Gulf of Maine to South Carolina, and localized areas in the Atlantic off Georgia and Florida. Localized areas off Puerto Rico and the U.S. Virgin Islands.
Common Thresher Shark (*Alopias vulpinus*) Reference: NMFS, 2009	Does not apply	In the Atlantic, from Cape Cod through North Carolina, and localized areas in the Gulf of Maine, South Carolina, Georgia, and off the mid-east coast of Florida. Localized areas off of Puerto Rico.		

Species	Life Stages			
	Eggs	Larvae	Juveniles	Adults
Dusky Shark (*Carcharhinus obscurus*) Reference: NMFS, 2009	Does not apply	Neonate/YOY ≤121 cm total length. Pelagic waters along the Atlantic coast from southern Cape Cod to South Carolina, mid-coast of Georgia to the east coast of Florida.	Pelagic waters in the Atlantic from southern Cape Cod to South Carolina, and the east coast of Florida. Localized areas in the Florida Keys, mid-west coast of Florida, the Florida Panhandle, southern Texas, and central Gulf of Mexico.	
Sand Tiger Shark (*Carcharias taurus*) Reference: NMFS, 2009	Does not apply	Neonate/YOY ≤129 cm total length. Along the Atlantic east coast from Cape Cod to northern Florida.	Not in AOI	Not in AOI
Sandbar Shark (*Carcharhinus plumbeus*) Reference: NMFS, 2009	Does not apply	Neonate/YOY ≤78 cm total length. Long Island, New York to Cape Lookout and localized areas along the Atlantic coast of South Carolina and Georgia.	79 to 190 cm total length. Southern New England to Cape Lookout and localized areas along the Atlantic coast of southern North Carolina South Carolina, and Florida.	≥191 cm total length. Atlantic coastal areas throughout southern New England to Florida. Coastal areas from the Florida Keys to the Florida Panhandle in the Gulf of Mexico, and localized area off of Alabama.
Shortfin Mako Shark (*Isurus oxyrinchus*) Reference: NMFS, 2009	Does not apply	In the Atlantic, localized areas off of Maine, South Carolina, and Florida, and from southern New England though Cape Lookout.		
Skipjack Tuna (*Katsuwonus pelamis*) Reference: NMFS, 2009	Does not apply	Not in AOI	Not in AOI	≥45 cm fork length. Cape Cod to Cape Hatteras and the southern east coast of Florida through the Florida Keys, and localized areas in the Atlantic off of South Carolina and the northern east coast of Florida.

Species	Life Stages			
	Eggs	**Larvae**	**Juveniles**	**Adults**
Tiger Shark (*Galeocerdo cuvieri*) Reference: NMFS, 2009	Does not apply	Not in AOI	205 to 319 cm total length. Atlantic east coast from New England to Florida.	≥ 320 cm total length. Atlantic east coast from southern New England to Florida.
White Shark (*Carcharodon carcharias*) Reference: NMFS, 2009	Does not apply	In the Atlantic, Cape Cod to Maryland, and along North Carolina, South Carolina, and the northern east and mid- coast of Florida.		

AOI = Area of Interest (New York WEA)

Designated* = denotes that EFH has been designated for this life stage in the area of interest. A summarized EFH description is available in the G&G Final PEIS (BOEM, 2014a).

Does not apply = Life stage does not exist for this species.

Insufficient information = there is insufficient data for the life stages listed and no EFH designation has been made as of yet.

N/A = there are no EFH designations for these squid, ocean quahog, or surfclam life stages.

ppt = parts per thousand

YOY = Young-of-the-year

Table 4-15
Pile Driving Sound Exposure Guidelines for Fish[1]

Fish Type	Hearing Detection Type	Mortality and Potential Mortal Injury[2]	Impairment			Behavior Changes[4]
			Recoverable Injury[2],[4]	Temporary Threshold Shift[3],[4]	Masking[4]	
No swim bladder	Particle motion	> 219 dB SEL_{cum} or > 213 dB_{peak}	> 216 dB SEL_{cum} or > 213 dB_{peak}	> 186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder (is not involved in hearing)	Particle motion	210 dB SEL_{cum} or > 207 dB_{peak}	203 dB SEL_{cum} or > 207 dB_{peak}	> 186 dB SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder (is involved in hearing)	Primarily pressure detection	207 dB SEL_{cum} or > 207 dB_{peak}	203 dB SEL_{cum} or > 207 dB_{peak}	186 dB SEL_{cum}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Eggs and larvae	N/A	> 210 dB SEL_{cum} or > 207 dB_{peak}	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low

[1] Data on mortality, recoverable injury, and the relative risk (high, moderate, and low) of masking and behavior changes for fish at three distances (near, intermediate, and far) from a pile driving source without mitigation measures. Adapted from Popper et al. (2014).

[2] Halvorsen et al., 2011, 2012a, 2012b

[3] Popper et al., 2005

[4] Relative terms of distance from source: N = near (tens of meters); I = intermediate (hundreds of meters); F = far (thousands of meters)

dB = decibel
dB_{peak} = peak sound pressure
SEL_{cum} = cumulative sound exposure level

The G&G Final PEIS (BOEM, 2014a) assessment of impacts on fish and EFH from acoustic sound sources, vessel and equipment noise, seafloor disturbance, and discharge of waste materials and accidental fuel releases was for G&G-related site characterization activities only. While the number of vessel trips and area of seafloor disturbance for activities covered in this EA differ from those in the G&G Final PEIS, the overall types of impacts to finfish, shellfish, and EFH would be the same, and the impact levels and conclusions are anticipated to be the same. The following sections discuss the potential impacts on finfish, shellfish, and EFH that could result under the proposed action and were not considered in the G&G Final PEIS analysis. These include impacts from meteorological tower/buoy installation, operation, and decommissioning, including the acoustic effects from pile driving, sedimentation, habitat loss, and changes in species abundance and distribution.

Meteorological Tower/Buoy Installation

Pile Driving Acoustic Effects

The primary factor that could affect finfish and shellfish resources from meteorological tower installation is the underwater noise generated during installation of the piles to support a meteorological tower. Impacts of man-made underwater sound on fishes and invertebrates, such as those generated during pile driving, have been discussed in a number of publications including McCauley et al. (2000), Hastings and Popper (2005), Thomsen et al. (2006), Popper and Hasting (2009), Normandeau Associates (2012), and Popper et al. (2013, 2014). Impact pile driving generates impulsive sounds characterized by a rapid rise time followed by a decay period in a wide range of frequencies (20 Hz to > 20 kHz; Thomsen et al., 2006; Popper et al., 2014). The type and intensity of the sounds produced during pile driving depend on a variety of factors, including the type and size of the pile, the substrate firmness, water depth, and the type and size of the pile driving hammer (Hanson et al., 2003). Major effects on fish from pile driving are behavioral changes (including suspension of feeding behavior), non-auditory tissue damage (e.g., internal hemorrhaging and swim bladder ruptures), auditory tissue damage, and temporary threshold shifts to permanent hearing loss (Hastings and Popper, 2005; CalTrans, 2009). The biology of individual fish species and the physiological state of individual fish may change the characterization and order of effects, as there are substantial differences in how a noise will affect different fish species (Carlson et al., 2007).

Sound detection in fish and invertebrates has been discussed in a number of publications, including Fay (1984), Popper and Fay (1993), Popper et al. (2001), Popper et al. (2003), Popper and Schilt (2008), and Mooney et al. (2010). Hearing thresholds (sensitivity) have been determined for approximately 100 fish species and for a small number of invertebrates (e.g., Mann et al., 2001; Casper et al., 2003; Popper et al., 2003; Nedwell et al., 2004; Pye and Watson, 2004; Lovell et al., 2005; Song et al., 2006; Casper and Mann, 2009; Meyer et al., 2010; Mooney et al., 2010; and Mooney et al., 2012). The G&G Final PEIS (BOEM, 2014a) summarizes fish and invertebrate hearing capabilities and sensitivities, and these are incorporated herein by reference.

Hearing threshold data suggest that most fish species cannot hear sounds above 3,000 to 4,000 Hz, with the majority of fish species being able to detect sound only to 1,000 Hz or below. The data from Lovell et al. (2005) and Meyer et al. (2010) suggest that sturgeons (*Acipenseridae*) have relatively poor sensitivity and can detect frequencies no higher than 800 Hz. A small number of studies on tunas suggest that they can detect frequencies no higher than 1,100 Hz (Song et al., 2006). The few studies on cartilaginous fishes suggest that sharks and skates are not very sensitive to sound and can detect frequencies no higher than 1,000 Hz (Casper et al., 2003; Casper and Mann, 2009). The limited data available on fish larvae suggest that hearing frequency ranges and acoustic startle thresholds of larval fish are similar to those of the adult of the species (Zeddies and Fay, 2005; Wright et al., 2011; Popper et al., 2014). Fish eggs and larvae developing swim bladders may be vulnerable to pile driving-generated vibrations that could result in pressure-related injuries (Popper et al., 2014). The few studies on squid suggest that they can detect particle motion at frequencies between 100 and 300 Hz (Mooney et al., 2010). A study on American lobster suggests that immature lobsters can detect frequencies between 20 and 1,000 Hz, while mature lobsters showed acoustic sensitivity at two distinct ranges of 20 to 300 Hz and 1,000 to 5,000 Hz (Pye and Watson, 2004). Currently no data exist regarding hearing capabilities and sensitivities for bivalves.

Three metrics have been used for evaluating hydroacoustic effects on fish: peak SPL (dB_{peak}), RMS SPL, and SEL. Peak sound pressure represents the maximum point of energy in a signal, while RMS describes the average energy level in the signal. The concern with both of these metrics is that they do not provide a good representation of the total energy in the signal over time, and it is the total energy that is likely to be the critical factor in determining the potential effects on marine organisms. Investigators have recently started to use SEL, which is an index of the total acoustic energy received by an organism, representing the total energy in a signal or sequence of signals. SEL allows different signals to be compared and can be used to estimate the sum of the energy in a sequence of signals. SEL_{cum} is the index of energy in all of the signals presented, accounting for accumulated exposure to repeated sound energy of a repetitive activity (e.g., pile driving) or for continuous activity over a specified time period (Popper et al., 2006; CalTrans, 2009; Popper and Hastings, 2009; BOEM, 2014a).

Established interim noise exposure criteria for the onset of direct physical injury in fish from pile driving activities are discussed in the G&G Final PEIS (BOEM, 2014a) and are incorporated herein by reference. The current interim criteria identified a peak SPL of 206 dB re 1 μPa, or 187 dB accumulated SEL for all listed fish larger than 0.07 ounce (2 grams) and 183 dB accumulated SEL for fish less than 0.07 ounce (2 grams), for the onset of direct physical injury in fish (Popper et al., 2006; Carlson et al., 2007). These criteria are based on sound pressure and SELs; they do not include particle motion. Data that arose concurrently and subsequently to the interim criteria indicate that, at least for cumulative exposure, the set levels are far too low for the onset of physiological effects. Halvorsen et al. (2011) suggest that the onset of physiological response from pile driving sound occurs at least 16 dB above, and probably more than 23 dB above, these interim criteria.

Popper et al. (2014) recently published sound exposure guidelines for pile driving that represent the lowest received level of sound that was found to produce a specified effect on fish based on the currently available data (Table 4-15). Sounds above the guideline levels in Table 4-15 will likely result in the specified effect; higher sound levels are expected to result in greater effects (Popper et al., 2014). Currently, there is insufficient data to establish noise exposure guidelines for any invertebrate species (Hawkins and Popper, 2014).

The use of vibratory hammers (vibratory pile driving) is a recommended conservation measure and best management practice for pile installation in marine fisheries habitat (Hanson et al., 2003; Johnson et al., 2008). Fish consistently display an avoidance response without sound habituation to the continuous sounds produced by vibratory hammers. Limited data are available on the effectiveness of vibratory hammers to reduce noise generated by pile installation. The current data indicate that vibratory hammers usually produce sound levels 10 to 20 dB lower than impact hammer driving (CalTrans, 2009). Research using a continuous wave sound suggests that a 220 dB threshold for accumulated SEL may be an appropriate starting point for determining a vibratory driving threshold, with a suggested final threshold ranging from 187 to 220 dB (Popper et al., 2006; Caltrans, 2009). No criteria for injury to fish or effects to fish behavior from vibratory pile driving have been established.

Modeled estimates of underwater noise levels for pile driving during meteorological tower installation vary, ranging from 185 dB re 1 µPa to 200 dB re 1 µPa RMS, with noise levels dissipating to below 180 dB re 1 µPa RMS at a distance of 1,640 to 3,281 ft (500 to 1,000 m) from the source and below 160 dB re 1 µPa RMS within 2.1 to 4.5 mi (3.4 to 7.2 km, NMFS, 2013a). Unmitigated meteorological tower installation noise is expected to disturb normal fish behavior; mask biologically important sounds; and cause temporary hearing threshold shifts, injuries, and mortality if fish are present within the construction area during pile driving activities.

The SOCs required by BOEM (Appendix B, Section B.4.) that are intended to reduce the potential for adverse impacts to marine mammals and sea turtles are expected to also benefit fish. With the "soft start" procedure for pile driving, it is anticipated that the majority of fish would flee the area during the tower installation period and return to the area and resume normal activity after construction. Fish that do not flee the area during pile driving could be exposed to noise levels that result in temporary hearing threshold shifts, injuries, or mortality. Thus, the noise associated with pile driving would cause avoidance or other adverse effects resulting in **minor** impacts to adult finfish. Demersal eggs and larvae may also be vulnerable to pile driving-generated vibrations (Popper et al., 2014), and could experience some adverse effects near pile installation resulting in **minor** impacts finfish populations. Underwater noise impacts (from all sources) to finfish and shellfish populations and EFH are expected to be **negligible** to **minor**.

Suspended Sediments

Installation of piles or anchor systems associated with a tower and/or buoys may cause an increase in local suspended sediments. These impacts would be limited to the immediate area surrounding the piles or anchors and of short duration. Depending on the currents, the suspended sediment is expected to disperse and settle on the surrounding seafloor, potentially coating or burying some benthic organisms. Effects on finfish and shellfish populations, and EFH from suspended sediments would be **negligible** because these activities would be localized and of short duration.

Habitat Loss

The installation of a meteorological tower foundation and/or buoy anchor systems and associated scour control systems may result in the direct mortality of benthic invertebrates, the loss of benthic habitat, and the displacement of water column (pelagic) habitat. Sessile marine invertebrates, including molluscan shellfish, would be lost (buried or crushed) in the footprint (200 ft^2 to 2 ac [19 m^2 to 0.8 ha]) of the tower foundations/moorings and scour control systems. Although sea scallops are mobile molluscan shellfish (Hart and Chute, 2004), it is a conservative assumption that they would not be able to avoid sudden deployment of an anchor or foundation/mooring system, and for these analyses are considered to be sessile. The amount of habitat temporarily displaced or lost in the area is small compared to the amount of habitat available in the surrounding area. Fish and mobile invertebrates are expected to move to the surrounding areas during installation activities and bottom recovery period. Meteorological tower foundations and moorings will adversely affect EFH; however, these structures have a small footprint, and are not expected to significantly affect the quality or quantity of EFH in the WEA. Impacts from habitat loss due to meteorological tower foundations and/or buoy anchor systems installation on finfish, shellfish, and EFH are expected to be **negligible**.

Meteorological Tower/Buoy Operations

Meteorological tower foundations and large anchoring systems installed on soft substrates would introduce hard substrate to these areas that could be colonized by benthic invertebrates. Fish species that prefer hardbottom or complex habitats would likely be attracted to the foundations or anchoring systems, potentially increasing local fish abundance. Pelagic fish may be attracted to the habitat created in the water column by the foundations and anchoring systems. Changes in species composition and community assemblage is expected only at the foundations or anchoring systems, and as a result, effects on finfish and shellfish populations and EFH are expected to be **negligible**.

Meteorological Tower/Buoy Decommissioning

A meteorological tower foundation pile would be removed by cutting the pile 13 to 16 ft (4 to 5 m) below the substrate surface using a common non-explosive severing method. Pile removal is expected to generate localized increases in noise and suspended sediment. The increase in noise levels produced by pile cutting is expected to be below the sound levels produced during pile installation. Fish and mobile invertebrates would most likely leave the area in the immediate vicinity of the pile being cut to a surrounding area and return once the activity has ceased. Increases in suspended sediments could reduce the ability of some fish to forage, while some species would benefit from opportunistic foraging. These effects are anticipated to be restricted to the immediate vicinity of the pile or anchor system and would be of short duration. The effects of decommissioning activities are expected to be **negligible** to finfish and shellfish populations, and EFH.

Non-Routine Events

Collisions/allisions are considered unlikely, as discussed in Section 3.3.2 *Allisions and Collisions*; accidental fuel spills that could occur if such an event were to happen are expected to be small (88 gallons [333 liters]) (see Section 3.3.3 *Spills*). Accidental fuel spills and the effects on finfish and EFH were analyzed in the *PEIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement* (MMS, 2007a) and G&G Final PEIS (BOEM, 2014a) and are incorporated herein by reference.

The meteorological tower or buoys could attract fish, resulting in an increase in recreational fishing in the area, which would increase the potential for collisions between recreational fishing vessels that could result in an accidental release of fuel. Storms may also contribute to collision and allision occurrences that could result in a fuel spill. Diesel fuel is a light refined petroleum product, and released fuel would dissipate quickly in the water column and evaporate within a few days. Pelagic fish and invertebrate eggs and larvae near the surface in the water column could be negatively impacted by a fuel spill; however, the impacts to fish and invertebrate populations would not be significant because of the small affected area and short duration of persistence. Overall, the impacts to finfish and shellfish populations, and EFH resulting from accidental fuel spills from collisions/allisions, should they occur, are expected to be minimal and temporary, and therefore **minor**.

Conclusion

Overall, impacts from site characterization and site assessment activities to finfish and shellfish populations and EFH in the WEA would be **minor.** However, impacts would range from **negligible** to **minor** depending on the activity.

A meteorological tower foundation and/or buoy anchor systems installation and decommissioning would produce noise that could disturb normal fish behaviors. Fish are expected to avoid or flee from the noise source. Fish that do not flee the immediate action area during pile driving could be exposed to injurious or lethal noise levels that may result in adverse effects. The short duration (4 to 8 hours per day over 3 days) and the use of mitigation measures required by the SOCs (Appendix B) would minimize the possible exposure to injurious and lethal noise levels, resulting in **minor** effects to finfish and shellfish populations, and EFH. The increases in suspended sediments, loss of benthic habitat, and displacement or alteration of water column habitat due to meteorological tower installation, operation, and decommissioning and/or installation and operation of buoy anchor systems are expected to be small compared to the available habitat in the surrounding areas, and would therefore result in **negligible** effects to finfish and shellfish populations, and EFH. The potential increase in vessel collisions and allisions that could result in accidental fuel spills due to a meteorological tower and/or buoys is expected to be minimal. The overall impact on finfish and shellfish populations and EFH from a fuel spill that could result from such an occurrence is expected to be minimal and temporary, and would therefore be considered **minor**.

4.4.2.8 ESA-Listed Fish Species

A federally endangered anadromous fish, Atlantic Sturgeon, and three federally designated Species of Concern, Bluefin Tuna, Dusky Shark, and Sand Tiger Shark, could occur in the WEA. These species are discussed below. Atlantic Sturgeon life history and DPS have been previously summarized in the Atlantic OCS WEAs Biological Opinion (NMFS, 2013a) and are hereby incorporated by reference.

Atlantic Sturgeon

Atlantic Sturgeon is a long-lived, late maturing, estuarine dependent, anadromous fish that ranges from Labrador to northern Florida (Collette and Klein-MacPhee, 2002; ASSRT, 2007). Thirty-five rivers have been confirmed to have had a historical spawning population; currently 32 rivers contain Atlantic Sturgeon, with at least 20 having a spawning population. Many of these stocks are at historic lows (ASSRT, 2007). On February 6, 2012, NMFS listed five DPS of Atlantic Sturgeon under the ESA: the New York Bight, Chesapeake Bay, Carolina, and South Atlantic populations were listed as endangered, while the Gulf of Maine population was listed as threatened (77 FR 5880; 77 FR 5914). The Hudson River contains one of the two spawning subpopulations found in the New York Bight DPS and enters the Atlantic Ocean approximately

23 nm (43 km) northwest of the WEA. The Hudson River currently supports the largest subpopulation of spawning adults (approximately 850 individuals) in the United States (ASSRT, 2007). Atlantic Sturgeon have been documented in the vicinity of the WEA in commercial fisheries bycatch, New York bottom trawl sub-adult Atlantic Sturgeon surveys, and a variety of tagging studies (Stein et al., 2004a; Stein et al., 2004b; Dunton et al., 2010; Erickson et al., 2011; Damon-Randall et al., 2013; Dunton et al., 2015; Wirgin et al., 2015). The New York bottom trawl surveys from 2005 through 2007 captured a total of 149 Atlantic Sturgeon in 512 bottom trawls (0.291 fish per tow), and all captures occurred in depths of less than 66 ft (20 m) (Dunton et al., 2010). Atlantic Sturgeon were collected within all months sampled with the highest catch per unit effort occurring during the fall months (0.35 fish per tow), followed by the spring (0.33 fish per tow), summer (0.26 fish per tow), and winter (0.07 fish per tow) (Dunton et al., 2010). DNA analysis indicated that Atlantic Sturgeon collected in the vicinity of the WEA by the Northeast Fisheries Observer Program during March 2009 through February 2012 originated from four different DPS: the Gulf of Maine, New York Bight, Chesapeake Bay, and South Atlantic (Damon-Randall et al., 2013; Wirgin et al., 2015). Atlantic Sturgeon may use the WEA as overwintering and foraging areas.

Atlantic Sturgeon use a wide variety of habitats. They require silt-free hardbottom substrates such as gradient boulder, bedrock, cobble-gravel, and coarse sand in freshwater rivers to spawn adhesive eggs (Greene et al., 2009). Eggs hatch in 94 to 140 hours at water temperatures of 15.0 to 24.5 °C. Larvae remain in deep river channels near spawning habitat upstream of the salt front. Juvenile sturgeon are found over sand, mud, cobble, rocks, and transitional substrates and remain in their natal estuary for 1 to 6 years before emigrating out of their natal estuarine habitats to coastal waters in fall and early winter (Dovel and Berggren, 1983; Smith, 1985; Greene et al., 2009). Sub-adult Atlantic Sturgeon can migrate long distances in the marine environment to other estuaries. Sub-adult and non-spawning adult Atlantic Sturgeon have been documented in nearshore Atlantic coastal shelf areas with moderately shallow (23 to 164 ft [7 to 50 m]) sand and gravel habitats (Stein et al., 2004a; Laney et al., 2007; Greene et al., 2009; Dunton et al., 2010). Atlantic Sturgeon aggregate in areas off southwest Long Island, along the New Jersey coast, near Delaware Bay, off Chesapeake Bay, and Cape Hatteras (Stein et al., 2004a; Stein et al., 2004b; Dunton et al., 2010; Erickson et al., 2011; Damon-Randall et al., 2013). Seasonal depth distribution patterns were observed in these studies, with sturgeon occupying the deepest waters during the winter and the shallowest waters during summer and early fall (Dunton et al., 2010; Erickson et al., 2011; Damon-Randall et al., 2013). The lowest numbers of Atlantic Sturgeon caught in coastal shelf areas occur during the summer (Dunton et al., 2010). Adult Atlantic Sturgeon make seasonal migrations in late winter to early summer to freshwater spawning habitats (Stein et al., 2004b). Following spawning, adults use marine waters either year-round or seasonally (Bain, 1997). Atlantic Sturgeon appear to undergo large-scale southerly fall migrations and northerly spring migrations (Dovel and Berggren, 1983; Dunton et al., 2010). Sturgeon use marine habitat for foraging before returning to natal rivers to spawn (Dunton et al., 2010). Diet prey items include polychaetes, amphipods, isopods, decapods, mollusks, and sand lance (*Ammodytes* spp.) (Scott and Scott, 1988; Johnson et al., 1997). Critical habitat has not been designated for any of the Atlantic Sturgeon DPS.

Bluefin Tuna

Bluefin Tuna is a large, epipelagic, highly migratory, piscivorous species that inhabits the warmer parts of the North Atlantic and its adjacent seas, particularly the Gulf of Mexico and

Mediterranean Sea. In the western North Atlantic, Bluefin Tuna range from 55°N to 0° latitude and are considered a single stock (NMFS, 2009). Bluefin Tuna seasonally migrate from spawning grounds in the Gulf of Mexico through the Straits of Florida to foraging grounds along the northeast U.S. coast. The species displays strong homing behavior and spawning site fidelity. Bluefin Tuna prey items include squid, sand lances, herring, and mackerels (Chase, 2002). NMFS received a petition to list the species under the ESA in 2010. However, it was determined that the species did not warrant listing under the ESA in 2011 because of remaining uncertainties regarding the effects of the Deepwater Horizon oil spill and overfishing. The species was listed as a Species of Concern in the Western Atlantic, Eastern Atlantic, and Mediterranean Sea (NMFS, 2011a). Bluefin Tuna may use the waters of the WEA as a foraging ground.

Dusky Shark

Dusky Sharks have a worldwide distribution in warm temperate and tropical waters from the surf zone to offshore at depths from 0 to 1,312 ft (0 to 400 m) (Compagno, 1984a). They occur in the western Atlantic from southern Massachusetts and Georges Bank to the Caribbean, and the northern Gulf of Mexico to southern Brazil (Collette and Klein-MacPhee, 2002; Compagno, 1984a). Dusky Sharks undergo seasonal temperature-related migrations northward in the summer and southward in the fall. This species is an apex predator and preys on squid, decapods, and fishes (Bowman et al., 2000). The species was listed as a Species of Concern in the Western Atlantic, Gulf of Mexico, and South Atlantic in 1997 (NMFS, 2011b). Commercial and recreational harvest was prohibited in 2000; however, this species is still routinely caught as bycatch in longline gears targeting tunas, groupers, and snappers. Dusky Sharks are vulnerable to overfishing due to slow growth rate, late maturity, and low reproduction rate (NMFS, 2011b). A status review was conducted in 2014, and it was determined that listing under the ESA was not warranted at that time (79 FR 74684). Dusky Sharks may use the waters of the WEA as a foraging ground.

Sand Tiger Shark

Sand Tiger Sharks are a large, coastal species found in tropical and warm temperate waters throughout the world. They occur along the U.S. Atlantic coast from the Gulf of Maine to Florida and throughout the northern Gulf of Mexico from the surf zone, shallow bays, and reefs to 627 ft (191 m) on the outer shelves (Compagno, 1984b). This species feeds on a variety of fishes, including herrings, croakers, bluefishes, bonitos, butterfishes, hakes, wrasses, sea robins, snappers, sea basses, skates, and small sharks (Compagno, 1984b; Bowman et al., 2000). Sand Tiger Sharks were designated a Species of Concern in the Western Atlantic in 2004. U.S. fishermen have been prohibited from harvesting this species since 1997; however, it is still caught as bycatch in a variety of fishing gears. This species is susceptible to overfishing as a result of its mating aggregations, slow growth rate, late maturity, and low fecundity (NMFS, 2010). Sand Tiger Sharks may use the waters of the WEA as a foraging ground.

Impact Analysis of Alternative A

The potential impacts associated with renewable energy site characterization activities, including G&G surveys; meteorological tower/buoy installation, operation, and decommissioning; and non-routine events on ESA-listed Atlantic Sturgeon have been previously analyzed in the G&G Final PEIS (BOEM, 2014a), the *Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer*

Continental Shelf Offshore Massachusetts (BOEM, 2014b), and the *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts* (BOEM, 2013a). Consultations pursuant to Section 7 (a)(2) of the ESA for site assessment and site characterization activities offshore Massachusetts, Rhode Island, New York, and New Jersey are covered in the Atlantic OCS WEAs Biological Opinion (NMFS, 2013a). These EAs and ESA assessments are hereby incorporated by reference and relevant information is summarized below. These documents concluded the following for ESA-listed Atlantic Sturgeon:

- Impacts from acoustic sound sources from HRG surveys and geotechnical exploration are expected to be **minor**. A boomer sub-bottom profiler is the only source expected to be produce sound within the hearing range of Atlantic Sturgeon (Table 4-16). Atlantic Sturgeon are expected to avoid HRG sources, any avoidance or disruptions to behavior are expected to be temporary.
- Impacts from vessel and equipment noise are expected to be **negligible**.
- Impacts from vessel traffic are expected to be **negligible**.
- Impacts from seafloor disturbances associated with bottom sampling and bottom-anchored monitoring buoys are expected to be **negligible**.

Table 4-16
Summary of Peak Source Levels for HRG Survey Activities and Operating Frequencies within Cetacean, Sea Turtle and Atlantic Sturgeon Hearing Range (from NMFS, 2013a).

Source	Pulse Length	Broadband Source Level (dB re 1 µPa at 1 m)	Operating Frequencies	Within Hearing Range		
				Cetaceans	Sea Turtles	Atlantic Sturgeon
Boomer	180 µs	212	200 Hz – 16 kHz	Yes	Yes	Yes
Side-scan sonar	20 ms	226	100 kHz	Yes	No	No
			400 kHz	No	No	No
Chirp sub-bottom Profiler	64 ms	222	3.5 kHz	Yes	No	No
			12 kHz	Yes	No	No
			200 kHz	No	No	No
Multi-beam depth sounder	225 µs	213.0	240 kHz	No	No	No

µPa = micropascal kHz = kilohertz
µs = microsecond ms = millisecond
dB = decibel Hz = hertz

The conclusions of the Atlantic OCS WEAs Biological Opinion (NMFS, 2013a) stated that impacts for site characterization (G&G surveys) *may affect, but are not likely to adversely affect* the ESA-listed Atlantic Sturgeon since effects are expected to be extremely unlikely or insignificant. These impacts would not likely jeopardize the continued existence of Atlantic Sturgeon.

Atlantic Sturgeon have been documented in the vicinity of the WEA in all months, with the highest occurrence during the fall. NMFS has generally recommended 150 dB RMS as the threshold for behavioral effects to ESA-listed fish species when evaluating pile installations, citing behavioral changes (startle and stress) that could alter forage areas, migration routes, and predator avoidance (CalTrans, 2009). The current noise exposure criteria for physiological effects to Atlantic Sturgeon are 206 dB_{peak} and 187 dB SEL_{cum}. Modeled estimates of underwater noise levels for pile driving during meteorological tower installation ranged from 185 dB re 1 μPa to 200 dB re 1 μPa RMS at the source (NMFS, 2013a). Meteorological tower installation noise could disturb normal behaviors (e.g., foraging and migration), mask biologically important sounds, cause temporary hearing threshold shifts, and cause injuries if an ESA-listed fish is present in the installation area during pile driving activities.

The "soft start" procedure for pile driving, which is an SOC required by BOEM (see Appendix B), would minimize the possibility of exposure to injurious sound levels to a ESA-listed fish by prompting any fish to leave the area prior to exposure to stressful or injurious sound levels. Pile driving activities would be limited to the time necessary to drive the piles for each tower (approximately 4 to 8 hours per day over 3 days). Fish are expected to return to the area once pile driving activities are completed. Additionally, pile driving activities would be prohibited from November 1 through April 30 for the protection of marine mammals (see Section 4.4.2.5 *Marine Mammals*), thus limiting the potential underwater noise exposure when Atlantic Sturgeon are most likely to occur in the action area. While the movements of an individual Atlantic Sturgeon may be temporarily disrupted, major shifts in habitat use, distribution, and foraging success are not expected. Injury or mortality to any Atlantic Sturgeon as a result of pile driving for meteorological tower installation is not anticipated. Pile driving which is required for meteorological tower installation could result in **minor** effects to Atlantic Sturgeon.

Atlantic Sturgeon could potentially be affected by habitat loss (foraging areas), suspended sediments, changes in prey abundance and distribution, and tower decommissioning. The installation of meteorological tower foundations and/or buoy anchor systems and the placement of associated scour control systems could result in increased suspended sediments in the immediate vicinity of the action, the direct morality of benthic invertebrates, and the loss of benthic forage habitat in a small (200 ft^2 to 2 ac [19 m^2 to 0.8 ha]) area. The disturbance and loss of this habitat is not likely to have measurable effects on the foraging activity or migrating behavior of Atlantic Sturgeon, therefore suspended sediments and loss of benthic habitat due to meteorological tower foundation and/or buoy anchor system installation are expected to be **negligible**.

Non routine events, such as collisions/allisions as discussed in Section 3.3.2 *Allisions and Collisions*, are considered unlikely. The accidental fuel spills that could occur if such an event were to happen are expected to be small (88 gallons [333 liters]) (see Section 3.3.3 *Spills*). The effects of accidental fuel spills on Atlantic Sturgeon were analyzed in the G&G Final PEIS (BOEM, 2014a) and the Section 7 (a)(2) consultation documents of the Atlantic OCS WEAs

Biological Opinion (NMFS, 2013a); these documents concluded that impacts from accidental fuel releases on these two ESA-listed species are expected to be **negligible**.

The impacts on Bluefin Tuna, Dusky Shark, and Sand Tiger Shark, all designated as federal species of concern, from meteorological tower/buoy installation, operation, and decommissioning, including the acoustic effects from pile driving, suspended sediments, habitat loss, and changes in species abundance and distribution are expected to be the same as other non-listed fish species, as described in Section 4.4.2.7 *Finfish, Invertebrates, and Essential Fish Habitat* above. The underwater noise generated by tower installation may result in temporary displacement and other behavioral changes, masking of important biological sounds, and temporary hearing threshold shifts. The SOCs required by BOEM (see Appendix B), including a "soft start" procedure for pile driving, would minimize the possibility of exposure to injurious sound levels to Bluefin Tuna, Dusky Shark, and Sand Tiger Shark. Underwater noise impacts (from all sources) are expected to be **negligible** for these three federal species of concern.

Conclusion

Overall, impacts on ESA-listed fish as a result of the proposed action would be **minor**. In several relevant NEPA documents and ESA consultations,[16] BOEM has determined that impacts on ESA-listed fish from site characterization would be **minor**. Installation of a meteorological tower would require pile driving, which could result in **minor** effects to Atlantic Sturgeon. If a lessee proposes pile driving in a SAP, BOEM would initiate ESA Section 7 consultation with NMFS.

4.4.2.9 Military Use and Navigation/Vessel Traffic

Description of the Affected Environment

This section describes military uses in the vicinity of the WEA. Military activities can include various vessel training exercises, submarine and antisubmarine training, and U.S. Air Force exercises. The U.S. Navy, U.S. Army, USCG, and U.S. Air Force have major and minor military installations located along the coasts of New York and New Jersey (Table 4-17).

Vessels and aircraft that conduct operations incompatible with commercial or recreational transportation are typically confined to Military Operating Areas (OPAREAs) away from commercially used waterways and inside Special Use Airspace. Hazardous operations are communicated to all vessels and operators by the USCG (via Notices to Mariners) and the FAA (via Notices to Airmen). The WEA falls into an area assessed by DOD for offshore wind mission compatibility, and would require site-specific stipulations regarding the installation of meteorological structures (Figure 4-16). There are also Danger Zones (used for military operations and may be closed to the public) and Restricted Areas (limited public access) within coastal and marine waters, as outlined in CFR and on Raster Navigational Charts (NOAA OCS, 2015). As shown on Figure 4-16, no Danger Zones or Restricted Areas occur in the WEA, although there is a Restricted Area/Danger Zone west of the WEA. The USCG has two Weapons

[16] G&G Final PEIS (BOEM, 2014a), BA (BOEM, 2012d), G&G Biological Opinion (NMFS, 2013b), and Atlantic OCS WEAs Biological Opinion (NMFS, 2013a)

Table 4-17
List of Military Installations Located along the Coast of New York and New Jersey

Military Installation	Location	Department
Fort Hamilton Army Base	Brooklyn, NY	U.S. Army
Station New York	Staten Island, NY	USCG
Station Jones Beach	Freeport, NY	USCG
Station Fire Island	Babylon, NY	USCG
Station Shinnecock	Hampton Bays, NY	USCG
Station Montauk	Montauk, NY	USCG
Station Sandy Hook	Highlands, NJ	USCG
Station Manasquan Inlet	Point Pleasant, NJ	USCG
NWS Earle Navy Base	Colts Neck, NJ	U.S. Navy
McGuire AFB	New Hanover, NJ	U.S. Air Force
Fort Dix Army Base	Burlington, NJ	U.S. Army
NAES Lakehurst Navy Base	Lakehurst, NJ	U.S. Navy

Sources: U.S. Military Bases, 2015; USCG, 2015b; USCG, 2015c

AFB = Air Force Base
NAES = Naval Air Engineering Station
NWS = Naval Weapons Station

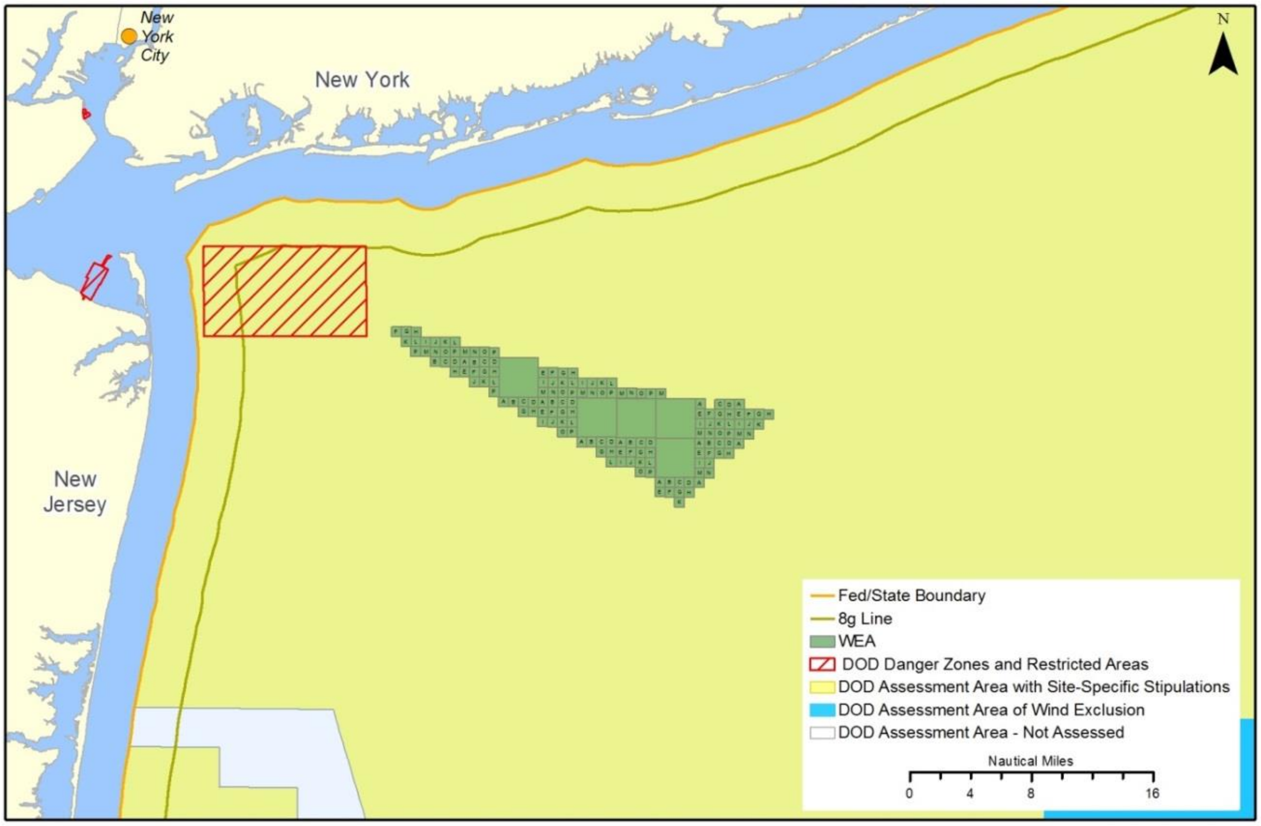


Figure 4-16 DOD Offshore Wind Mission Compatibility Assessment for Vicinity of the WEA

Training Areas offshore New York (not shown on Figure 4-16), which the USCG uses for proficiency training in law enforcement operations (USCG, 2013). One of these Weapons Training Areas covers a large portion of the WEA.

Impact Analysis of Alternative A

Vessels associated with the proposed action could interact with military aircraft and military vessels during site characterization and site assessment. Potential use conflicts with military OPAREAs, danger zones, restricted areas, and the USCG Weapons Training Area that overlaps the WEA are expected to be avoided by coordinating with military commanders and the USCG prior to surveys. All authorizations for permitted site characterization and assessment activities would include guidance for military coordination with the relevant agency. Vessel and aircraft operators would be required to establish and maintain early contact and coordination with the appropriate military command headquarters or point of contact. Military activities have the potential to create temporary space-use conflicts on the OCS. Section 2.1.2.5 of the G&G Final PEIS (BOEM, 2014a) includes guidance for military coordination and is incorporated herein by reference. Although the G&G Final PEIS does not address the New York WEA specifically, the coordination procedures would be the same.

On April 3, 2012, the DOD Office of the Secretary of Defense presented an assessment of offshore military activities and wind energy development on the OCS offshore New York to the Task Force. The DOD has identified three categories of wind energy development areas: wind exclusion areas where wind energy development would be incompatible with existing military uses, areas with site-specific stipulations, and areas with no restrictions. The entire WEA falls within a DOD-designated area of site-specific stipulations.

To avoid or minimize potential conflicts with existing DOD activities, site-specific stipulations may be necessary for all OCS blocks within the WEA. Such stipulations may include a hold-and-save-harmless agreement where the lessee assumes all risks of damage or injury to persons or property if such injury or damage to persons or property occurs by reason of the activities of the United States, and/or a requirement that, when requested by the DOD, the lessee controls its own electromagnetic emissions and those of its agents, employees, invitees, independent contractors, or subcontractors when operating in specified DOD OPAREAs or warning areas.

Other examples of site-specific stipulations that may be required include the lessee entering into an agreement with the appropriate DOD commander when operating vessels or aircraft in a designated OPAREA or warning area, requiring that these vessel and aircraft movements be coordinated with the appropriate DOD commander, and/or a stipulation that DOD can request temporary suspension of operations or require evacuation on the lease in the interest of safety or national security. With implementation of DOD stipulations, impacts on military use are expected to be **negligible**.

Conclusion

Because site-specific coordination would be required to minimize multiple use conflicts on the OCS in and around the WEA, impacts on military use from the placement of a meteorological tower and/or buoys are expected to be **negligible**.

4.4.2.10 Navigation/Vessel Traffic

Description of the Affected Environment

This section describes navigation/vessel traffic in the vicinity of the WEA. Vessel traffic in the vicinity of the WEA is supported by a network of navigation features, including TSSs[17] (i.e., shipping lanes) and navigational aids. There are three TSSs leading to/from New York Harbor, each with two traffic lanes (one for inbound and one for outbound): 1) a west-east corridor off the southern coast of Long Island that includes the Ambrose to Nantucket and Nantucket to Ambrose navigation lanes; 2) a north-south corridor that includes the Ambrose to Barnegat and Barnegat to Ambrose navigation lanes; and 3) a northwest-southeast corridor that includes the Ambrose to Hudson Canyon and Hudson Canyon to Ambrose navigation lanes (Figure 4-17). The WEA lies between the Ambrose to Nantucket and the Hudson Canyon to Ambrose navigation lanes.

The Port of New York and New Jersey, which comprises five marine terminals and ports in the Upper New York Bay area, is the largest port on the East Coast and the third largest port in the United States (Port Authority of New York and New Jersey, 2015). As noted in Section 3.2.3 *Port Facilities*, BOEM has identified several ports along the New York and New Jersey coast that vessels associated with the proposed action could be used for staging and for surveying and operations and maintenance activities. Vessels using the ports and navigation routes in the vicinity of the WEA include cargo ships, such as tankers, bulk carriers, and tug and barge units (which almost exclusively stay in the TSSs); passenger ferries; naval vessels; government research, enforcement, and search and rescue vessels; pilot boats; and fishing and recreational crafts.

The USCG requires all vessels with a gross tonnage of 300 tons or more and all passenger ships with a gross tonnage over 150 tons, to carry AIS equipment to identify, locate, and electronically exchange information with other nearby ships (USCG Navigation Center, 2015). Figure 4-17 shows the vessel traffic density analyzed from a year of AIS data (2013). Vessel traffic is concentrated in the TSSs and along a corridor running parallel to the New Jersey coast within approximately 5 nm (9.3 km) of the shoreline.

Maritime commercial ship traffic is an important component of U.S. commerce. According to the U.S. Department of Transportation Maritime Administration (MARAD), during 2013, the Port of New York and New Jersey received approximately 285 million tons of U.S./foreign containers, equaling approximately 5,500 vessel calls (MARAD, 2013). Smaller ports generally include marinas and mostly support commercial fishing and recreational boating vessels with little to no freight traffic.

[17] TSSs are established in busy shipping areas where a lack of traffic regulation may result in accidents. TSSs are overseen by the International Maritime Organization. Within a TSS, there is typically at least one traffic lane in each direction, turning points, deep-water lanes, and separation zones between the main traffic lanes (IMO, 2015).

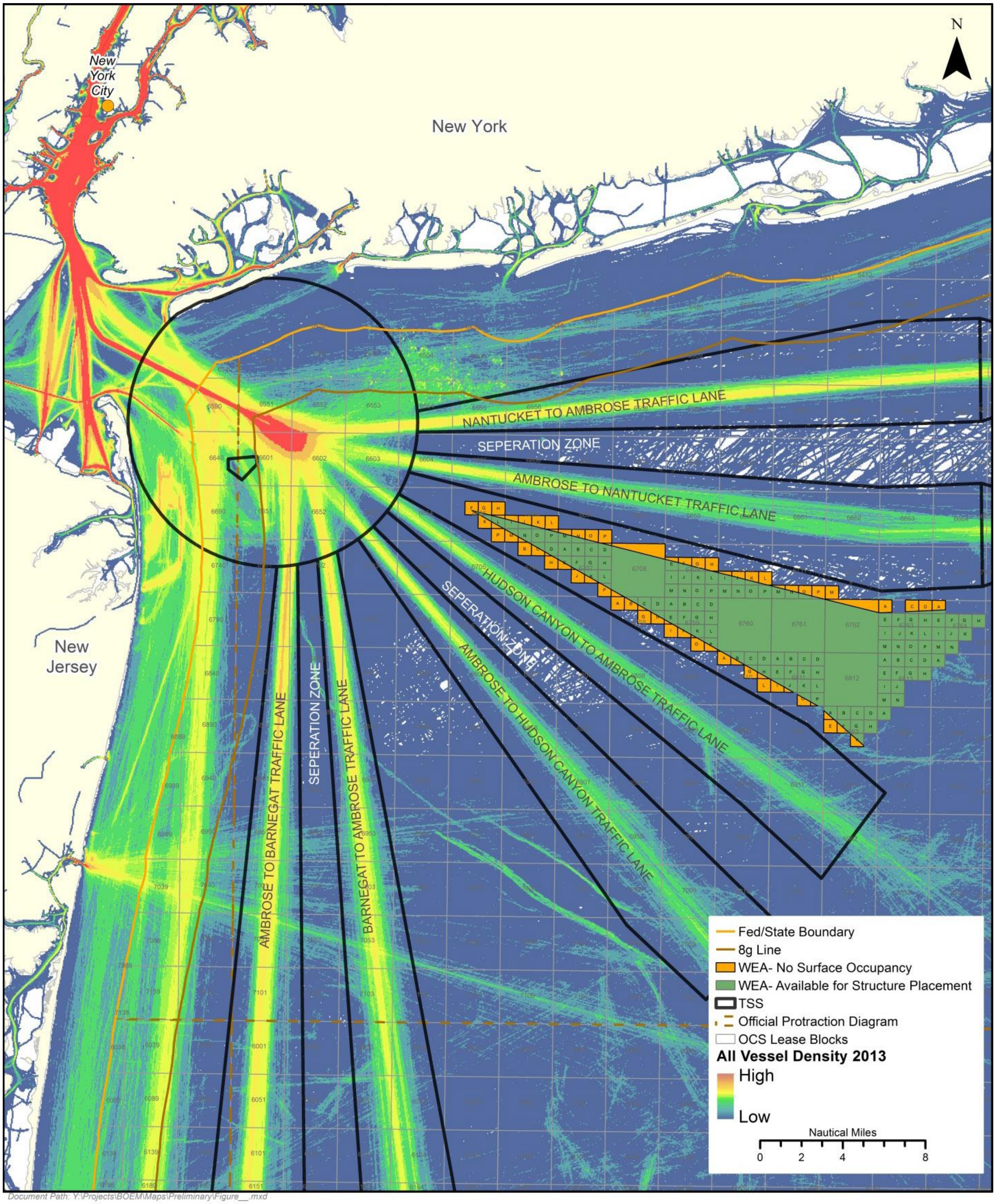


Figure 4-17 Vessel Density and TSSs in the Vicinity of the WEA

Impact Analysis of Alternative A

Routine activities (site characterization and assessment) and non-routine events associated with Alternative A have the potential to directly affect coastal and offshore vessel traffic.

Routine Activities

Increased vessel traffic associated with site characterization surveys and the construction, operation, and decommissioning of a meteorological tower and/or buoys would be anticipated as a result of Alternative A. BOEM estimates that the number of vessel round trips from routine activities would range from approximately 350 to 1,000 (Table 3-10, Section 3.2.4 *Vessel Traffic*). The vessel traffic anticipated as a result of Alternative A would add to the existing vessel traffic in the WEA, as well as between the WEA and shore.

Exclusion zones are typically established around large and/or slow work-related vessels (referred to as "source vessels"; e.g., barges and tow vessels) to maintain safe passage of the source vessel and by keeping it clear of other vessel traffic. The size of the vessel exclusion zone would vary. Exclusion zones around source vessels are temporary, but the approximate length of time that any particular point would be within the vessel exclusion zone would be about 1 hour (BOEM, 2014a). Temporary exclusion zones would also be established around the meteorological tower and buoys. The North Carolina EA (BOEM, 2015a) describes a typical vessel exclusion zone for a meteorological tower 377 ft (115 m) in height above the water with a radius of approximately 1,500 ft (457 m) around the tower, resulting in an exclusion area of approximately 162 ac (66 ha).

BOEM assumes that one or two survey vessels could be active in the WEA at any given time during site characterization. While meteorological tower and/or buoy installation, operations, and decommissioning activities are being conducted, BOEM anticipates there could be two to three vessels in the WEA at any given time (due to vessels needed to tow and assist in buoy placement, or a specialized jack-up vessel used for installing foundation pilings for a tower or to perform routine maintenance). The additional vessel traffic increases the potential for interference with other marine uses in the area. However, because the estimate of one to three vessels at any given time in the WEA associated with the proposed action is a relatively small amount of activity, and with proper scheduling and notification to the marine community, impacts can be minimized. BOEM anticipates that the vessel traffic associated with Alternative A would be **minor**.

Although the WEA is not within designated routing measures such as a TSS, and Alternative A has been developed such that a meteorological tower and/or buoys would be set back at least 1 nm (1.9 km) from the edge of an adjacent TSS, the meteorological tower and/or buoys may still pose an obstruction to navigation. Placement of a meteorological tower and/or buoys would be mitigated by USCG-required marking and lighting and would be considered PATON (defined as a buoy, light, or day beacon owned and maintained by any individual or organization other than the USCG). PATON, which are regulated by the USCG under 33 CFR 66, are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation. Use of these aids would minimize any potential adverse impacts on navigation from the placement of a meteorological tower and/or buoys; therefore, impacts on navigation are expected to be **minor**.

Non-Routine Events

As shown on Figure 4-17, the majority of vessel traffic in the region occurs:

- In TSS lanes;
- Following distinct patterns to approach/depart the TSS lanes; and
- In a corridor running parallel to the New Jersey coast.

The WEA was developed so that placement of a tower and/or buoys would avoid the TSS lanes and the more heavily traveled approach/departure areas associated with those lanes. When BOEM considers an individual SAP, it will further consider vessel traffic patterns to make sure the tower and/or buoy placement would reduce the already small likelihood of vessel collision or allision with meteorological structures.

The additional vessel traffic associated with Alternative A—one to three vessels at any given time in the WEA and between the shore and the WEA—would be **minor** compared with the existing vessel traffic. Therefore, vessel traffic under Alternative A would not appreciably increase the probability of vessel collisions or allisions in these areas. Vessels associated with installing, servicing, or decommissioning a tower and/or buoys would have a higher, but still extremely low potential, to collide than passing vessels. All vessel movements are associated with a risk of collision and subsequent loss of fuel. The water quality effects of non-routine events are described in Sections 3.3.2 *Allisions and Collisions* and 3.3.3 *Spills*.

Because large vessels such as tanker ships are expected to stay in the TSSs and not transit through the WEA, BOEM does not anticipate aa large fuel/oil spill resulting from tanker ships and other large vessels in the WEA from collision with vessels associated with the proposed action or from an allision between a tanker and a meteorological tower or buoy. Additionally, in 2011, 98 percent of the oil and gas tanker stops at ports in the United States were by double-hulled vessels, which are much less likely to release oil from collision or allision than single-hulled tankers or other vessels (MARAD, 2013). Although impacts from a large fuel/oil spill would be adverse, because of their low likelihood, the potential for impacts would be **minor**. As concluded in the G&G Final PEIS (BOEM, 2014a), impacts on navigation and vessel traffic from a small diesel spill would be **negligible** because a small spill would only prohibit full use of a small area by other marine users for a short time.

Conclusion

Overall, BOEM anticipates that impacts to navigation and vessel traffic would be **minor**. Because the vessel activity associated with Alternative A is expected to be relatively small compared to existing vessel traffic at the ports, in the WEA, and between the shore and the WEA, impacts on navigation from the additional vessels would be **minor**. With the use of navigation aids, impacts on navigation from the placement of a meteorological tower and/or buoys are expected to be **minor**. In addition, because the WEA was designed to avoid the major shipping lanes, the risk of allisions with meteorological structures is extremely low; in the event of an allision, there would be limited damage. Impacts from small fuel/oil spills associated with site characterization surveys or site assessment activities are anticipated to result in **minor** disruptions to vessel traffic and navigation, and thus **minor** impacts.

4.4.3 Socioeconomic Resources

4.4.3.1 Cultural, Historical, and Archaeological Resources

Description of the Affected Environment

Historic properties are defined as any pre-contact or historic period districts, sites, buildings, structures, or objects included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties that could experience impacts from site characterization (i.e., HRG surveys and geotechnical sampling) and/or site assessment activities (i.e., installation of a meteorological tower and/or buoys) include:

- Offshore historic properties on or below the seafloor within portions of the WEA or cable routes to shore that could be affected by seafloor disturbing activities, and
- Onshore historic properties within the viewshed of survey activities, construction activities, or a meteorological tower and/or buoys.

The information presented in this section is based on existing and available information and is not intended to be a complete inventory of historic properties within the affected environment. The WEA has not been extensively surveyed and that is the reason, in part, that BOEM requires the results of historic property identification surveys to be submitted with a SAP and COP.

Offshore Historic Properties

The potential for encountering offshore historic properties within the affected environment is closely tied to several variables that encompass the end of the last ice age during the late Pleistocene ±17,000 before present (B.P.) to present day. The most important variables include:

- Global (eustatic) sea level response to collapse of the continental ice sheets,
- Ground level response to crustal unloading (isostatic rebounding from ice sheet melting),
- Migration of humans into the ice-free areas of the OCS during the Late Pleistocene through Holocene Periods,
- European exploration of the North America coastline, and
- Subsequent establishment of maritime colonies and associated trade ports.

Historic properties that could potentially be affected include:

- Sailing ships of discovery,
- Oceanic and coastal trading vessels,
- Fishing and vernacular watercraft,
- Maritime and communications infrastructure related to the development and growth of New York City, and
- Pre-contact and historic period archaeological sites.

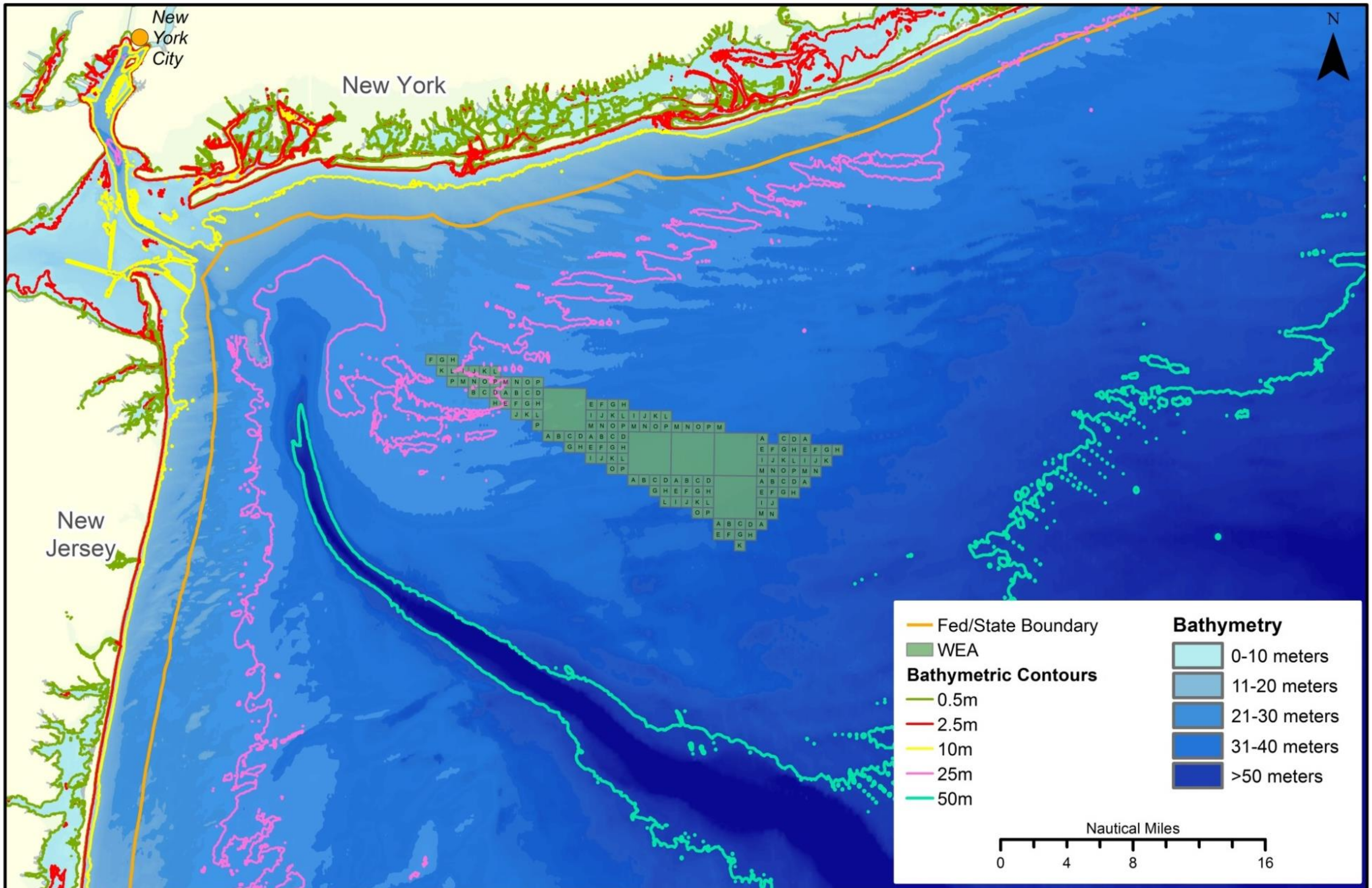
Pre-contact Archaeological Sites

During the Late Pleistocene, at the Last Glacial Maximum (20,000 B.P.), the glaciers that covered vast portions of the Earth's surface sequestered massive amounts of water as ice and lowered global sea level approximately 394 ft (120 m). Corresponding with lower global sea level during the Late Pleistocene, the section of the OCS where the WEA is located was once exposed, dry land and was submerged by rising sea level during the Early Holocene. These previously exposed areas are identified as having a high potential for the presence of submerged archaeological sites (TRC, 2012) dating to the time periods during which they were exposed. While no pre-contact period archaeological sites have been identified on the OCS offshore New York at this time (Schuldenrein et al., 2013), known pre-contact archaeological sites are located onshore in formerly upland locations on western Staten Island (at Port Mobil and Wards Point), 29 nm (53.7 km) west of the closest point of the WEA.

Based on the present understanding of the archaeological record, early human populations developed distinct cultures and lifeways corresponding with three broadly-construed periods: Paleoindian (circa 15,000 to 10,000 B.P.), Archaic (10,000 to 3000 B.P.), and Woodland (3000 B.P. to 400 B.P.). Paleoindian society was semi-nomadic within a defined territory (TRC, 2012) using a broad spectrum of plants and animals for subsistence. Small to medium-sized fauna would have been the predominant focus for game, as the large megafauna (mammoth and mastodons) populations were declining in response to climatic changes (Schuldenrein et al., 2013). The transition to Early Archaic cultures is characterized by nomadic cultures becoming more complex and establishing sedentary societies, whereas the transition to Woodland cultures is based on the development of agriculture.

The Paleoindian period was a time of slowly moderating climate with cooler temperatures, increased precipitation, and rapid sea level rise. Several episodes of melting occurred (up to 11,000 B.P.) as a result of the North American ice sheet collapsing (TRC, 2012). As the sea level rose and isostatic rebound occurred, smaller drainages were captured and deeply incised drainages formed across portions of the OCS. These drainages formed highly localized productive estuarine environments that would have been utilized for food procurement, fresh water sources, and habitation as the marine transgression continued moving up the OCS. The enhanced sediment flows in these drainages associated with catastrophic flooding and increased precipitation would have provided localized burial of possible Paleoindian sites below the transgressive sediment reworking. The only known Paleoindian sites within the region are found onshore in formerly upland locations at Port Mobil and Ward's Point on western Staten Island along the Arthur Kill (Schuldenrein et al., 2013).

By the early Archaic Period (10,000 B.P.), the climate had become warmer with less precipitation. Sea level had risen from −330 ft (−100 m) to −75 ft (−23 m) below present day levels (Schuldenrein et al., 2013). The −75 ft (−23 m) depth contour is located at the westernmost extent of the WEA, indicating that by the early Archaic period the majority of the WEA had been inundated (Figure 4-18). Prior to this inundation, the WEA was likely exposed dry land, although it would have been proximal to the shoreline and experiencing continued transgression with rapid burial of deeply incised drainages, ponds, or lagoons. By the Middle Archaic, sea level rise would have completely inundated the WEA and the shoreline would have migrated landward to approximately 33 to 40 ft (10 to 12 m) below present sea level (Schuldenrein et al., 2013). After inundation, the WEA would have been exposed to wave and current-based sediment transport and reworking during the Later Archaic to present day.



Note: The 25 m bathymetric contour, indicated in purple, approximates the former shoreline during the Early Archaic period and illustrates that by this time the majority of the WEA was inundated.

Figure 4-18 Sea Level Changes from the Archaic to Present Day

Based on sea level rise, the WEA has a high potential for the presence submerged archaeological sites dating from the Paleoindian through Early Archaic periods and very low to no potential for the presence of submerged archaeological sites more recent than the end of the Early Archaic (Table 4-18).

Table 4-18
Cultural Periods Potentially Present within the WEA

Cultural Period	Chronology in Years B.P.	Epoch	Sea Level ft (m)	Bathymetric Contour ft (m)
Paleoindian	15,000 to 10,000	Late Pleistocene to Early Holocene	−328 (100)	328 (100)
Early Archaic	10,000 to 8,000	Early Holocene	−328 to −75 (100 to 23)	75 (23)
Middle Archaic	8,000 to 6,000	Mid Holocene	−75 to −36 (23 to 11)	36 (11)
Late Archaic	6,000 to 3,000	Mid Holocene	−36 to −13 (11 to 4)	13 (4)

Source: Schuldenrein et al., 2013 B.P. = before present

Historic Archaeological Sites

The waters of the New York OCS are some of the heaviest trafficked shipping routes in the country. Every class or type of ship has transited through or operated in the vicinity of the WEA since the 17th century to the present day (Huie, 1941; Rattray, 1973; Bourque, 1979; Morris and Quinn, 1989; TRC, 2012). As the internal network of canals and rail developed and allowed the movement of goods to and from coastal cities, maritime technologies kept pace, becoming more complex with the advent of steam-, oil-, and internal combustion-powered vessels. An ever increasing amount of trade developed across the Atlantic, which moved through port cities such as New York. Of all the major ports for coastal and international commerce, none rivaled the Port of New York, which became the economic engine of the developing nation (Huie, 1941; Bourque, 1979). The volume of shipping that was transiting through the Port of New York from 1710 to 1780 during the Dutch and English colonial periods indicates there were well over 300 vessels transiting the vicinity of the WEA, and that number grew to more than 1,500 vessels in the 1780s (Bourque, 1979).

Later, in the 19th century between 1821 through 1882 (Table 4-19), the volume of ships entering the Port of New York grew explosively (Huie, 1941). In 1821, 910 foreign ships entered the port, likely crossing the vicinity of the WEA. By 1882, this number had increased to 4,531 foreign ships (Huie, 1941). The reported marine casualties in the port of New York and the vicinity of the WEA indicate a growing number of potential shipwrecks (Table 4-20). This table is not a complete list and represents only those shipwreck events witnessed or reported by survivors.

The highest concentrations of reported shipwrecks in this area cluster around shipping channels and uncharted obstructions, as well as the Atlantic side of Long Island where sailing vessels foundered during storms as they tried to enter the port. Other sources put the number of marine casualties along the Atlantic coast at over 15,000 to 20,000 (TRC, 2012). Of the entire reported vessel losses, 10 to 20 percent are estimated to have sunk in the open waters of the OCS

Table 4-19
Foreign Shipping in New York Harbor

Year	Steamships	Ships (Sail)	Barks (Sail)	Brigs (Sail)	Schooners (Sail)
1821	0	260	4	315	331
1844	3	471	351	929	451
1859	268	713	872	1,269	885
1865	455	625	1,420	1,184	1,042
1877	1,074	389	2,234	1,076	1,451
1882	1,945	407	1,857	896	1,371

Source: Huie, 1941

Table 4-20
Shipping Losses in New York Waters

Year	Reported Vessel Losses
1600–1650	6
1651–1700	2
1701–1750	3
1751–1800	32
1801–1850	157
1851–1900	514

Source: Rattray, 1973

(TRC, 2012). Shipwrecks potentially located in the WEA could date as far back as the 16th century with ships of discovery, but the bulk of the potential losses are more likely to be from the 19th to mid-20th century (Table 4-21).

There are nine shipwrecks reported for the WEA, two of which have dates for sinking; the remaining seven do not have dates associated with them. One of the nine is simply identified as an unknown vessel and has no further data to suggest construction, rig, or purpose. Additionally, the precision of the hull locations of the nine vessels is medium to low, and the hulls may be up to 3 mi (4.8 km) from the plotted positions. These vessels potentially meet several of the criteria for eligibility on the NRHP.

Onshore Historic Properties

The types of historic properties expected within the onshore affected environment include districts, sites, buildings, structures, or objects within the viewshed of site characterization and site assessment activities. An overview of the nature and scope of onshore historic properties that could be affected by site characterization and site assessment activities is presented in *Evaluation of Visual Impact on Cultural Resources/Historic Properties: North Atlantic, Mid-Atlantic, South Atlantic, and Florida Straits* (Klein et al., 2012).

Table 4-21
Shipwrecks Reported in the New York WEA

Record	Vessel	Position Accuracy	Year Sunk	History
7791	*Irma C*	Medium	Unknown	Identified as Irma C
7815	*Florence*	Medium	Unknown	Identified as Florence
7706	*Three Sisters*	Medium	Unknown	Identified as Three Sisters
1533	*Burnside*	Low	1913	24 NO. 8391; schooner, 855 GT, sunk April 20, 1913 by marine casualty, accuracy within 1 mi (1.6 km)
1542	*Tarantula*	Low	1918	24 NO.120; subchaser, 160 GT, sunk October 28, 1918, by marine casualty, accuracy 1 to 3 mi (1.6 to 4.8 km) Recorded April 1, 1923.
7774	*Happy Days*	Medium	Unknown	Identified as Happy Days
7721	*Durley Chine*	Medium	Unknown	Identified as Durley Chine
7732	*Skippy*	Medium	Unknown	Identified as Skippy
7741	*Unknown*	Medium	Unknown	No further information available

Source: NOAA OCS, 2015 GT = gross tonnage

The affected environment for onshore historic properties included a 0.25 mi (0.40 km) onshore buffer along the coastline between Ocean Grove, NJ, and the northeast tip of the FIIS, located in Long Island, NY. This area corresponded to baseline data on historic properties archived in the New York State Office of Parks, Recreation, and Historic Preservation SPHINX system, and is documented in *Evaluation of Visual Impact on Cultural Resources/Historic Properties: North Atlantic, Mid-Atlantic, South Atlantic, and Florida Straits* (Klein et al., 2012). Because seascape views from inland locations are largely obstructed by buildings, this onshore buffer area corresponds to shoreline areas potentially within the viewshed of site characterization and site assessment activities. Klein et al. (2012) documented 40 known NRHP-listed and potentially eligible properties within the analysis area that are considered in this assessment (Figure 4-19). Additional historic properties that have been documented since the time of this 2012 study or that have not yet been identified through historic property identification survey may also be located in this area.

Impact Analysis of Alternative A

Impacts to cultural, historical, and archaeological resources in the discussion below are categorized by reasonably foreseeable impacts to offshore and onshore historic properties.

<u>Routine Activities</u>

Site Characterization Activities

<u>Offshore Historic Properties</u>

Site characterization activities include both HRG survey (e.g., shallow hazard, geological, and archaeological surveys) and geotechnical sampling techniques. Geophysical surveys do not

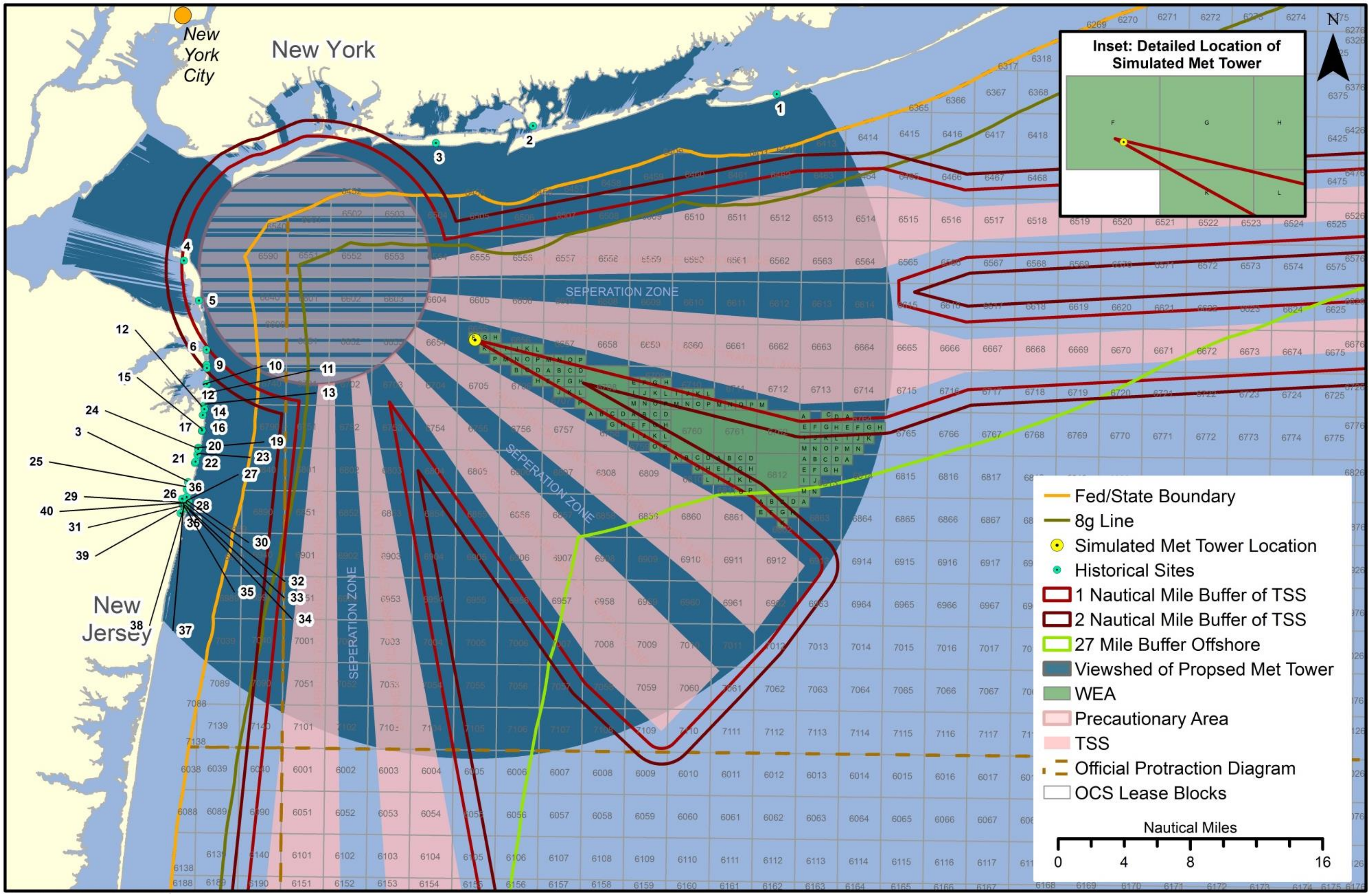


Figure 4-19 NRHP-Listed and Potentially Eligible Properties (key to the figure is on the next page)

Key to Figure 4-19:

ID Historical Sites

1 Fire Island Light Station
2 Jones Beach State Park, Causeway and Parkway System
3 House at 226 West Penn St.
4 Fort Hancock and Sandy Hook Proving Ground Historic District
5 Fort Hancock U.S. Life Saving Station
6 U.S. Lifesaving Station #3
7 Washington E. Connor Stable
8 First Methodist Church
9 St. Luke's A.M.E. Church
10 U.S. Life Saving Station #4
11 Monmouth Beach Bath and Tennis Club
12 The Reservation/Navaho Lodge
13 Edgar A. West Building
14 The Reservation Historic District
15 Theodore Moss House
16 Theodore Moss House
17 L.J. Phillips House
18 U.S. Life Saving Station #5, and Takanassee Beach Club Historic District
19 St. Michael's Roman Catholic Church
20 Ocean Avenue Bridge
21 Elberon Hotel Garage
22 Church of the Presidents
23 James M. Brown House
24 Deal Esplanade District
25 Allenhurst Residential Historic District
26 George Wurt's Summer Home
27 Howard Johnson's Pavilion
28 Baronet Theatre
29 Sunset Lake Hisoric District
30 Waterfront Resort Historic District
31 Library Square Historic District
32 Berkeley-Carteret Hotel
33 The Stone Pony
34 Jersey Apartments
35 Asbury Park Casino and Carousel
36 Asbury Park Convention Hall
37 Metropolitan Hotel
38 Palace Amusements Building
39 Ocean Grove Camp Meeting Association Historic District
40 Britwoods Court
41 Willis Apartments

Document Path: Y:\Projects\BOEM\Maps\Preliminary\Figure_4_16_Key.mxd come in contact with the seafloor and, therefore, have no ability to impact offshore historic properties. Geotechnical sampling activities, when conducted to inform the design and installation of renewable energy structures or cables, disturb the seafloor and therefore have the potential to impact historic properties located on or below the seafloor. Coring, sediment grab sampling, and other direct sampling techniques (e.g., CPTs, deep borings), in addition to anchoring, anchor chain sweep from moored or anchored support vessels, use of jack-up barges, or other equipment used in conducting geotechnical sampling all have the potential for damaging or destroying historic properties located on or under the seafloor. These potential impacts can be reduced to **negligible** through the completion of geophysical surveys in the WEA consistent with BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. Geophysical surveys, in part, serve to identify offshore historic properties. If geophysical surveys are completed by a lessee prior to conducting geotechnical/sediment sampling, historic properties can be identified and bottom disturbing activities can be located in areas where historic properties are not present. BOEM would therefore require a lessee to conduct geophysical surveys consistent with the *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* prior to conducting geotechnical sampling, and if a potential offshore historic property is identified, the lessee would be required to avoid it.

The following elements, designed to avoid impacts to offshore historic properties from site characterization activities, would be included in a commercial lease issued for the WEA:

- The lessee may only conduct geotechnical exploration activities, including geotechnical sampling or other direct sampling or investigation techniques, which are performed in support of plan (i.e., SAP and/or COP) submittal, in areas in which an archaeological analysis of the results of geophysical surveys has been completed for that area.
- The analysis must be completed by a qualified marine archaeologist who both meets the Secretary of the Interior's Professional Qualifications Standards (48 FR 44738–44739) and has experience analyzing marine geophysical data.
- The qualified marine archaeologist's analysis of the geophysical data must include a determination of whether any potential archaeological resources are present in the area of geotechnical sampling, including consideration of both pre-contact and historic period archaeological resources.
- If present in the area, the lessee's geotechnical sampling activities must avoid any potential archaeological resources by a minimum of 164 ft (50 m). The avoidance distance must be calculated by the qualified marine archaeologist from the maximum discernible extent of the archaeological resource.
- The qualified marine archaeologist must certify in the lessee's archaeological reports included with a SAP or COP that geotechnical exploration activities did not affect potential historic properties identified as a result of the HRG surveys.
- In no case may the lessee's actions affect a potential archaeological resource without BOEM's prior approval.

In addition, BOEM would require that the lessee observe the unanticipated finds requirements at 30 CFR 585.802. The following elements would be included in a commercial lease issued within the WEA:

- If the lessee, while conducting site characterization activities in support of plan (i.e., SAP and/or COP) submittal, discovers a potential archaeological resource such as the presence of a shipwreck or pre-contact archaeological site within the project area, the lessee must:
    - Immediate halt of seafloor-disturbing activities in the area of discovery;
    - Notify the lessor within 24 hours of discovery;
    - Notify the lessor in writing by report within 72 hours of its discovery;
    - Keep the location of the discovery confidential and take no action that may adversely affect the archaeological resource until the lessor has made an evaluation and instructs the applicant on how to proceed; and
    - Conduct any additional investigations as directed by the lessor to determine if the resource is eligible for listing in the NRHP (30 CFR 585.802(b)). The lessor will direct the lessee to conduct such investigations if: (1) the site has been affected by the lessee's project activities; or (2) impacts on the site or on the area of potential effect cannot be avoided. If investigations indicate that the resource is potentially eligible for listing in the NRHP, the lessor will tell the lessee how to protect the resource or how to mitigate adverse effects on the site. If the lessor incurs costs in protecting the resource, under Section 110(g) of the NHPA, the lessor may charge the lessee reasonable costs for carrying out preservation responsibilities under the OCS Lands Act (30 CFR 585.802(c-d)).

Because a lessee would be required to conduct geophysical surveys prior to conducting geotechnical sampling, and would be required to follow the lease stipulations regarding avoidance and unanticipated discovery protocols for submerged historic properties, impacts from site characterization on offshore historic properties are expected to be **negligible**.

In some cases, geotechnical testing methods may also provide a useful strategy of confirming the presence or absence of features of archaeological interest and for gathering information that informs the archaeological interpretation of HRG data. If a lessee intends to impact a potential offshore historic property for the purpose of historic property identification or NRHP testing and evaluation, the lessee would be required to provide written notification describing these activities to BOEM for approval under the elements of lease issuance outlined above. BOEM would review this information under Section 106 of the NHPA and the stipulations of the Programmatic Agreement, discussed below. Impacts to submerged historic properties from vibracores or other direct samples collected, by or under the supervision of a Qualified Marine Archaeologist, for the purposes—at least in part—of historic property identification or NRHP eligibility testing and evaluation are expected to be **negligible.**

Onshore Historic Properties

Vessel traffic from site characterization activities could be visible from onshore historic properties. As noted in Section 4.4.3.2 *Navigation/Vessel Traffic*, BOEM anticipates that there would be one to three vessels at any given time in the WEA and between the shore and the WEA associated with the proposed action. Survey vessels in the WEA would appear small in scale or would fall below the horizon, thereby reducing the likelihood that vessels are seen from onshore locations. Similarly, lighting associated with survey vessels operating under night conditions would appear small in scale and isolated, consistent with existing nautical lighting visible on the horizon. However, the increased ocean vessel traffic from these survey activities would be indistinguishable from existing ocean vessel traffic, and these impacts would be temporary and minimal. Additionally, based on the distance of survey activities from any onshore historic properties, the impacts to the characteristics of these properties that contributed to their eligibility for listing in the NRHP are expected to be **negligible**.

Site Assessment Activities

Offshore Historic Properties

Although installation of a meteorological tower and/or buoys would affect the seafloor, the lessee's SAP must be approved by BOEM prior to installation. To assist BOEM in complying with the NHPA and other relevant laws (30 CFR 585.611(a), 30 CFR 585.611(b)(6)), the SAP must contain a description of the historic properties that could be affected by the activities proposed in the plan. Under its Programmatic Agreement, BOEM will consult with the New York SHPO and other appropriate parties prior to approval of a SAP to ensure potential effects on historic properties are avoided, minimized, or mitigated under Section 106 of the NHPA.

The seafloor impacts associated with installation of a meteorological tower and/or buoys include:

- Disturbance resulting from foundation installation;
- Dropping and dragging anchors from construction vessels; and
- Mooring chain sweeping.

Impacts on archaeological resources in these activity areas could result in destruction of all or part of the historic properties or loss of their archaeological context. Should the archaeological surveys reveal the possible presence of an archaeological site in an area that may be affected by activities proposed in a SAP, BOEM would likely require the lessee to avoid the potential site or to demonstrate through additional investigations that an archaeological resource either does not exist or would not be adversely affected by the seafloor/bottom-disturbing activities. If avoidance of the historic property is not possible, BOEM would continue Section 106 consultation under the Programmatic Agreement to resolve adverse effects. Although site assessment activities have the potential to affect historic properties either on or below the seabed, existing regulatory measures, coupled with the information generated for a lessee's initial site characterization activities and presented in the lessee's SAP, make the potential for bottom-disturbing activities to damage historic properties low. Therefore, impacts on offshore historic properties from site assessment activities are expected to be **negligible**.

Onshore Historic Properties

Because of the distance of the WEA from shore, it is anticipated that meteorological buoys would not be visible from onshore areas and would have no impact on onshore historic properties.

Under daytime conditions, if a lessee installed a meteorological tower at the closet point of the WEA that is available for meteorological structure placement to the shoreline (at the western tip of the 1 nm [1.9 km] buffer), approximately 13.5 nm (25 km) from the shoreline, the tower may be visible, although it would be difficult to detect by the casual observer when viewed from onshore historic properties. Assuming no daytime avoidance lighting on the meteorological tower (see discussion of avoidance lighting per FAA [2015] in Section 4.4.4.6 *Visual Resources*), if the tower was detected by an observer on the shore, it would appear small in scale relative to the broad horizon of the seascape, and visual contrast would be weak.

During nighttime conditions, avoidance lighting on the tower could be visible from onshore historic properties; however lighting would be discrete and isolated and appear consistent with existing nautical lighting on the horizon. Lighting would appear similar to lights visible from existing vessel traffic. Visibility of the meteorological tower, and related viewshed impacts, would attenuate with distance due to the influence of atmospheric haze and the reduction in scale of the tower relative to the surrounding seascape. No portion of the meteorological structure or lighting would be visible if the tower was placed beyond 23.5 nm (44 km), because the entire tower would fall below the horizon when viewed from the shore. Consequently, visual impacts to onshore historic properties resulting from the proposed action would be **minor.**

Conclusion

Overall, impacts to cultural, historical, and archaeological resources would be **minor**.

Impacts to submerged historic properties from site characterization activities are expected to be **negligible** given the geophysical surveying requirements and lease conditions discussed above. Impacts to submerged historic properties from installation of a meteorological tower and/or buoys are expected to be **negligible** as avoidance would likely be required by BOEM. If avoidance of potential historic properties is not feasible, BOEM will continue its Section 106 consultation to resolve adverse effects.

Vessel traffic associated with survey activities would be indistinguishable from existing vessel traffic and short-term. Therefore, impacts to onshore historic properties from site characterization activities are expected to be **negligible**.

A meteorological tower is not expected to be detected by the casual observer when viewed from onshore historic properties under daytime conditions. Nighttime lighting would be discrete and isolated and appear consistent with existing nautical lighting on the horizon and is not expected to adversely impact the character of onshore historic properties. Therefore, overall impacts on onshore historic properties from installation of a meteorological tower are expected to be **minor**.

4.4.3.2 Demographics and Employment

Description of the Affected Environment

This section presents an overview of major socioeconomic characteristics and trends to provide a context from which to assess impacts of the proposed action. The counties chosen for analysis are those with ports and the immediate surrounding area that may be used by a lessee in the future. Section 3.2.3 *Port Facilities* describes in detail the rationale for identifying the ports. The demographic and economic characteristics and trends are presented at the county level; ports are located in five counties in New Jersey and three counties in New York.

Within the State of New Jersey, the ports are located in the counties of Hudson, Union, Essex, Middlesex, and Monmouth. The populations of these counties range from around 550,000 persons to 835,000 persons (U.S. Census Bureau, 2016a). With the exception of Monmouth

County where population decreased by a very small percentage (−0.2 percent) between 2010 and 2014, the remaining four counties have experienced modest increases in population during this time period (Table 4-22). Within New York State, two out of the three counties in which the ports are located are in New York City, and the remaining county is located on Long Island. These include Kings County (Brooklyn), Richmond County (Staten Island), and Suffolk County. Kings County had the largest increase in population (4.7 percent) between 2010 and 2014, whereas the population in Suffolk County increased by only 0.6 percent during this time period. Richmond County experienced an increase of 1.0 percent between 2010 and 2014 (U.S. Census Bureau, 2016b).

Table 4-22
Population and Unemployment of New York and New Jersey Coastal Counties with Large Ports

Port Location	County, State	County-wide Population (2014 estimate)	Unemployment Rates (2009-2013 Estimates)	Percentage Change in Population (2010 to 2014)
Bayonne	Hudson County, NJ	669,115	10.9%	5.5%
Brooklyn	Kings County, NY	2,621,793	10.9%	4.7%
Elizabeth	Union County, NJ	552,939	11.0%	3.1%
Newark	Essex County, NJ	795,723	13.9%	1.5%
Staten Island	Richmond County, NY	473,279	7.9%	1.0%
Erie Basin	Kings County, NY	2,621,793	10.9%	4.7%
Perth Amboy	Middlesex County, NJ	836,297	9.0	3.3%
Kismet Harbor	Suffolk County, NY	1,502,968	7.4%	0.6%
Ocean Beach Harbor	Suffolk County, NY	1,502,968	7.4%	0.6%
Shark River	Monmouth County, NJ	629,279	9.0%	–0.2%
Manasquan	Monmouth County, NJ	629,279	9.0%	–0.2%

Source: U.S. Census Bureau, 2016a; ; U.S. Census Bureau, 2016b; U.S. Census Bureau, 2016c

As shown in Table 4-22, unemployment rates within the counties range between 7.4 percent in Suffolk County, NY, to 13.9 percent in Essex County, NJ (U.S. Census Bureau, 2016b). The rate of unemployment in three of the five New Jersey counties–Hudson, Union, and Essex counties–was higher than the state average unemployment rate of 10.1 percent. In New York, only Kings County had a higher unemployment rate (10.9 percent) than the state average (9.2 percent). For both states, the educational services and health care and social assistance sector is the single largest employment sector, employing between 23 and 28 percent of the total workforce (U.S. Census Bureau, 2016d). In terms of future employment, within New Jersey, the educational and health services sectors and the trade, transportation, and utilities sector are expected to see the highest rates of growth over the next 8 to 10 years (NJDOL, 2013). Within New York State, similar trends are exhibited based on projections up to 2022 by the New York State Department of Labor (NYSDOL, n.d.). Employment in the professional and business services sector is expected to grow by 23 percent during this time period. The construction sector is also expected to see increased employment in this area over the same time period.

The National Ocean Economics Program publishes datasets on employment and establishments compiled from the Bureau of Labor Statistics on economic activity that typically takes place in the ocean or is supportive of such activity in some shape or form (NOEP, 2016). The industrial sectors for which the data are compiled include living resources, marine construction, offshore minerals, tourism and recreation, and transportation. Based on 2012 data, the five New Jersey counties employ approximately 58,000 persons and the three New York counties employ nearly 59,000 persons, respectively, supporting the ocean economy industry sectors. In New Jersey, the study area counties employed about 4 percent of their total labor force in these ocean-based sectors and approximately 5 percent in the study area counties of New York State; both percentages are relatively high when compared to the total employment in each respective state.

Impact Analysis of Alternative A

Routine Activities

The potential impacts on demographics and employment that could occur as a result of the site characterization and assessment were previously analyzed in the G&G Final PEIS (BOEM, 2014a), and it was concluded that impacts from site characterization and assessment activities were expected to be **negligible**. Although the WEA does not fall within the geographic region covered by the G&G Final PEIS, the types of activities addressed in the G&G Final PEIS would have similar impacts on demographics and employment in the New York and New Jersey coastal areas.

Temporary increases in employment from proposed action activities, such as surveying, tower and buoy fabrication, and construction would occur in various local economies associated with onshore- and offshore-related industry in the coastal counties of New York and New Jersey. Additionally, the G&G Final PEIS (BOEM, 2014a) found that the small number of workers directly employed in site characterization surveys (10 to 20 people; BOEM, 2012b) would be insufficient to have a perceptible impact on local employment and population.

BOEM expects any beneficial impacts on employment, population, and the local economies in and around the ports to be short-term and imperceptible, depending on the distribution of activities among ports and over time, and therefore impacts would be **negligible**. Although the approximate number of workers directly employed would be measureable, benefits to the local economy would be difficult to measure, and the overall impact to local economy, and therefore to demographics and employment, would be **negligible**.

Non-Routine Events

The G&G Final PEIS (BOEM, 2014a) analyzed potential impacts on demographics and employment that could occur as a result of accidental fuel spills, and concluded that impacts from fuel spills would be **negligible**. Based on the analysis reported in that document and the similarity to activities for the proposed action, BOEM anticipates that fuel spills would have **negligible** impacts to the demographics and employment of the New York and New Jersey coastal counties.

Conclusion

BOEM anticipates that the proposed action would have beneficial, short-term impacts to demographics and employment in the coastal counties of New York and New Jersey, but impacts would be imperceptible and are expected to be **negligible**.

4.4.3.3 Environmental Justice

Description of the Affected Environment

EO 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 and low-income populations" (Subsection 1-101).

EO 12898 also requires that each federal agency:

- Conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons and populations from participation in, denying persons and populations the benefits of, or subjecting persons or populations to discrimination under such programs, policies, and activities because of their race, color, or national origin [Subsection 2-2].
- Work to ensure that public documents, notices, and hearings relating to human health or the environment are concise, understandable, and readily accessible to the public [Subsection 5-5(c)].

The following section presents an evaluation of the demographic composition of minority and low-income persons living within the study area counties. Population and income characteristics from the 2010 U.S. Census of Population and Housing were analyzed to identify populations of concern with respect to potential environmental justice issues. The following information was collected at the county level.

- Racial and Ethnic Characteristics—The population in each census block of the study area counties was characterized using the following racial categories: White Hispanic, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Other, and Persons of Hispanic Origin. These categories are consistent with the affected populations requiring study under EO 12898 and are described below.
- Percentage of Minority Population—As defined by the U.S. Census Bureau, the minority population includes all non-Whites and White-Hispanic persons.
- Low-Income Population—The percentage of persons living below the poverty level, as defined in the census, was one of the indicators used to determine the low-income population in a given county.

In New Jersey, based on the demographic characteristics of the study area counties presented in Table 4-23, Hudson, Union, Essex, and Middlesex Counties exhibited higher percentages of minority persons than the state-wide average of 43.2 percent (U.S. Census Bureau, 2016a). In

New York, only Kings County exhibited a higher percentage of minority persons than the statewide average of 43.5 percent (U.S. Census Bureau, 2016b). In terms of persons below the poverty level, Hudson and Union Counties in New Jersey and Kings County in New York have a higher share of persons below the poverty level than the state averages of 11.1 and 15.9 percent, respectively (U.S. Census Bureau, 2016a; U.S. Census Bureau, 2016b).

Table 4-23
Percent of Minority Persons and Persons Below Poverty for New York and New Jersey Coastal Counties with Large Ports

Port Location	County, State	Minority Percentage of County[(1),(2)]	Persons Below Poverty in County (2014)
Bayonne	Hudson County, NJ	70.8%	17.7%
Brooklyn	Kings County, NY	64.3%	23.4%
Elizabeth	Union County, NJ	57.7%	11.1%
Newark	Essex County, NJ	67.8%	16.7%
Staten Island	Richmond County, NY	37.4%	14.5%
Erie Basin	Kings County, NY	64.3%	23.4%
Perth Amboy	Middlesex County, NJ	54.6%	8.3%
Kismet Harbor	Suffolk County, NY	30.7%	7.7%
Ocean Beach Harbor	Suffolk County, NY	30.7%	7.7%
Shark River	Monmouth County, NJ	24.3%	8.2%
Manasquan	Monmouth County, NJ	24.3%	8.2%

Source: U.S. Census Bureau, , 2016a; U.S. Census Bureau, 2016b

(1) Minority Persons computed as the sum of the following Ethnic Groups: Hispanic White, Black or African American Alone, American Indian and Alaska Native Alone, Asian Alone, Native Hawaiian and Other Pacific Islander Alone, and Two or More Races.

(2) Percentage of Minority Persons in New Jersey was 43.2% and in New York was 43.5% based the 2010 U.S. Census.

The presence of minority or low-income persons alone does not trigger EO 12898. The EO only applies if the effects of the project are adverse and affect a low-income or minority population disproportionately compared to the project's effect on the overall population.

The G&G Final PEIS (BOEM, 2014a) also considered potential environmental justice impacts on fishing communities, because these are often low-income. The G&G Final PEIS (BOEM, 2014a) concluded that fishing communities in the Mid- and South-Atlantic coastal states do not generally have a minority or low-income presence greater than the country as a whole. However, individual fishing communities could be minority or low-income populations. Although the WEA does not fall within the geographic region covered by the G&G Final PEIS, the types of activities addressed would have similar impacts on minority or low-income populations in the New York and New Jersey coastal areas. Because identification of individual minority or low-income fishing communities would not affect the environmental justice impact analysis at the current level of analysis, no further detail on fishing communities is provided in this EA. Site-specific project environmental reviews would be expected to identify individual minority and low-income fishing communities and assess any disproportionately high human health and environmental effects that these communities may face.

Impact Analysis of Alternative A

No high and adverse human health or environmental effects that would disproportionately affect low-income and minority persons would occur as a result of site characterization or site assessment. Therefore, there would be **no impacts** on environmental justice as a result of the proposed action.

Conclusion

Because no disproportionately high and adverse human health effects would occur as a result of the proposed action, there would be **no impacts** on minority or low-income populations.

4.4.3.4 Recreation and Tourism

The analysis area for recreation and tourism includes areas within 0.25 mi (0.4 km) of the coastline of Suffolk, Nassau, Queens, and King Counties in New York and Monmouth County in New Jersey.

Description of the Affected Environment

The coastal areas of New York and New Jersey are characterized by an abundance of coastal recreation and tourism opportunities. A detailed account of these opportunities within the analysis area is provided by BOEM (2012a), which is incorporated in this section by reference. These counties are characterized by tourism economies dependent on ocean-related recreation and tourism for employment and business (Table 4-24) (BOEM, 2012a).

Table 4-24
Percentage of Ocean-Related Jobs Related to Recreation and Tourism by County

County	Percent of Ocean-Related Jobs Related to Tourism
Monmouth, NJ	92.6%
Kings, NY	93.9%
Nassau, NY	94.4%
Suffolk, NY	87.7%
Queens, NY	77.5%

Source: NOAA, 2012

Though many recreation and tourism opportunities exist in inland portions of these counties, the assessment in this EA focuses on those areas situated along the shoreline that may depend on coastal settings. An overview of coastal recreation and tourism opportunities is provided below by County.

Monmouth County, NJ – Monmouth County is characterized by 27 mi (43 km) of shoreline along the Atlantic Ocean (Monmouth County Tourism, 2015). Coastal recreation opportunities include public beaches, boardwalks, a harbor, marinas, boatyards, yacht clubs, state parks, trails, and historic sites (Monmouth County Tourism, 2015). The white sand beaches provide recreational opportunities such as swimming, picnicking, and sunbathing, while the waters within and outside the bay attract fishermen, scuba divers, surfers, and wind surfers. Sandy Hook, part of the Gateway National Recreation Area, is the County's most popular attraction, drawing over 2 million visitors per year (NPS, 2015b). The national landmarks of Fort Hancock and the Sandy Hook Lighthouse are located on the Sandy Hook peninsula. The Twin Lights historic monument, located on the hillside overlooking the shoreline, attracts thousands of history enthusiasts each year (Friends of Twin Lights, 2015).

Kings County, NY – Kings County is characterized by minimal coastline along the Atlantic Ocean, as the majority of the County borders the East River or is within the Upper or Lower New York Bay. Coastal recreation and tourism opportunities include public beaches (Brighton Beach, Coney Island Beach, and Manhattan Beach), harbors, marinas, boatyards, and yacht clubs (New York City Department of Parks and Recreation, 2015). The beaches are accessible by New York City's subway system and are generally only visited by local residents. A popular local coastal resident and tourist areas of interest is Coney Island, a beachside amusement park (New York City Department of Parks and Recreation, 2015).

Nassau County, NY – Nassau County borders Long Island Sound to the north. The southern shoreline faces the Atlantic Ocean and is characterized by sand beach, wetlands, or industry. Jones Beach, located on the southern shoreline, is a 6.5 mi (10.5 km) long public beach (Nassau County, 2015). This recreation area is included in the NRHP (NPS, 2016a). An average of six to eight million people visits Jones Beach annually (NYSDPRHP, 2016). Several wildlife sanctuaries and state parks are present in the wetlands along the southern coast. Coastal recreation and tourism activities include surfing, swimming, sunbathing, and beachcombing. The Long Beach Boardwalk, built in 1907, is regarded as a "quintessential surf town" by the Nassau County Industrial Development Agency (Nassau County, 2015).

Suffolk County, NY – Suffolk County is located between Long Island Sound to the north and the Atlantic Ocean to the south. Coastal recreation and tourism opportunities include public beaches, harbors, marinas and boatyards, and yacht clubs (Long Island Convention and Visitors Bureau and Sports Commission, 2015). Numerous national parks and wildlife refuges exist within the County including the FIIS (NPS, 2015a). The FIIS was established "for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population" (16 U.S.C. § 459e). The area attracts beachgoers ranging from surfers to nature enthusiasts who are drawn to the wildlife, natural areas, scenic views, and secluded beach (NPS, 2015a).

Queens County, NY – The majority of the coastline is characterized as industrial, though sand beaches are present along the southern shore. The County has one public beach—Rockaway Park—two harbors, five marinas, and nine yacht clubs (New York City Department of Parks and Recreation, 2015). The Gateway National Recreation Area is located in Queen County, and includes the Sandy Hook Unit, located in Highlands, New Jersey, and two units in New York City: the Jamaica Bay and Staten Island Units (NPS, 2016b). This National Recreation Area was established to "preserve and protect for the use and enjoyment of present and future generations an area possessing outstanding natural and recreational features" (16 U.S.C. § 460cc). The Jamaica Bay Wildlife Refuge, part of the Gateway National Recreation Area, is characterized by extensive salt marsh, upland fields and woods, several fresh and brackish water ponds, and an open bay (NPS, 2015b).

Impact Analysis of Alternative A

The analysis focuses on the following impact-producing factors from both site characterization and assessment to measure potential impacts to recreation and tourism opportunities:

- Vessel traffic during site characterization and site assessment
- Vessel exclusion zones surrounding the meteorological tower and/or buoys during deployment (no exclusion zones once a tower and/or buoys are operational)
- Trash and debris from vessels
- Viewshed-related impacts associated with site characterization and site assessment from additional vessels, and nighttime lighting on the vessels that could be seen both from shore and from recreational boaters
- Viewshed-related impacts from the meteorological tower, including nighttime lighting
- Fuel spills

The assessment of potential impacts resulting from site assessment activities was based, in part, on information presented in the G&G Final PEIS (BOEM, 2014a). Where applicable, this information is incorporated by reference and summarized below. Viewshed-related impacts were assessed per methods described in Section 4.4.4.6 *Visual Resources*.

Routine Activities

Vessel Traffic and Vessel Exclusion Zones

BOEM assumes that for staging during site assessment the lessee would use a large port with sufficient berth space to accommodate vessels and to host fabrication of a meteorological tower and/or buoy. Smaller vessels, such as those related to the maintenance of the meteorological tower, may use a smaller commercial port close to the WEA as described in Section 3.2.3 *Port Facilities*. As noted in Section 4.4.3.2 *Navigation/Vessel Traffic*, BOEM anticipates that there would be one to three vessels at any given time in the WEA and between the shore and the WEA associated with the proposed action. The impact of this additional vessel traffic associated with Alternative A would be **negligible** for recreational boating activities given the existing vessel traffic.

Exclusion zones around vessels and the meteorological tower and/or buoys are discussed in Section 4.4.3.2 *Navigation/Vessel Traffic*. The New York WEA is located away from popular sport fishing spots. Impacts on recreational boating and fishing from vessel and meteorological tower and/or buoy deployment exclusion zones are expected to be **negligible**.

Impacts from site characterization and site assessment on recreational fishing are discussed in Section 4.4.4.5 *Commercial and Recreational Fisheries*. Increased vessel traffic associated with the proposed action is expected to result in **negligible** impacts to recreational boating activities given the temporary nature of exclusion zones and the location of the WEA away from popular recreational spots that tend to be closer to shore.

Trash and Debris

As discussed in detail Section 4.4.4.1 *Cultural, Historical, and Archaeological Resources* under onshore historic properties, the primary impact-producing factor associated with vessels used in support of the proposed action would be the potential for generation of trash and debris. Trash and debris, if accidentally released, could wash up on beaches and into harbors, bays, and coastal marshes and other recreation and tourism destinations. Presence of trash/debris could adversely affect the aesthetic quality of the setting and alter the perception of affected areas, particularly for those areas valued for beach and near shore recreation (e.g., Gateway National Recreation Area, Jones Beach State Park), or those considered pristine wilderness (e.g., FIIS). However, because of restrictions that prohibit the release of trash and debris provided by existing regulations (MARPOL 73/78 Annex V) impacts to recreation and tourism resulting from trash and debris are expected to be **negligible**.

Viewshed-Related Impacts from a Meteorological Tower

Potential impacts to recreation and tourism settings resulting from the visual contrast of the meteorological tower and/or buoys and associated nighttime lighting would be **minor**, as described in Section 4.4.4.6 *Visual Resources.*

Non-Routine Events

The likelihood of a fuel spill during surveys is expected to be remote (see Section 3.3.3 *Spills*). As noted in the G&G Final PEIS (BOEM, 2014a), potential impacts to recreation and tourism would depend on the location of a spill, meteorological conditions at the time of the spill, and the speed with which cleanup occurred. Should a spill occur, access to recreation and tourism destinations could be temporarily limited by cleanup and response vessel activity. However, a spill would likely be relatively small (88 gallons [333 liters]; see Section 3.3.3 *Spills*) so a large-scale spill response involving multiple cleanup vessels is not expected. Therefore, impacts on recreational resources from a small diesel fuel spill are expected to be **minor**.

Conclusion

Impacts to recreation and tourism resulting from routine and non-routine activities would be **minor.** Impacts would result primarily from vessel traffic restrictions in exclusion zones, potential for small scale spills, and from vessel traffic associated with installation of a meteorological tower and/or buoys.

4.4.3.5 Commercial and Recreational Fisheries

Description of the Affected Environment

The WEA is located in the New York Bight (extending from Cape May, NJ to Montauk Point, NY) and home to fish targeted by commercial fishermen. There are known fishing locations, such as Cholera Banks, Middle Ground, Anglers Bank, and the Flats, that are adjacent to and overlapping with the WEA (Figure 4-20 and Figure 4-21). The description of fish and EFH is found in Section 4.4.2.7 *Finfish, Invertebrates, and Essential Fish Habitat*.

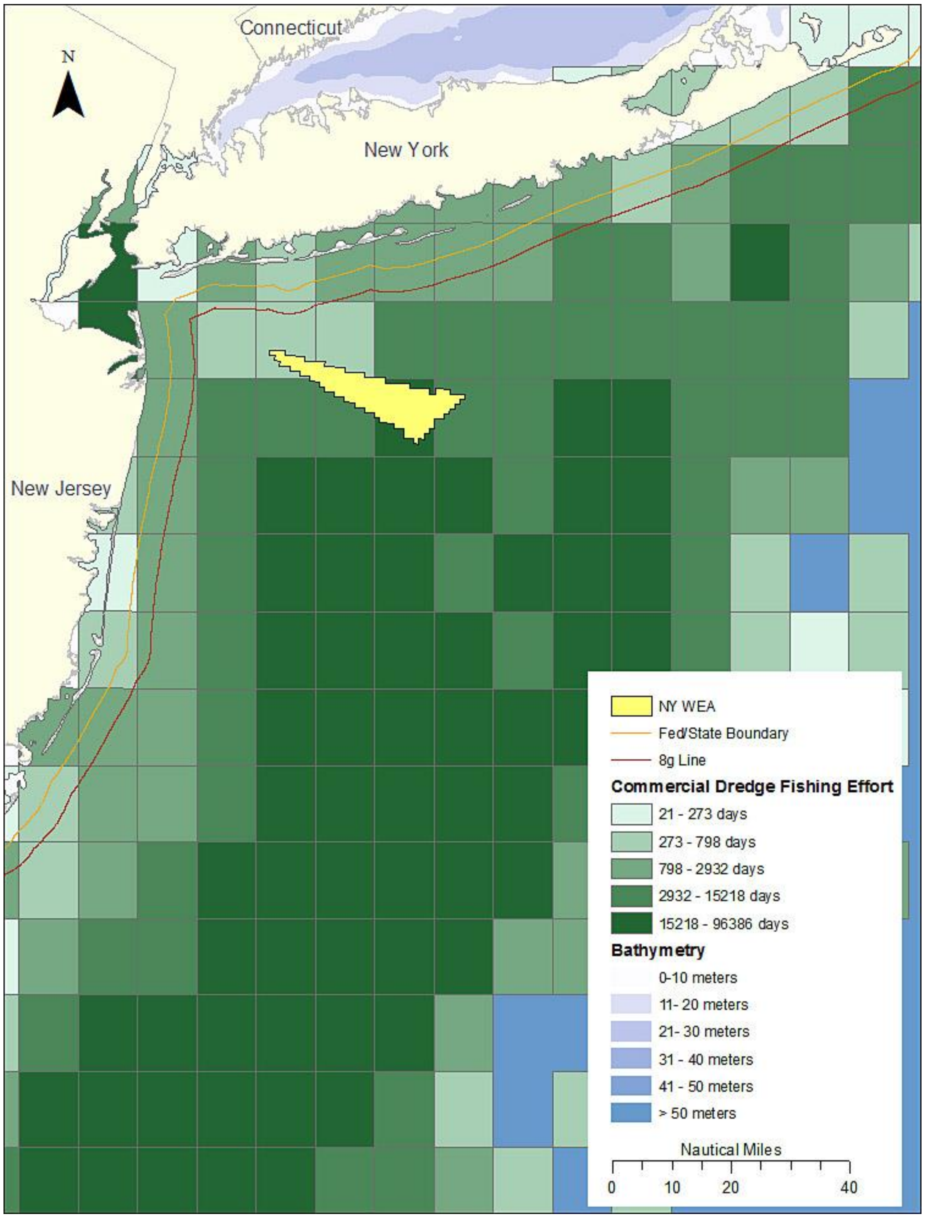


Figure 4-20 Commercial Dredge Fishing Effort (in days) from 2001 to 2010 Gridded in 10-Minute Squares

Source: NYSDOS, 2015a
Note: Data are based on fishing vessel trip reports provided by the National Marine Fisheries Service

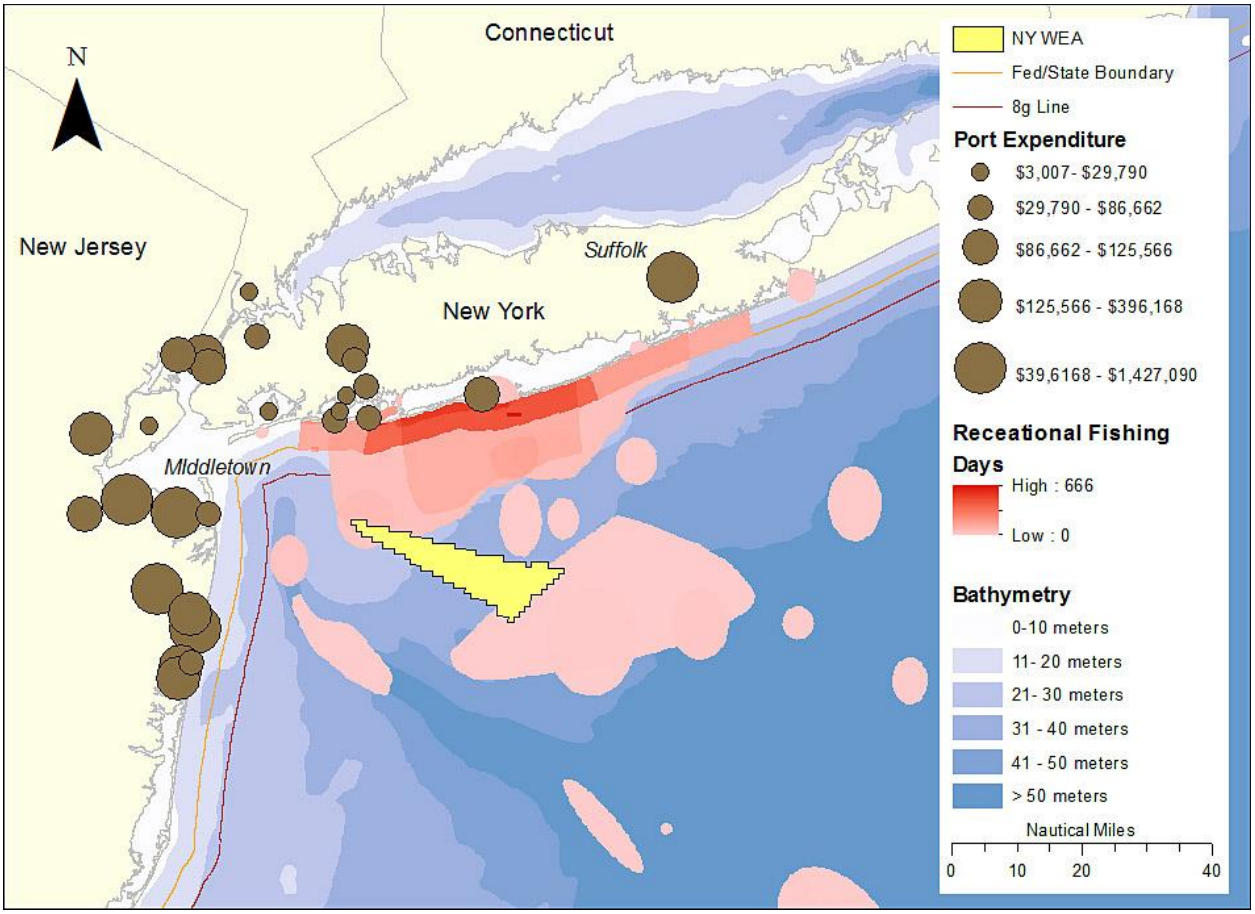


Figure 4-21 Recreational Fishing Activity and Port's Expenditures in Relation to the WEA

Source: NYSDOS, 2015b
Notes: Recreational fishing days spent per year in various regions were compiled to identify major recreational fishing areas. Fishing day data were collated by New York State's Department of State and NOAA's Coastal Services Center (CSC). New York and New Jersey ports' expenditures exposed to the WEA are reflected by the size of the points. Ports' map locations are approximated using the towns' or counties' general latitudes and longitudes.

Commercial Fisheries

In 2012, commercial fishermen in the Mid-Atlantic Region landed 751 million pounds of finfish and shellfish, earning $488 million in landings revenue (NOAA NMFS, 2014). Commercial fisheries indirectly support related industries, such as seafood distributers and restaurants. BOEM contracted with NMFS to characterize the commercial fishing industry in the New York Call Area (the proposed action WEA is identical to the New York Call Area). NMFS developed a statistical model to predict the spatial footprint of a fishing trip by merging vessel trip reports with data collected by at-sea fisheries observers. NMFS then linked these locations to seafood dealer reports to create revenue-intensity maps as a visual representation of the fishing harvest (DePiper, 2014).

According to the NMFS fishing revenue study, commercial fishermen sourced an average of $3.59 million annually from the New York Call Area from 2007 to 2012 (Kirkpatrick et al., 2015.). Based on analysis of NMFS data, input derived from outreach efforts with the fishing industry, and public comments, BOEM determined that the fisheries that use the area the most, based on a percentage of total revenue, are the Atlantic sea scallop and the squid, mackerel, butterfish (SMB) fisheries. Other species of commercial importance with distributions that overlap the WEA include monkfish, Atlantic herring, black sea bass, summer flounder, and scup.

The average annual scallop revenue represents more than 90 percent of the total fishing revenue sourced from the New York Call Area (Figure 4-22). During the 6-year study period, the scallop revenue from the New York Call Area ranged from $494,326 to $6 million. The average annual scallop revenue from the New York Call Area was $3.26 million, which represents 0.8 percent of the total Atlantic sea scallop revenue from the Atlantic seaboard. Much of the total scallop revenue is from regulated access areas farther offshore, such as on Georges Bank, Hudson Canyon, and the Delmarva access areas.

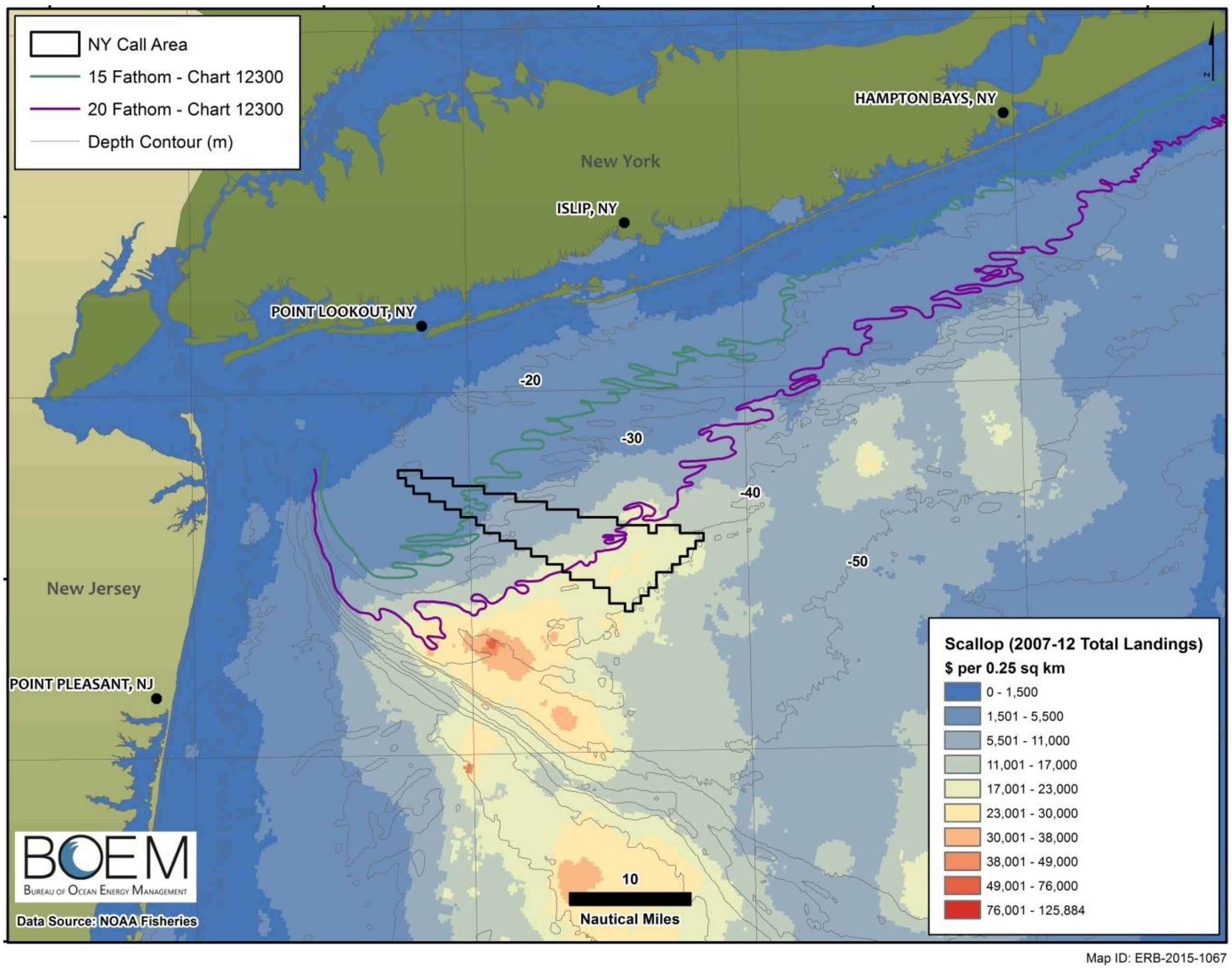


Figure 4-22 Scallop Landings in the Vicinity of the New York Call Area

The New York Call Area's annual SMB fishery revenue ranged from $71,673 to $319,686. These values equate to 0.2 and 0.7 percent of the total squid value landed from the Atlantic in those low and high years, respectively (Kirkpatrick et al., 2015). The squid fishery operates in and around the New York Call Area primarily between June and September. The fishery is highly variable regarding where the squid will occur and where they will be caught. Although the entire New York Call Area is used as a squid fishery, the primary area fished by the squid fleet is in waters less than 16 fathoms (30 m) closer to Cholera Banks.

Recreational Fisheries

Waters off New York and New Jersey are home to substantial recreational fishing activities (Figure 4-21). The WEA is adjacent to and overlaps with some reported recreational fishing ground (see Figure 4-21). The major recreational fishing areas along the south coast of Long Island are roughly 10 to 25 nm (19 to 46 km) from the WEA (Figure 4-21). NMFS described the recreational fishery as lightly overlapping the New York Call Area (Kirkpatrick et al., 2015).

Impact Analysis of Alternative A

Site characterization and site assessment activities would result in underwater noise from survey activity and the installation of piles to support the meteorological tower. The direct impact of these noise sources on fish is analyzed in Section 4.4.2.7 *Finfish, Invertebrates, and Essential Fish Habitat*. The analysis in that section concludes that impacts of low frequency sound on fish and fish populations, including SOCs such as the "soft-start" provision for pile driving, is anticipated to be negligible. BOEM does not anticipate adverse impacts from noise associated with installation of piles on fish populations that are targeted by commercial and recreational fishing groups. However, noise generated from low frequency sound, like pile driving and some survey equipment, may result in decreased catch rates of fish while the noise producing activity is occurring. Decreased catch rates may be most acute in hook and line fisheries since behavior changes may reduce the availability of the fish to be captured in the fishery (Skalski et al., 1992; Lokkeborg et al., 2012).

Routine Activities

Site assessment activities would result in underwater noise from installation of piles to support the meteorological tower. The impact of this noise source on fish is analyzed in Section 4.4.2.7 *Finfish, Invertebrates, and Essential Fish Habitat*. The analysis in that section concludes that, with the pile driving "soft-start" provision, underwater noise impacts on fish would be expected to be **negligible**. Based on this analysis, BOEM does not anticipate adverse impacts from noise associated with installation of piles on fish populations that are targeted by commercial and recreational fishing groups. However, noise generated from low frequency sound, like pile driving, may result in decreased catch rates of fish while the construction activity is occurring. Decreased catch rates may be most acute in hook and line fisheries since behavior changes may reduce the availability of the fish to be captured in the fishery (Skalski et al., 1992; Lokkeborg et al., 2012).

The increase in vessel traffic associated with installation, maintenance, and decommissioning of a meteorological tower and/or buoys could potentially deter commercial and recreational fishermen from using the area around the tower or buoys while work-related vessels are in the area. To avoid collisions and gear entanglement with vessels, commercial and recreational fishermen may temporarily move to other locations. As noted by BOEM (2014b; 2014d), the tower and buoys could provide previously unavailable habitat for species that prefer structured and hardbottom habitats, creating a temporary increase in these types of fish in the area of the tower or buoy while the structure is in place. This could have a temporary beneficial effect to commercial and recreational fisheries, depending on the species of interest and the fishing gear used. Commercial fisheries in areas adjacent to the WEA are more productive than the commercial fisheries in the WEA (Kirkpatrick et al., 2015), so the temporary increased vessel traffic associated with site assessment is expected to be **minor**. Similarly, most coastal recreational fishing for New York and New Jersey takes place away from the WEA (Figure 4-21), and impacts of increased vessel traffic are anticipated to be **negligible**.

Impacts from seafloor disturbances are anticipated to be **negligible** to **minor** for commercial and recreational fisheries. As described Sections 4.4.2.3 *Benthic Resources* and 4.4.2.7 *Finfish, Invertebrates, and Essential Fish Habitat*, mollusks, such as scallops, would likely be adversely affected in the immediate area of the tower foundations and/or buoy moorings and suffer from suspended sediment during the construction process. BOEM anticipates that impacts on commercial fishing from seafloor disturbances would be **negligible** and impacts on recreational fishing would be **minor**.

Exclusion zones are typically established around large and/or slow work-related vessels (referred to as "source vessels"; e.g., barges and tow vessels) to maintain safe passage of the source vessel and by keeping it clear of other vessel traffic. Temporary adverse impacts expected to result from vessel traffic and/or vessel exclusion zones could be avoided by recreational anglers because these user groups tend to use smaller boats that are more maneuverable; therefore, avoidance of survey vessels could be achieved as needed (BOEM, 2014a). Impacts would be limited geographically to the vessel exclusion zone and would be temporary at any given location since the exclusion area would move along with the movement of the vessel. Temporary exclusion zones would also be established around the meteorological tower during construction and decommissioning. During construction/decommissioning, BOEM anticipates that the typical temporary vessel exclusion zone around a 377 ft (115 m) tall meteorological tower would be approximately 162 ac (66 ha) (BOEM, 2015a). Impacts on recreational fishing could be greater if the exclusion zone is established over a popular and/or critical sport fishing location, such as one that may coincide with the migration route of a target fishing species. Impacts on recreational boating and fishing from temporary vessel exclusion zones are expected to be **negligible**, and impacts on recreational boating and fishing from temporary exclusion zones are expected to be **minor**.

Non-Routine Events

Accidental oil spills from damaged gear or machinery (e.g., vessels, generators, pile driving hammers) associated with site assessment could directly affect commercial and recreational fisheries by contaminating fish and gear and interfering during cleanup and recovery operations, or indirectly affect fisheries by temporarily degrading fishing habitat. Spills could result from severe weather damage to vessels or the tower/buoys, from vessel collisions/allisions, or during generator refueling. However, as noted in the G&G Final PEIS (BOEM, 2014a), the impact of a spill on commercial and recreational fishing activity would largely depend on the size of the spill. The effects would be detrimental to commercial and recreational fisheries if they led to declines in target species. While such spills are hard to predict, based on the structures and vessels associated with the activities, the potential for oil spills, and the size of these spills, the impact to commercial recreational fisheries from non-routine events is expected to be **negligible**.

Conclusion

Overall, impacts to commercial and recreational fisheries under Alternative A would be **minor**. Impacts would range from **negligible** to **minor** depending on the fishery and proposed action activity. **Minor** impacts are expected based on the low level of vessel traffic activity associated with site characterization and site assessment activities, the fact that one meteorological tower and/or two buoys would be installed over a relatively large geographic area, the level and duration of sound produced from routine activities and events, and the low likelihood of potential impacts from disturbances and pollution.

4.4.3.6 Visual Resources

The analysis area for visual resources includes a 27 mi (43 km) buffer around the WEA, cropped at 0.25 mi (0.4 km) inland from the shoreline (Figure 4-23). The 27 mi (43 km) buffer was selected because this buffer represents the distance at which the tip of a meteorological tower measuring 394 ft (120 m) would drop below the horizon, thereby precluding any potential view of the structure. The onshore analysis area was restricted to within 0.25 mi (0.4 km) of the shoreline based on the likelihood for potential views of the project area to be blocked by vegetation, buildings, or other structures. This area includes portions of Long Island, New York, and New Jersey.

Description of the Affected Environment

The landscape character of the analysis area is a combination of beaches, communities, and industry. In general, the seascape appears large in scale, panoramic, and dominated by the broad horizontal plane of the Atlantic Ocean. Dominant colors in the landscape include the varied blue tones of the ocean and sky, the pale tan of the sandy beach, and the greens of upland vegetation. The horizon appears pale tan/white as a result of the atmospheric haze and sea spray. No major structures exist on the horizon, though commercial and recreational boat traffic is common.

Throughout the analysis area, observers experience the seascape from both a stationary and mobile observer position. Observer geometry relative to the WEA is typically at grade, where seascape views are intermittently blocked by dunes, coastal vegetation, and structures. Superior observer positions occur from lighthouse decks situated throughout the analysis area. Views from these locations are not obstructed, and are limited only by the curvature of the earth and light refraction.

Key Observation Points (KOPs) considered representative of the varied character of the seascape and typical observer experience were established within the analysis area to establish baseline conditions within the affected environment (Figure 4-23). The KOPs were selected based on consideration of the following criteria: proximity to the WEAs, availability of open views of the ocean and horizon, high public use and visitation, historical significance and sensitivity of the sites, and inclusion of views available from both the ground and elevated vantage points. Landscape character and observer experience at each of the KOPs is described in Appendix F.

Impact Analysis of Alternative A

Potential impacts to visual resources were assessed for site characterization activities (i.e., surveys) and site assessment (i.e., the construction and operation of a meteorological tower and/or buoys).

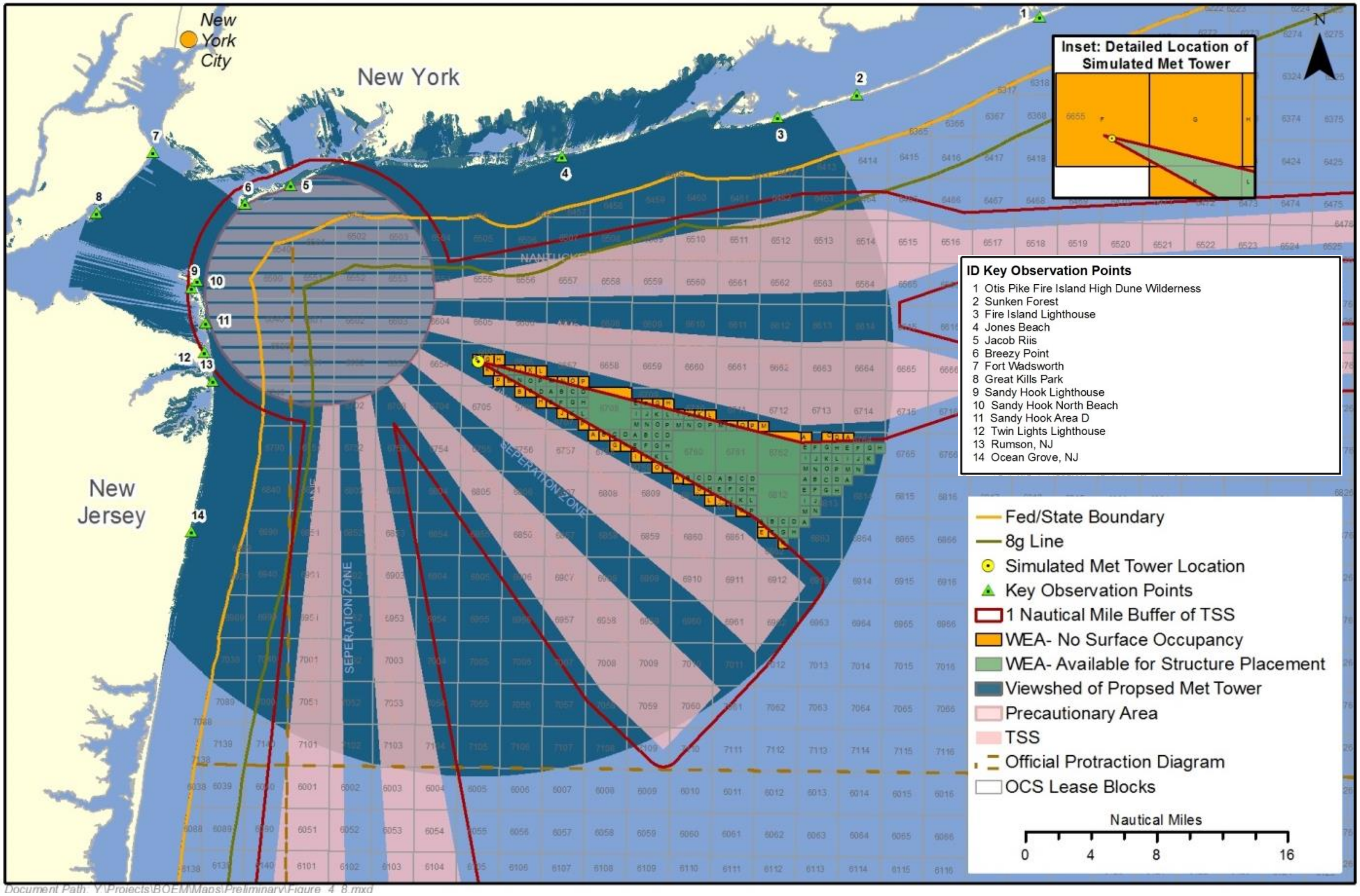


Figure 4-23 Meteorological Tower Viewshed and Key Observation Points

Methodology

Impacts to scenic quality and landscape character were evaluated from 14 KOPs located in coastal areas of New York and New Jersey (Figure 4-23) using the Bureau of Land Management's Contrast Rating System (BLM, 1986). The Contrast Rating System describes adverse effects to visual resources as a function of the visual contrast between the proposed action and the existing landscape character. Visual contrast is classified as follows:

- **None:** Project features are not visible or perceived.
- **Weak:** Project features can be seen but do not attract attention.
- **Moderate:** Project features begin to attract attention and dominate the characteristic landscape.
- **Strong:** Project features demands attention, would not be overlooked, and are dominant in the landscape.

Visual contrast of site characterization and assessment activities was assessed for day and night conditions. This assessment was based, in part, on information presented in the G&G Final PEIS (BOEM, 2014a), which analyzed impacts to visual resources that may result from site characterization activities.

BOEM assumed the following in the visual analysis:

- The height of the meteorological tower measured 394 ft (120 m) above mean sea level, including a 49 ft (15 m) high antenna mounted at the top of the structure.
- The closest viewer receptor would be Jones Beach, as represented by KOP 4 (Figure 4-23).
- Construction and operational nighttime lighting of a meteorological tower would be designed in accordance with FAA (2015), as described in detail in Appendix D.

For the purpose of photosimulations, the meteorological tower was placed at the western-most tip of the WEA, 13.5 nm (25 km) from the shoreline, which is the closest location to land that a meteorological tower could be installed under the proposed action. This location assumes the highest potential visibility of the meteorological tower from a shoreline viewer location.

Per FAA (2015), two lighting scenarios could be applied to the meteorological tower:

- **Lighting Option 1**: Red lights (L-864), mounted at the top and incrementally along the structure, with the structure painted with red/white bands; or,
- **Lighting Option 2**: A duel lighting system that includes red lights (L-864) for nighttime, and medium intensity, white lights (L-865) for daytime and twilight use. This option would remove the requirement for painting the structure.

Photosimulations of a meteorological tower 13.5 nm (25 km) from the shoreline, viewed from the closest KOP (Jones Beach, KOP 4 on Figure 4-23), are provided in Appendix F. The photosimulations use lighting standards described in Lighting Option 1. Visibility of the meteorological tower, and related viewshed impacts, would be reduced if the tower was installed at a greater distance from the shoreline.

Routine Activities

The extent to which routine activities associated with site characterization and assessment are visible from shoreline and/or inland locations would depend to some extent on the relationship between the height of the structure (meteorological tower or buoy; vessel) and its distance from the shoreline, as curvature of the earth could cause the structure to drop below the horizon when viewed from KOPs. For example, assuming a height of 394 ft (120 m), the tip of the meteorological tower would drop below the horizon at a distance of 23.5 nm (43.5 km) (Figure 4-24). Survey vessels characterized by a lower height would drop below the horizon at a closer distance than that described for the meteorological tower.

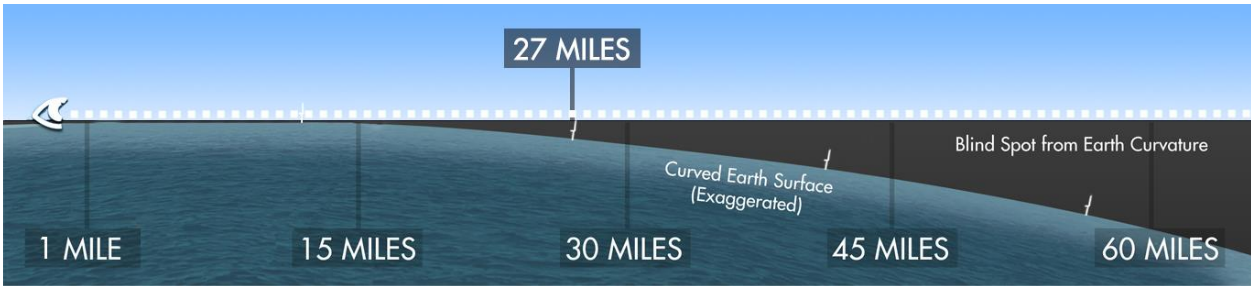


Figure 4-24 Distance at Which the Proposed Meteorological Tower Would Drop Below the Horizon Based on a Height of 394 ft (120 m)

Site Characterization Activities

Site characterization activities would result in additional vessel traffic between the shore and the WEA and therefore new sources of offshore nighttime lighting on the vessels if surveys are conducted at night. BOEM anticipates that only one to three vessels would be active within the WEA at any given time for site characterization. Given the relatively low stature (height) of these vessels, it is likely that vessels within the WEA and the TSSs would not be visible from the shoreline or inland locations, as vessels would drop below the horizon due to curvature of the earth. Consequently, survey vessels and related traffic would not be visible or perceived (no visual contrast). Impacts to visual resources from site characterization activities would be **negligible**.

Site Assessment Activities

Meteorological buoys are not expected to be visible or perceived from the shoreline because their height above the water surface would be low in stature, thus falling below the horizon when viewed from KOPs.

Under Alternative A, the meteorological tower could be placed at a minimum of 13.5 nm (25 km) offshore from the nearest viewer receptor (KOP 4, Jones Beach; Figure 4-23). Under daytime conditions, the meteorological tower could be seen but would be difficult to detect (weak visual contrast). If the meteorological tower was viewed from a higher elevation vantage point (such as a lighthouse observation deck) it would be easier to detect; however the tower would not attract attention or appear dominant in the view (weak visual contrast) (Appendix F, Photosimulations). Potential visibility of the tower would decrease with distance from the shore due to the influence of atmospheric haze and the reduction in scale of the tower relative to the surrounding seascape.

Should Lighting Option 2 (red lights for nighttime and medium intensity, white lights for daytime and twilight use) be applied, the daytime lighting could increase visual contrast of the tower to a moderate level, thereby increasing overall viewshed related impacts experienced under daylight conditions. Nighttime lighting under Lighting Option 2 could be visible from shore, but would not dominate the view (weak visual contrast). Lighting would appear discrete and isolated, consistent with existing nautical lighting.

Impacts to visual resources from site assessment activities would be **minor**.

Non-Routine Events

There would be **negligible** impacts from non-routine events such as allisions/collisions and spills on the visual resources of the WEA.

Conclusion

BOEM anticipates that the overall impacts to visual resources from the proposed action would be **minor** because a meteorological tower may be detected under daytime and nighttime conditions. BOEM does not anticipate that meteorological buoys could be seen from the shoreline. A meteorological tower may be visible if installed at the closest point possible to the shoreline, approximately 13.5 nm (25 km) from KOP 4 (Jones Beach on Long Island). If detected, the structure would appear small in scale relative to the broad horizon of the seascape, and visual contrast would be weak. Nighttime lighting on the meteorological tower would appear similar to lights visible from existing vessel traffic. No lighting would be visible if the tower was placed beyond 23.5 nm (44 km), because the entire meteorological tower would fall below the horizon.

Vessel activity in the WEA and TSSs associated with site characterization and site assessment activities is not likely to be visible or perceived from land-based KOPs because: (1) the distance of the activity from the shoreline and the likelihood vessels would be below the horizon, and (2) the small increase in vessel traffic anticipated as a result of the proposed action relative to existing levels.

4.5 Alternative B – Leasing of the Whole Wind Energy Area Restricting Site Assessment Structure Placement Within 2 Nautical Miles of a TSS

Under Alternative B, BOEM would not allow construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys) within 2 nm (3.7 km) of the two TSSs that border the WEA (Figure 2-2). The area available for leasing, and the area that would likely be surveyed, is the same area as considered under Alternative A (*see* Section 2.2 *Alternative B* for further details).

The area available for site assessment facilities under Alternative B is approximately 37 percent of the area of the Alternative A; however, BOEM assumes that all survey activities would take place over the entire WEA. While site assessment activities (installation of up to one meteorological tower and/or two buoys) would occur in a smaller area than in Alternative A, the level of those activities would be the same as Alternative A, therefore, the vessel traffic and impacts associated tower and/or buoy installation, operations and maintenance, and decommissioning would be similar to Alternative A.

4.5.1 Physical Resources

4.5.1.1 Air Quality

Reducing the area available for the placement of site assessment facilities would not change impacts to air quality, therefore, all assumptions for air quality listed in under Alternative A in Section 4.4.1.1 *Air Quality*) are the same for Alternative B. Results from the Alternative A analysis (Section 4.4.1.1) indicate that emissions from the proposed action would not be expected to lead to a violation of the NAAQS. Thus, total emissions and any effects on air quality would be the same for Alternative B, and are not expected to lead to any violation of the NAAQS. Although the emissions estimates from site characterization and site assessment activities are measurable, they would not be distinguishable from other air emissions onshore or offshore; therefore, emissions associated with Alternative B would be **negligible**.

4.5.1.2 Water Quality

BOEM anticipates that overall impacts to water quality under Alternative B would be **minor**. Site characterization and site assessment activities and non-routine events (such as spills) under Alternative B would be similar to those described for Alternative A and impacts to water quality from Alternative B would be **minor**, localized and transient. Alternative B would have similar vessel traffic to Alternative A and the potential for a release/spill associated with vessels conducting site characterization and site assessment activities under Alternative B would be no different than Alternative A.

4.5.2 Biological Resources

4.5.2.1 Birds

Although impacts on birds would range from negligible to minor, depending on the survey activities being conducted and the type of site assessment facility installed, overall, impacts to birds under Alternative B would be **minor**. As described for Alternative A in Section 4.4.2.1 *Birds*, BOEM anticipates negligible impacts from vessel traffic, loss of water column habitat, benthic habitat, and associated prey abundance, surveying activities, and noise associated with decommissioning of a tower and/or buoys. BOEM anticipates minor impacts on birds from noise impacts during construction and from the risk of collision with a meteorological tower. Like Alternative A, BOEM's SOCs for birds (Appendix B, Section B.6) are included in Alternative B.

4.5.2.2 Bats

Impacts to bats under Alternative B would be the same as those described for Alternative A; therefore, impacts on bats under Alternative B would be **negligible**. Like Alternative A, the SOCs for birds (Appendix B, Section B.6), including lighting restrictions and prohibition on guy wires, are included in Alternative B.

4.5.2.3 Benthic Resources

Overall impacts from Alternative B to benthic resources would be **minor**. The distribution of benthic habitats within the WEA is relatively mixed, and thus, the reduced area available for site assessment activities associated with Alternative B is not expected to affect a substantially different composition of habitat types. The amount of benthic habitat and organisms affected from installation of a meteorological tower and/or two buoys would be the same as Alternative A. Thus, little to no difference in impacts between Alternatives A and B is expected. Under both alternatives, the primary benthic species affected would be soft-bottom invertebrates other than corals.

4.5.2.4 Coastal Habitats

Overall, the impacts to coastal habitats from Alternative B would be **negligible**. Impacts to coastal habitats from site characterization and site assessment activities, and thus the use of existing port facilities, and vessel traffic associated with site characterization and site assessment would be similar to impacts described for Alternative A. Indirect impacts expected from wake-induced erosion, increased turbidity, vessel collisions and spills under Alternative B would be similar to impacts described for Alternative A (characterized as negligible).

4.5.2.5 Marine Mammals

Although impacts to marine mammals would range from **negligible** to **moderate**, depending on the survey activities being conducted and the type of site assessment facility installed, overall, impacts to marine mammals under Alternative B would be **moderate** due to potential acoustic impacts during pile driving activities. The prohibited construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys) within 2 nm (3.7 km) of the two TSSs that border the WEA could decrease the risk of a collision or allision and any resultant fuel spill that could impact marine mammals. However the risk of fuel spills occurring and contacting a marine mammal are low. The impacts to marine mammals from Alternative B are not expected to measurably increase or decrease from the impacts described for Alternative A. Any impacts related to site assessment and site characterization activities are expected to be no different under Alternative B compared to Alternative A. Like Alternative A, BOEM's SOCs related to site characterization surveys (Appendix B, Section B.3) and site assessment (Appendix B, Section B.4) to minimize the potential for impacts to marine mammals are included in Alternative B.

4.5.2.6 Sea Turtles

Although impacts on sea turtle would range from negligible to minor, depending on the survey activities being conducted and the type of site assessment facility installed, overall, impacts to sea turtles under Alternative B would be **moderate**. The prohibited construction or placement of site assessment structures (i.e., a meteorological tower and/or two buoys) within 2 nm (3.7 km) of the two TSSs that border the WEA could decrease the risk of a collision or allision and any resultant fuel spill that could impact sea turtles. However the risk of fuel spills occurring and contacting a sea turtle are low. The impacts to sea turtles from Alternative B are not expected to measurably increase or decrease from the impacts described for Alternative A. Any impacts related to site assessment and site characterization activities are expected to be no different under Alternative B compared to Alternative A. Like Alternative A, BOEM's SOCs related to site characterization surveys (Appendix B, Section B.3) and site assessment (Appendix B, Section B.4) to minimize the potential for impacts to sea turtles are included in Alternative B.

4.5.2.7 Finfish, Invertebrates, and Essential Fish Habitat

Site characterization and site assessment activities under Alternative B would be similar to those described for Alternative A. Therefore, impacts to finfish, invertebrates, and EFH under Alternative B would be similar to the impacts described under Alternative A, which BOEM determined to be **minor** overall. Impacts from noise associated with pile driving and a potential fuel spill are expected to be minor; all other impacts such as increases in suspended sediment, loss of benthic habitat, displacement, or alteration of water column habitat, are expected to be negligible.

4.5.2.8 ESA-Listed Fish Species

Overall, impacts to ESA-listed fish species would be **minor**. As with Alternative A, installation of a meteorological tower would require pile driving, which could result in minor effects to Atlantic Sturgeon other site assessment activities are expected to have negligible impacts on these species. Impacts to ESA-listed fish as a result of the site characterization would be negligible.

4.5.3 Military Use and Navigation/Vessel Traffic

4.5.3.1 Military Use

As with Alternative A, site-specific coordination with DOD would be required to minimize multiple use conflicts on the OCS in and around the WEA. The level of site characterization and assessment activities would also be the same as Alternative A; therefore, impacts on military use under Alternative B are also expected to be **negligible**.

4.5.3.2 Navigation/Vessel Traffic

Under Alternative B, the same amount of vessel traffic would be associated with site assessment activities as Alternative A. Adherence by these vessels to navigation regulations would minimize navigational risk. Alternative B accommodates the USCG's MPG recommendation of a 2 nm (3.7 km) buffer from the outer edge of a TSS for permanent structures to allow larger ships to maneuver and to stop and anchor in emergency situations (USCG, 2016). In addition, the USCG asked for a 5 nm (9.3 km) buffer from the entry/exit of the TSS lanes, which was not included in Alternative B. The USCG identified structures placed beyond these suggested buffers as having a medium risk for allision. Under Alternative B, there would be lower risk for allision within 2 nm (3.7 km) of the TSSs. Similar to Alternative A, a meteorological tower and/or buoys would be mitigated by USCG-required marking and lighting. Impacts on navigation due to increase in vessel traffic and the addition of a meteorological tower and/or buoys are expected to be **minor.**

4.5.4 Socioeconomic Resources

4.5.4.1 Cultural, Historical, and Archaeological Resources

Overall, impacts to cultural, historical, and archaeological resources under Alternative B would be **minor**. The area that may be affected by site characterization activities would be the same as Alternative A, and BOEM would require the survey and avoidance measures outlined in Section 4.4.4.1 to reduce impacts to offshore cultural resources. Impacts from site assessment activities resulting in disturbances to the seafloor would be the same as Alternative A (which BOEM determined to be negligible). Minor visual impacts would occur to onshore cultural resources from the visibility of a meteorological tower in the WEA; however, impacts would be slightly less because a tower would be placed an additional nautical mile further offshore compared to Alternative A and therefore would be more difficult to visually detect from onshore areas compared to Alternative B.

4.5.4.2 Demographics and Employment

Impacts on demographics and employment under Alternative B would be **negligible**. The intensity of impacts on demographics and employment associated with survey and assessment activities under Alternative B would be the same as for Alternative A. As with Alternative A, there would be short-term beneficial impacts on employment.

4.5.4.3 Environmental Justice

As with Alternative A, no high and adverse human health or environmental effects that would disproportionately affect low-income and minority persons would occur under Alternative B, and there would be **no impacts** on environmental justice.

4.5.4.4 Recreation and Tourism

Impacts on recreation and tourism from Alternative B would be **negligible**. Impacts on nearby coastal areas would be slightly less than under Alternative A since the closest point to shore that a meteorological tower could be installed would be about 1 nm (1.9 km) farther offshore compared to Alternative A (due to the 2 nm [3.7 km] TSS buffer). Since the same level of site characterization and assessment activities would occur, impacts from the generation of trash and debris and from accidental diesel fuel spills would be the same as under Alternative A.

4.5.4.5 Commercial and Recreational Fisheries

Impacts to commercial and recreational fisheries under Alternative B would be **minor**. The amount of vessel traffic associated with site characterization is anticipated to be the same as Alternative A, for which BOEM determined would be minor to commercial and recreational fisheries. Although the area available for site assessment activities is reduced, the level of impact to commercial and recreational fisheries as described under Alternative A would remain unchanged. BOEM determined these impacts to be minor.

4.5.4.6 Visual Resources

Because the closest point that a meteorological tower could be installed in the WEA would be about 1 nm (1.9 km) farther offshore compared to Alternative A (due to the 2 nm [3.7 km] TSS buffer), effects on visual resources from Alternative B would be slightly less than for Alternative A. Because impacts on visual resources under Alternative A are expected to be minor, impacts under Alternative B would also be **minor.**

4.6 Alternative C – No Action

Under the No Action Alternative, BOEM would not issue a commercial wind energy lease and no site assessment activities would be approved in the WEA offshore New York. This would eliminate vessel traffic associated with site assessment (construction and installation of a meteorological tower and/or buoys). Site characterization surveys are not under BOEM's jurisdiction[18] and could still be conducted; however, a potential lessee is not likely to undertake these activities without the possibility of a commercial wind energy lease. For purposes of this analysis, BOEM therefore assumes that such activities would not take place.

4.6.1 Physical Resources

Under the No Action Alternative, there would be no activity that requires emission-producing vehicles such as pile drivers associated with installation of a meteorological tower, or survey vessels, or vessels associated with installation, operation, and decommissioning of a tower or buoys; therefore, there would be **no impacts** on air quality.

Under the No Action Alternative, there would be no activity that could affect water quality such as turbidity during installation and decommissioning of a meteorological tower or buoy, or fuel spills or waste discharges from vessels. Therefore, there would be **no impacts** on water quality.

4.6.2 Biological Resources

Under the No Action Alternative, there would be no activities such as vessel traffic, acoustic disturbances from pile driving associated with installation of a meteorological tower, or fuel spills that could result in impacts on birds, bats, benthic organisms, coastal habitats, marine mammals, sea turtles or fish; therefore, there would be **no impacts** on biological resources. Although site characterization surveys are not under BOEM's jurisdiction[18] and could still be conducted, BOEM assumes that a lessee would not conduct biological surveys in the WEA. Therefore, under this alternative the collection of data related to protected species that could be used to assist in future analyses of offshore activities, development of additional avoidance and minimization measures, as well as gaining a better understanding of habitat utilization in the New York Bight, would not occur.

[18] At this time, BOEM does not issue permits for site characterization activities that are conducted on unleased or ungranted areas of the OCS as it does for oil and gas and minerals under the authority of section 11 of the OCS Lands Act.

4.6.3 Military Use and Navigation/Vessel Traffic

Under the No Action Alternative, there would be no military space-use conflicts, and no vessel traffic above existing conditions. Therefore, there would be **no impacts** on these resources.

4.6.4 Socioeconomic Resources

Under the No Action Alternative, there would be no activities that disturb the seafloor, and therefore no impacts on offshore cultural, historical, or archaeological resources. There would be no additional vessel traffic above existing conditions and no installation of a meteorological tower, and thus no potential impacts to the viewshed; therefore, there would be no visual-related impacts on onshore historic properties or recreation and tourism. Demographics, employment, and environmental justice would not be affected. Therefore, there would be **no impacts** on socioeconomic resources.

4.7 Cumulative Impacts

Cumulative impacts are the incremental effects of the proposed action on the environment when added to other past, present, or reasonably foreseeable future actions taking place within the region of the WEA, regardless of which agency or person undertakes the actions (see 40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a given period. This EA identifies potential cumulative impacts over the life of the proposed action, which BOEM anticipates could reasonably occur between 2017 and 2023.

BOEM used a localized geographic scope to evaluate cumulative impacts for resources that are fixed in nature (i.e., their location is stationary such as benthic and archaeological resources), or for resources where impacts from the proposed action would only occur in waters in and around the New York WEA (e.g., water quality). This includes potential activities that would occur on the Atlantic OCS offshore New York, New Jersey, Rhode Island, and Massachusetts as well as activities that would take place in state waters (Figure 4-25). However, the geographic boundaries for the analysis for marine mammals, sea turtles, fish, and birds include the entire U.S. East Coast given their migratory nature. Given the broader geographic scope for these resources, BOEM also considered the impacts associated with the Virginia Offshore Wind Technology Advancement Project, given that the project was recently approved by BOEM.[19]

Activities that would result in impacts and impact-producing factors associated with the proposed action are summarized below.

Onshore activities supporting the proposed action that could result in impacts include tower and/or buoy staging, and loading and launching of support vessels. Potential impact-producing factors associated with these activities include vessel traffic, trash and debris, operational

[19] More information is available on BOEM's website at http://www.boem.gov/VOWTAP/.

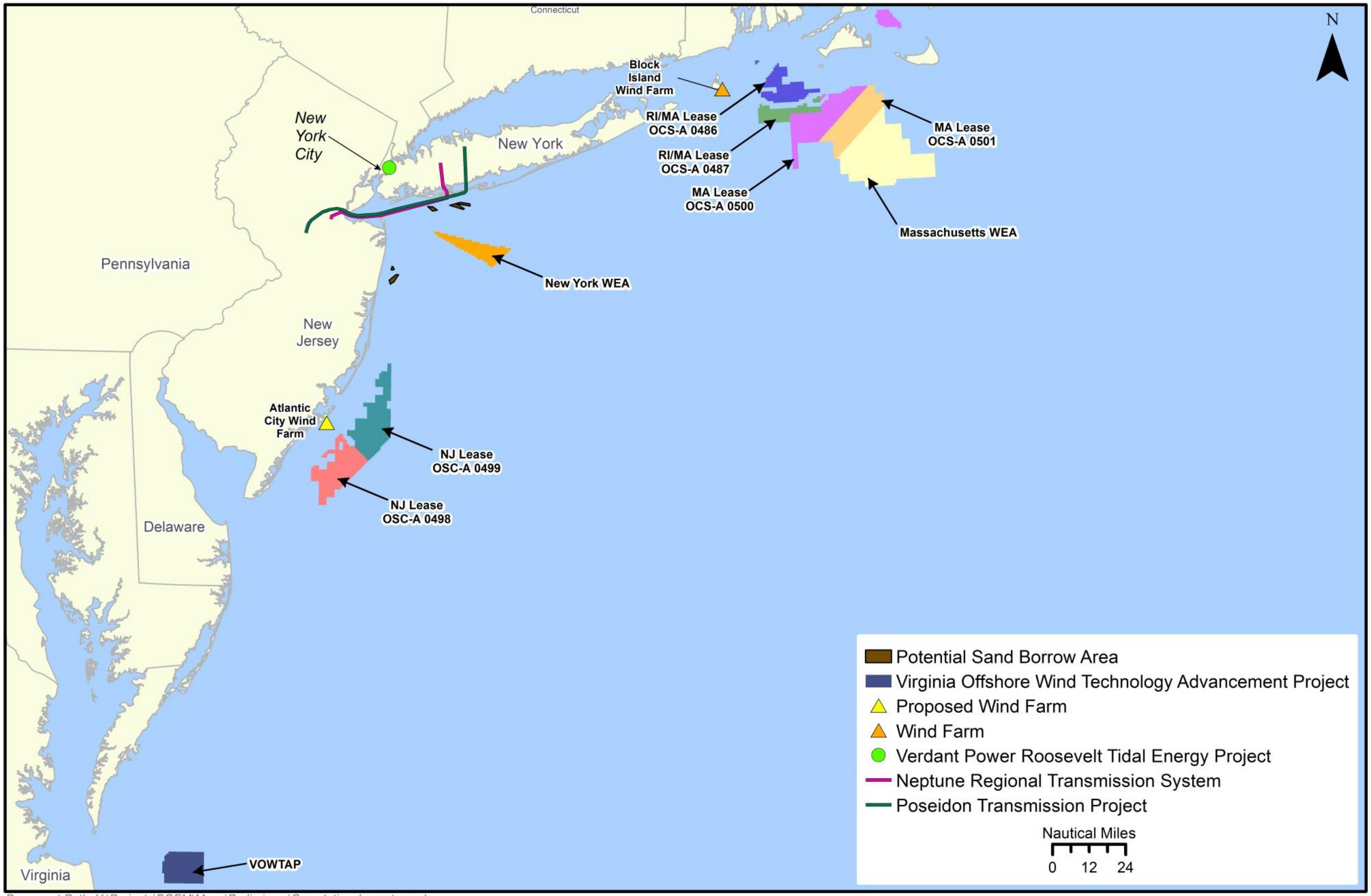


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Figure 4-25 Cumulative Activities and Projects

discharges from vessels, fuel spills, and viewshed effects from a meteorological tower. Effects associated with vessel traffic and vessel use are the primary contributor to potential onshore cumulative effects.

Offshore activities supporting the proposed action that could result in impacts include vessel traffic during site characterization, site assessment, and the installation and decommissioning of a meteorological tower and/or buoys. Potential impact-producing factors associated with these activities include underwater acoustic disturbances from vessels and installation activities (i.e., pile driving); vessel discharges; bottom disturbance during geotechnical surveying and sampling, anchoring, and structure placement; collision risk from an increase in vessel traffic and structure placement; and space-use conflicts. Impacts from installation and decommissioning would be a short-term (between 1 to 10 weeks for installation and approximately 1 week for decommissioning of a tower), while impacts associated with ongoing vessel traffic throughout the 5-year site assessment term of the proposed action, would have a longer duration.

4.7.1 Past, Present and Future Reasonably Foreseeable Activities and Projects

This section includes a list of the projects that BOEM has identified as potentially contributing to cumulative impacts when combined with impacts from the proposed action over the geography and time scale described above. Cumulative projects and activities, which are discussed below, include seven types of actions: (1) wind energy development (site characterization surveys, site assessment, construction and operation of wind turbines); (2) hydrokinetic projects; (3) undersea transmission lines; (4) marine minerals use and ocean dredged material disposal; (5) military use; and (6) marine transportation, and (7) fisheries management. Figure 4-25 shows some of the reasonably foreseeable cumulative actions in the vicinity of the WEA, which are discussed in this section.

4.7.1.1 Wind Energy Development Including Site Characterization and Assessment Activities

Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision making process (see Section 1.1.1) and occurs over several years with varying impacts.

Site Characterization Surveys and Site Assessment Activities

A holder of a BOEM OCS lease can evaluate the meteorological conditions, such as wind resources, with the approved installation of meteorological towers and/or buoys. Further, a lessee is required to provide the results of site characterization activities (shallow hazard, geological, geotechnical, biological, and archaeological surveys) with its SAP or COP. The reasonably foreseeable consequence of issuing these leases is site characterization. For those lessees with submitted SAPs, site assessment activities are also considered in this cumulative analysis.

BOEM has leased the following areas on the Atlantic OCS in the region of the New York WEA.

- Massachusetts Lease Areas: BOEM issued two commercial wind energy leases in April 2015; one to RES America Developments, Inc. for Lease Area OCS-A 0500 (187,523 ac [75,888 ha]) and another to Offshore MW LLC for Lease Area OCS-A 0501 (166,886 ac [67,536 ha]). The lessees were required to submit their SAPs by April 1, 2016. On June

12, 2015, BOEM approved the assignment of Lease Area OCS-A 0500 from RES America Developments, Inc. to DONG Energy. DONG Energy has since renamed its American subsidiary and the project Bay State Wind. Both Bay State Wind and Offshore MW LLC have requested, and BOEM has approved, 12 month extensions of the preliminary terms to April 1, 2017. Bay State Wind plans to begin their SAP surveys in fall of 2016.

- Massachusetts/Rhode Island Lease Areas: In September 2013, BOEM issued commercial wind energy leases OCS-A 0486 and OCS-A 0487 (north and south, respectively) to Deepwater Wind New England, LLC. For the north lease area, Deepwater Wind submitted a SAP on April 1, 2016 for the installation of a meteorological buoy. As of April 2014, Deepwater Wind informed BOEM that they do not intend to conduct site assessment in the south lease area.
- New Jersey Lease Areas: BOEM issued two commercial wind energy leases in March 2016 for the 343,833 acre (139,145 ha) WEA offshore New Jersey; one to RES America Developments, Inc. for Lease Area OCS-A 0498 for the southern part of the WEA, and one to US Wind, Inc. for Lease Area OCS-A 0499 in the northern part of the WEA. The lessees are required to submit a SAP by March 2017. However, US Wind has requested and BOEM has approved an extension of 12 months, to submit their SAP by March 2018.

Activities and potential impacts associated with BOEM OCS leases identified above would be similar to those considered under the proposed action in this EA.

Construction and Operation of Wind Turbines

This EA will not consider the cumulative impacts of the potential construction of wind energy facilities in the Massachusetts/Rhode Island, New Jersey, or Massachusetts lease areas, nor within the New York WEA. BOEM takes this approach based on several factors.

As stated in Section 1.4.2, *Scope of Analysis*, BOEM has received no project proposals (in the form of a COP) for any of the above-listed leases or potential leases. Given the nascent nature of the offshore wind industry and market uncertainties, it is speculative at this time whether projects will be proposed at all within these areas. Second, even assuming that projects are proposed, the parameters of such project are unclear. BOEM has considered the experiences of the wind industry offshore northern Europe, which has seen rapidly changing technology and numerous project designs. The project design and the resulting environmental impacts are often geographically and design specific, and it would therefore be premature to analyze environmental impacts related to potential approval of any future COP at this time (Musial and Ram, 2010; Michel et al., 2007). Since none of the lessees have submitted a COP on the above leases, this cumulative analysis does not consider commercial-scale development in the adjacent OCS leases. Additional analyses under NEPA would be required before any future decision is made regarding construction of wind energy facilities on the OCS.

Therefore, BOEM limits its cumulative analysis of construction and operation of wind turbines to two wind farms in the region of the New York WEA that have been proposed in State waters and installation and operation of two wind turbines, which has been approved offshore Virginia in federal waters.

- Block Island Wind Farm, Rhode Island: Deepwater Wind is installing five wind turbines in State waters. Construction on the Block Island Wind Farm began in 2015 with installation of the turbine foundations. It is expected that submarine cable installation will begin in spring 2016, the five wind turbines will be erected in summer 2016, and the wind farm will be in-service and generating power in the fourth quarter of 2016 (Deepwater Wind, 2015). The submarine cable will pass through federal waters, so in December 2014, BOEM executed a right of way grant for the Block Island Transmission System and approved Deepwater Wind's GAP for the project, with modifications.

- Atlantic City Wind Farm, New Jersey: The Atlantic City Wind Farm has been proposed by Fishermen's Energy of New Jersey in a two-stage approach. The first stage would be in State waters 2.8 mi (4.5 km) off the coast of Atlantic City, and would consist of five wind turbines with generation capacity of 25 megawatts (MW). The second stage would be a 330 MW utility scale project in federal waters. The first phase has received nearly all permits and licenses in 2011 and 2012; however, the regulatory process to obtain approval from the New Jersey Board of Public Utilities is ongoing (Fishermen's Energy, LLC, 2016).
- Virginia Offshore Wind Technology Advancement Project: On March 24, 2016, BOEM announced it approved the Research Activities Plan for the first wind energy research lease in federal waters, which was issued to the Virginia Department of Mines, Minerals and Energy for the installation and operation of two 6 MW turbines and associated cabling to shore.

Chapter 7.6.2 of the PEIS (MMS, 2007a) discusses cumulative impacts on environmental and socioeconomic resources associated with offshore renewable energy. The main impacts associated with construction and operational activities are listed below.

<u>Construction</u>: The largest impacts are likely to come from installation of the wind turbine and electric service platform foundations and the submarine power cables. These impacts include:

- Moderate impact from noise due to short term, localized pile driving activities could occur during foundation installation.
- Disturbance of the seafloor could result in negligible to major impacts on seafloor habitat under and adjacent to the foundations and cables.
- Negligible to moderate impacts to coastal habitats (e.g., wetlands, barrier beaches) from transmission cable installation and construction of onshore facilities.
- Minor to moderate air quality impacts, mainly from fugitive dust emissions as well as emissions of SO_2 and ozone precursors.

<u>Operation</u>: Minimal maintenance vessel activity and underwater disturbance during operations is expected. Potential impacts include:

- Negligible to minor impacts from vessel traffic that could can cause noise or lead to collisions with marine mammals or sea turtles.
- Small, minor-impact spills of fuel, lubricating oil, or dielectric fluids. A larger spill of dielectric fluid stored on an electric service platform or of fuel or lubricating oil from a vessel could cause moderate to major impacts but is highly unlikely. Impacts from a spill as a consequence of a vessel collision could be moderate to major.

- Minor to moderately adverse impacts to sea turtles due to hatchling disorientation from the lighting from onshore facilities with possible major impacts on sea turtles if nests or aggregates of hatchlings are destroyed during onshore operations.
- Minor to potentially major impacts due to marine and coastal birds as well as migrating inland birds may experience turbine collisions; endangered species would be the most impacted.
- Impacts to visual resources may occur.

In general, most impacts would be negligible to moderate for construction and operation of wind energy facilities assuming that reasonable siting and mitigation measures are followed. Vessel activity on the OCS related to a wind facility is relatively low, with only a few support vessels in operation at any one time during the highest activity period (construction). Potential impacts are the highest during the construction phase, because this phase involves the highest amount of vessel traffic, noise generation, and air emissions.

4.7.1.2 Hydrokinetic Projects

There is a potential hydrokinetic energy project proposed in New York state waters (outside of BOEM jurisdiction), the Verdant Power Roosevelt Tidal Energy Project, for which a pilot commercial license was issued by the Federal Energy Regulatory Commission in January 2012 (Verdant Power Inc., 2015). Verdant Power may install up to 30 underwater turbines in the East Channel of the East River (near New York City) under this license. The project will have a phased approach and include environmental monitoring.

Reasonably foreseeable impacts of hydrokinetic projects could include (EPRI, 2012; Cada et al., 2007):

- Alteration of river/ocean bottom habitats during installation and operation;
- Creation of structural habitat in open waters or obstruction of movements/migrations of aquatic animals;
- Suspension of sediments and contaminants from deployment and operation, and erosion/scour around anchors, cables, and other structures;
- Alteration of hydraulics and hydrologic regimes (movement of devices would cause localized shear stresses and turbulence that may be damaging to aquatic organisms);
- Impacts to fish, other aquatic organisms, diving birds, and marine mammals from rotor strikes, entanglement in submerged cables, or impingement on screens used to protect the machine or reduce strikes; and
- Electromagnetic fields associated with these devices may attract, deter, or injure aquatic animals.

4.7.1.3 Undersea Transmission Lines

A cable running from the WEA into New York could overlap the existing undersea Neptune Regional Transmission System line, which is an operational high voltage direct current transmission line that extends from Long Island to New Jersey. It was completed in June 2007 and runs approximately 50 mi (80 km) underwater (Neptune Regional Transmission System, 2016). Two undersea transmission lines are currently proposed for construction in the vicinity of the WEA, the Block Island Transmission System cable that will run from Block Island to Massachusetts and potentially Rhode Island, and the Poseidon Transmission Project. The Poseidon project is a proposed 82 mi (132 km) long electrical transmission line that extends from South Brunswick, New Jersey to Long Island, New York (Poseidon Transmission Project, 2016a). As of spring 2015, the in-service date was expected to be 2020 (Poseidon Transmission Project, 2016b). Should the Poseidon Transmission Project be constructed, a cable running from the WEA to shore would likely overlap this transmission line.

Reasonably foreseeable impacts of transmission projects could include (DWBITS, 2012):

- Increased vessel traffic and associated effluent discharges, air emissions, and noise;
- Increases of accidental releases of trash and marine debris;
- Intermittent underwater noise associated with construction;
- Temporary disturbance of benthic habitat from cable installation;
- Impacts to existing telecommunication cables; and
- Temporary sediment disturbance during cable installation.

4.7.1.4 Marine Minerals Use and Ocean Dredged Material Disposal

The precursor agency to BOEM—the Minerals Management Service—identified and evaluated five potential borrow areas in the New York Bight area for beach replenishment (Byrnes et al., 2004). BOEM's Marine Minerals Program currently has one lease for a sand borrow area offshore New Jersey for the Long Beach Island, NJ project (Lease Number OCS-A-0505). The WEA does not overlap any of the potential sand borrow areas, but cable route site characterization activities could occur in the vicinity of the borrow areas. The USACE New York District has indicated potential future sand resource needs in Rockaway Beach, Long Beach, and Fire Island, NY and Sandy Hook, NJ. BOEM is also currently conducting offshore surveys to identify new sources of sand in federal waters, between 3 and 8 nm (5.5 and 14.8 km) offshore New York and New Jersey. Impacts from sand removal (i.e., seafloor disturbances) could contribute to cumulative impacts when combined with the proposed action.

EPA Region 2 is responsible for designating and managing ocean disposal sites for materials offshore in the region of the WEA. USACE issues permits for ocean disposal sites and all ocean sites are for the disposal of dredged material permitted or authorized under the Marine Protection, Research and Sanctuaries Act. There are several dredged material disposal sites in nearshore waters off New York and New Jersey that are no longer used for disposal and one active site (the Historic Area Remediation Site) located roughly 10 nm (18 km) west of the western tip of the WEA (EPA, 2016b).

Reasonably foreseeable impacts of OCS sand mining and disposal of dredge material disposal include:

- Increased seafloor disturbance, turbidity, and benthic habitat alterations;
- A risk of direct physical impacts to sea turtles;

- Increased vessel traffic and associated effluent discharges, air emissions, and noise;
- Accidental releases of trash and marine debris;
- A risk of fuel spills; and
- Increased coastal and dune habitat (which may create nesting habitat for threatened birds and turtles).

4.7.1.5 Military Use

Military activities can include various vessel training exercises, submarine and antisubmarine training, and U.S. Air Force exercises. The U.S. Navy, U.S. Army, USCG, and U.S. Air Force have major and minor military installations located along the coasts of New York and New Jersey. The USCG has a Weapons Training Area that covers a large portion of the New York WEA.

Potential impact-producing factors include:

- Acoustic stressors (e.g., sonar, explosives, air guns, noise from weapons, vessels and aircraft);
- Energy stressors (e.g., electromagnetic devices, high energy lasers);
- Physical disturbances and strike stressors (e.g., increased vessel traffic, military expended materials);
- Entanglement stressors (e.g., fiber optic cables and guidance wires); and
- Ingestion stressors (e.g., military expended materials).

4.7.1.6 Marine Transportation

More than 54,000 vessel transits (involving commercial vessels of at least 150 gross registered tons) occur at U.S. East Coast ports per year (BOEM, 2014a). Other vessels using these ports include military vessels, commercial business craft (tug boats, fishing vessels, and ferries), commercial recreational craft (cruise ships and fishing/sight-seeing/diving charters), research vessels, and personal craft (fishing boats, houseboats, yachts and sailboats, and other pleasure craft). Over the cumulative assessment time period, BOEM assumes that shipping and marine transportation activities would increase above the present level, due in part to the expansion of the Panama Canal, which is near completion and will allow larger vessels to travel through the canal. Vessels that were previously unable to get through the canal and would, therefore, dock on the West Coast and have their goods sent via truck or rail across the United States, will now be able to go through the Panama Canal and dock directly at East Coast ports, resulting in an increase in vessel traffic and the size of vessels on the East Coast of the United States. Several East Coast ports, including the Port Authority of New York and New Jersey, have been deepening harbors and expanding cargo-handling facilities to accommodate and attract the larger vessels. Work on the Panama Canal Expansion was over 95 percent complete as of November 2015 (Canal de Panamá, 2016).

Reasonably foreseeable impacts associated with increased oceanic transportation include:

- Increase in vessel traffic, including associated effluent discharges, air emissions, and noise;
- Increase in use of underused capacity at ports and creation of jobs;
- More accidental releases of trash and marine debris;
- Increased risk of fuel spills from commercial vessels; and
- Increased vessel strikes.

4.7.1.7 Fisheries Management

NMFS implements regulations managing commercial and recreational fisheries in federal waters, including those within which the New York WEA is located. Although there are several fisheries that operate in the New York WEA, the two principal fisheries that have expressed concern with activities in the vicinity of the WEA are the Atlantic sea scallop fishery and the longfin squid fishery. Management measures for the Atlantic sea scallop fishery are developed by the New England Fisheries Management Council and those for squid are developed by the Mid-Atlantic Fisheries Management Council. The governing statute for federal fisheries management is the Magnuson-Stevens Fishery Conservation and Management Act. This statute requires that fisheries be managed sustainably. The latest report from NMFS, which includes a summary of the stock status for various species, indicates that the Atlantic sea scallop fishery is not overfished (biomass is above threshold) and overfishing is not occurring (fishing mortality is below threshold) (NMFS, 2016). Although the overfishing status for longfin squid is designated as "unknown" in the report, the stock is not currently overfished. Although the annual quota for longfin squid is rarely exceeded, the fishery does regularly harvest its allowable quota in the second trimester (May to August) each year (NOAA Fisheries, 2016). Thus, harvest is constrained by regulation during that period. Reasonably foreseeable impacts from federally-regulated commercial fishing include:

- Fish mortality;
- Regulated fishing effort; and
- Vessel traffic.

4.7.2 Reasonably Foreseeable Cumulative Impacts

The impacts associated with Alternative B and the No Action Alternative would overall be less than, or identical to, the impacts for Alternative A. Therefore, this cumulative impacts analysis evaluates the cumulative impacts of Alternative A (the proposed action) when added to other past, present and reasonably foreseeable projects and activities listed in Section 4.7.1 *Existing and Future Reasonably Foreseeable Activities and Projects*.

Air Quality Including Greenhouse Gas Emissions

The spatial extent of potential cumulative air quality impacts onshore includes the New Jersey and New York coastal areas closest to the WEA. Offshore, the spatial extent includes state waters and federal waters within approximately 25 mi (40 km) of the shoreline (which includes the New York WEA) given that under the Clean Air Act, air quality emissions within

25 mi (40 km) of a state's seaward boundaries are subject to the same federal and state requirements as those that would apply if the source were located onshore.

Onshore within the analysis area, sources include transportation-related sources, which make up the largest percentage of the onshore NO_X and CO emissions. Emission contributions of NO_X and CO are associated with minor transportation/freight movement highways that service the smaller ports and cities, and the numerous railway corridors along the coast that run north-south or terminate at the coastal port cities. The major contributors to emissions of ammonia (NH3), PM_{10}, and $PM_{2.5}$ are area sources associated with population centers/activities. Area sources include home heating units, solvent utilization (architectural coatings/painting, auto refinishing, metal/wood refinishing, de-greasing, dry cleaning), petroleum storage and transport (gas stations, fuel terminals), solid waste and wastewater treatment facilities, landfills, small boilers, restaurants, outdoor grills, road dust, agricultural operations, and open burning. Major contributors of SO2 emissions are from large industrial point sources, such as electric generation units and other smaller industrial sources situated in a variety of locations along the Atlantic coast. The on-road, non-road, and area source sectors are equal contributors to anthropogenic VOC emissions, while forests, wetlands, crops, and other vegetation are contributors to biogenic VOC emissions along the Atlantic coast. Population growth and infrastructure expansion would continue to increase these pollutant sources.

Offshore there are a variety of anthropogenic pollutant sources associated with commercial marine vessels, recreational boating, military activities, and commercial fishing operations. The largest contributors to criteria pollutant emissions are commercial marine vessels. Figure 4-17 depicts commercial marine vessel traffic density within the analysis area. The colored areas are individual traces of marine vessel traffic paths with the "warmer" colors in the figure depicting higher vessel density and corresponding higher emissions, especially offshore of New York and New Jersey. Commercial marine vessels burning diesel or other fuel oil would primarily emit larger quantities of NO_X, CO, and SO2 emissions and smaller quantities of VOC, PM_{10}, $PM_{2.5}$, and NH3 emissions.

Warming of the earth's climate system is occurring, and most of the observed increases in global average temperatures since the mid-20th century are very likely due to the increase in anthropogenic greenhouse gas concentrations (USGCRP, 2014). In general, the cumulative activities would contribute to greenhouse gas (GHG) emissions, with the proposed action contributing a negligible amount (i.e., approximately 1,300 metric tons per year (see Table 4-1 in Section 4.4.1.1 of this EA). However, during the life of the proposed action, these cumulative impacts are difficult to discern from effects of other natural and anthropogenic factors. Therefore, when compared with the aggregate global emissions of GHGs, the emissions from the cumulative activities within this analysis would not be detectable.

Over the life of the proposed action, local impacts to air quality are likely to be small, incremental, and difficult to discern from effects of other pollutant sources. Onshore, transportation-related pollutant sources are the largest contributor to air quality impacts. Population growth and infrastructure expansion would continue to increase these pollutant sources. Offshore, the largest contributors to pollutant emissions are commercial marine vessels.

Although the emissions estimates from the proposed action (site characterization and site assessment activities) are measurable, they would not be distinguishable from other air emissions onshore or offshore. The additional air emissions from up to approximately 1,000 vessel round trips associated with the proposed action would be relatively small compared with the existing and projected future vessel traffic in the vicinity's heavily used waterways and ports, and would not represent a substantive incremental contribution to cumulative impacts on air quality.

Therefore, cumulative activities considered in this analysis are anticipated to result in minor impacts to air quality, with the proposed action resulting in an incremental contribution, when combined with the past, present and reasonably foreseeable future activities.

Water Quality

The reasonably foreseeable impacts to water quality in New York, New Jersey, Rhode Island, and Massachusetts federal and state waters, which is the spatial extent of the analysis area, are from vessel discharges, sediment disturbance, and potential spills associated with the cumulative activities identified in Section 4.7.1. Water quality could be affected by increased concentrations of suspended sediments in locations specific to site characterization surveys (shallow hazard, geological, geotechnical, and archaeological surveys), site assessment activities (construction and decommissioning of meteorological towers and/or buoys), the construction of wind turbines, hydrokinetic turbine construction and operation, undersea transmission line installation, deepening of ports in preparation for larger vessels associated with expansion of the Panama Canal, and marine minerals use and dredged material disposal.

Accidental spills or releases of oils and/or chemical fluids could also occur during construction, operation, and decommissioning of structures in the offshore environment. Elevated suspended sediment concentrations and increased turbidity would occur within the immediate vicinity of the cable routes and renewable energy development projects. Accidental releases and spills are unlikely; all onshore and offshore project facilities are designed with appropriate spill containment systems. All project activities would be implemented under a series of storm water management, erosion control, oil spill response, and marine trash and debris plans. Therefore, the potential that an accidental spill or release of trash and debris would have a cumulative effect on water quality is very low.

Overall, cumulative impacts to coastal and marine water quality are anticipated to be **minor** (if detectable), with any changes being small in magnitude, highly localized, and transient.

4.7.2.1 Biological Resources

The geographic boundaries for the cumulative analysis for birds, bats, marine mammals, sea turtles, and fish include the entire U.S. East Coast given their migratory nature. For benthic resources and coastal habitats, cumulative impacts would be more localized and BOEM's analysis centers on the waters in and around the NY WEA and the surrounding nearshore waters and coastlines of New York and New Jersey.

Birds

Birds in the vicinity of the WEA and surrounding nearshore waters and ports are subject to a variety of anthropogenic stressors, including collisions with manmade structures, commercial and recreational boating activity, pollution, disturbance of marine and coastal environments, hunting, habitat degradation and loss (including displacement by invasive species), predation (e.g., cats, foxes, owls, hawks), and climate change (NABCI, 2011). Migratory birds are also affected by these factors, but over a much broader geographical area. The proposed action may affect birds through tower allisions, accidental spills, noise, and other disturbances. However, because surveying activities, meteorological tower and/or buoy installation, and decommissioning activities are of short duration, and because the proposed action would result in the installation of one tower and/or two buoys over a widespread geographic area, the overall impact of the proposed action on birds would be minor.

The impacts to birds from other reasonably foreseeable activities (discussed in Section 4.7.1) are expected to occur from site characterization and site assessment activities associated with BOEM OCS leases such as construction and pile driving noise, lighting, vessel traffic, collisions with meteorological towers, and loss of habitat and associated prey. These effects would be the same as for the proposed action and would be minor. Impacts to birds from the construction and operation of wind turbines in state and federal waters, as identified in Section 4.7.1.1 above, would include noise from pile driving, impacts to wetland and barrier beach habitat from transmission line cable installation and construction of onshore facilities, vessel or turbine strikes, and small spills of fuel, lubricating fluids or dielectric fluid. Impacts to birds from hydrokinetic projects, undersea transmission cables, and marine transportation would primarily include impacts to wetland and barrier beach habitat from transmission line cable installation and construction of onshore facilities, vessel strikes, and small spills of fuel. Assuming proper siting and mitigation measures are followed, these impacts would be **negligible** to **moderate**. There is a potential for **major** impacts to some threatened and endangered species of birds from turbine strikes, disturbance of nesting areas, alteration of key habitat, or low-probability large spills of fuel or lubricating oil or dielectric fluids, because population-level impacts are possible from injury or death of individual females if population numbers are critically low. Compliance with the regulations and coordination with appropriate wildlife protection agencies would ensure that project activities would be conducted in a manner that would greatly minimize or avoid impacting these species or their habitats (see Chapter 5 *Consultation and Coordination*, of this EA).

Bats

Bats in the vicinity of the WEA are subject to a variety of anthropogenic stressors, but primarily collisions with manmade structures along the coastlines and inland areas of New York and New Jersey. Instances of bat collisions with towers are reported infrequently at terrestrial sites, and distribution and scarcity of bats in the offshore environment further reduces the potential for a collision with a comparatively small and isolated meteorological tower at least 13.5 nm (25 km) offshore under the proposed action. The SOCs for birds (Appendix B of this EA) may also reduce potential impacts on bats.

Other reasonably foreseeable activities (discussed in detail in Section 4.7.1), may impact bats in the vicinity of the WEA, primarily from collisions with installed meteorological towers, buoys and wind turbines. The distribution and scarcity of bats in the offshore environment reduces the potential for a collision and impacts to bats from these projects would be negligible, assuming proper siting and mitigation measures are followed. Therefore, the proposed action would result in a negligible incremental contribution when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **negligible** impacts to bats.

Benthic Resources

Benthic resources in the WEA and surrounding nearshore waters and the coastlines of New Jersey and New York are affected by ground-disturbing activities on the seafloor. Placement of anchors, piles, and scour protection, and piers, rock riprap, and dredging can displace, cover, or smother benthic organisms. Permanent structures such as piles and riprap result in conversion of soft sediment necessary for benthic habitat. Although conversion of soft sediment and benthic habitat is common along the coastline, it is less common offshore where the WEA is located. Sediment disturbance and conversion as a result of the proposed action would occur in the offshore environment where there is benthic habitat adjacent to the area being disturbed (i.e., near the tower foundation or buoy mooring). In areas of temporary disturbance, benthic resources typically recover in one to three years. BOEM has determined that the overall impact on benthic resources from the proposed action would be minor.

The impacts to benthic resources from other reasonably foreseeable activities discussed in detail in Section 4.7.1 are expected to occur primarily from installation and decommissioning of structures such as meteorological towers, buoys, undersea transmission lines, hydrokinetic turbines and wind turbines, as well as geotechnical/sub-bottom sampling, and dredging of minerals borrow areas, and commercial fishing.

Installation and decommissioning of structures in state and federal waters and geotechnical/sub-bottom sampling may cause displacement, injury, or direct mortality of benthic organisms, loss or alteration of habitat from scouring and suspension/redeposition of sediments, spills from collisions/allisions, and generator refueling operations. These effects were determined individually to range from negligible to minor; the overall impact of these activities on benthic resources would be minor.

Although disturbance of the seafloor during wind farm development could result in negligible to major impacts on benthic resources under and adjacent to the foundations and cable, in general, most impacts to benthic resources from these projects would be negligible to moderate for all phases of development, assuming proper siting and mitigation measures are followed.

Hydrokinetic projects may affect benthic resources through direct mortality of benthic organisms, loss/alteration of benthic habitat, suspension of sediments and contaminants, and alteration of hydrologic regimes, but impacts are anticipated to be negligible to minor with appropriate site selection and project.

Commercial fishing will result in the direct mortality of benthic resources, primarily Atlantic sea scallop, and temporary bottom disturbance from the interaction between the scallop dredge and the seafloor.

The cumulative activities considered in this analysis are anticipated to cause **minor** impacts to benthic resources, with the proposed action resulting in a negligible incremental contribution, when combined with the past, present and reasonably foreseeable future activities.

Coastal Habitats

The analysis area for coastal habitats includes the nearshore waters, tidal flats, salt/brackish and freshwater marshes along the coastlines of New York and New Jersey. Much of the New York and New Jersey shoreline and most of the coastal habitats have been impacted by human activities such as development, maritime activities, beach replenishment, or shore-protection structures such as groins and jetties (MMS, 2007a). Because the proposed action would be supported by existing port facilities and the proposed action would generate a minor amount of additional vessel traffic, BOEM has determined that the overall impact on coastal habitats from the proposed action would be negligible.

In addition to the proposed action, impacts to coastal habitats could occur from transmission line cable installation, construction of onshore facilities associated with wind energy development, hydrokinetic projects, transmission lines, and marine transportation. These projects may affect coastal habitats through increased suspension of sediments and contaminants and alteration of hydrologic regimes; impacts from cumulative activities are anticipated to be negligible to minor with appropriate site selection, project design, and mitigation measures. Effects from marine transportation would include wake erosion, increased turbidity in nearshore waters, and accidental fuel spills and releases of trash/debris; with implementation of mitigation measures and adherence to vessel speed, impacts from cumulative marine transportation on coastal habitats would be negligible.

The cumulative activities considered in this analysis are anticipated to cause **negligible** impacts to coastal habitats, with the proposed action resulting in a negligible incremental contribution, when combined with the past, present and reasonably foreseeable future activities.

Marine Mammals

Marine mammals experience a variety of anthropogenic impacts, including collisions with vessels (ship strikes), entanglement with fishing gear, noise from human activities, pollution, disturbance of marine and coastal environments, climate change, effects on benthic habitat, waste discharge, and accidental fuel leaks or spills. Many marine mammals migrate long distances and are affected by these factors over very broad geographical scales. Three federally endangered whales—fin whale, North Atlantic right whale, and humpback whale—could occur in the WEA.

Impacts associated with the proposed action (e.g., vessel strikes, acoustic impacts from pile driving, water quality effects, entanglement and changes in prey abundance and distribution) are expected to be moderate overall, although potential impacts would range from negligible to moderate depending on the activity being conducted during site characterization and site assessment. Adherence to BOEM’s SOCs (Appendix B) regarding vessel strike avoidance measures and exclusion zones to minimize acoustic impacts would reduce the potential for cumulative impacts on marine mammals, including ESA-listed species. The proposed action's incremental contribution to cumulative impacts is expected to be minor. Based on the mitigation measures outlined in BOEM’s SOCs for Protected Species (Appendix B), BOEM has determined that the overall impact on marine mammals from the proposed action would be moderate.

Impacts to marine mammals from other reasonably foreseeable activities (discussed in Section 4.7.1) would occur due to site characterization surveys, site assessment activities, and construction and operation of wind turbines primarily from underwater noise from pile driving; vessel strikes; entrainment in DP thrusters; increases in suspended sediment resulting in elevated turbidity levels, release of contaminants, and temporary displacement of prey and marine mammals; entanglement related to meteorological tower and buoy operation; loss of habitat and changes to prey abundance/distribution; trash and debris; and fuel spills. Impacts from these activities would range from negligible to moderate.

There is a potential for major impacts to some threatened and endangered species of marine mammals from vessel strikes, alteration of key habitat, or low-probability large spills of fuel or lubricating oil or dielectric fluids, because population-level impacts are possible from injury or death of individual females if population numbers are critically low. Compliance with state and federal regulations and coordination with appropriate federal wildlife protection agencies would ensure that project activities would be conducted in a manner that would greatly minimize or avoid impacting these species or their habitats (see Chapter 5 *Consultation and Coordination* of this EA).

Hydrokinetic projects may affect marine mammals through obstruction of movements/migration, suspension of sediments and contaminants, turbulence and/or rotor strikes, entanglement in submerged cables, and impingement on screens used to protect machinery, but impacts are anticipated to be negligible to minor with appropriate site selection and project design.

The proposed action would result in a minor incremental contribution when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **moderate** impacts to marine mammals.

Sea Turtles

Loggerhead turtle, green turtle, Kemp's ridley turtle, and leatherback turtle are ESA-listed as threatened or endangered and are all highly migratory species that could occur within, or in the vicinity of, the WEA. Human impacts on sea turtles include collisions with vessels (ship strikes), entanglement with fishing gear, noise, pollution, disturbance of marine and coastal environments, disturbance of nesting habitat, and climate change. The most likely impacts on sea turtles as a result of the proposed action are vessel strikes and noise. Adherence to BOEM's SOCs (Appendix B) regarding vessel strike avoidance measures and exclusion zones to minimize acoustic impacts would reduce the potential for impacts on sea turtles from the proposed action.

The impacts to sea turtles from the other reasonably foreseeable activities (discussed in detail in Section 4.7.1)activities are expected to occur primarily from underwater noise from pile driving; vessel strikes; entrainment in DP thrusters; increases in suspended sediment resulting in elevated turbidity levels, release of contaminants, and temporary displacement of prey and sea turtles; entanglement related to meteorological tower and buoy operation; loss of habitat and changes to prey abundance/distribution; trash and debris; fuel spills; construction and operation of wind turbines; and hydrokinetic projects. For BOEM-regulated projects and activities (wind energy development, Block Island Wind Farm undersea transmission line, and OCS minerals use), adherence to BOEM SOCs would reduce the potential cumulative impacts on sea turtles. Impacts would range from negligible to moderate.

In general, most impacts to sea turtles from wind farm projects would be negligible to moderate for all phases of development, assuming proper siting and mitigation measures are followed. There is a potential for major impacts to threatened and endangered species of sea turtles from vessel strikes, alteration of key habitat, or low-probability large spills of fuel or lubricating oil or dielectric fluids, because population-level impacts are possible from injury or death of individual females if population numbers are critically low. Compliance with state and federal regulations and coordination with appropriate federal wildlife protection agencies would ensure that project activities would be conducted in a manner that would greatly minimize or avoid impacting these species or their habitats (see Chapter 5 *Consultation and Coordination* of this EA).

Hydrokinetic projects may affect marine mammals through obstruction of movements/migration, suspension of sediments and contaminants, turbulence and/or rotor strikes, entanglement in submerged cables, and impingement on screens used to protect machinery, but impacts are anticipated to be negligible to minor with appropriate site selection and project design.

The proposed action would result in a minor incremental contribution when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **moderate** impacts to sea turtles.

Finfish, Invertebrates, Essential Fish Habitat, and Federally Listed Fish Species

The analysis area for finfish, invertebrates, EFH, and federally listed fish species is the waters offshore New York and New Jersey, the New York WEA and the waters surrounding the WEA. The analysis area encompasses demersal and pelagic habitats in the open ocean that provide habitat for over 300 fish species (Jones et al., 1978). Primary invertebrate species that occur in the analysis area include longfin inshore squid, Atlantic sea scallop, Atlantic surfclam, ocean quahog, horseshoe crabs, and American lobster. EFH has been designated for nearly 40 species in the analysis area. Two federally endangered anadromous fish, Atlantic Sturgeon and Shortnose Sturgeon, and three federally designated Species of Concern, Bluefin Tuna, Dusky Shark, and Sand Tiger Shark, occur in the analysis area.

Impacts from site characterization activities would be negligible and thus are not anticipated to contribute to a cumulative effect on fish species. Noise from pile driving during installation of meteorological towers and wind turbines could result in minor effects to fish including Atlantic Sturgeon and Shortnose Sturgeon. The cumulative impact to fishing from underwater noise concerns the availability and catchability of fish as a result of underwater noise exposure. Because there are no significant noise impacts evident from the cumulative activities and because there is no evidence of ambient noise levels approaching a threshold level where fisheries might be significantly affected, it is expected that there would be an extremely minor incremental decrease in the availability and catchability of fish resulting from active acoustic sound disturbances from cumulative activities.

Other impacts to finfish, invertebrates and federally listed fish within the analysis area from cumulative activities include increased anthropogenic noise in the ocean, including underwater noise from sonars, explosives, and other active sound sources; vessel traffic and exclusion zones; seafloor disturbance; increased potential for accidental fuel spills, and increased vessel discharge of trash and debris.

Cumulative activities including the installation of meteorological/oceanographic buoys and meteorological towers in support of various energy development projects would likely introduce more structure and navigational obstructions offshore New York, New Jersey, Rhode Island, and Massachusetts. However, the number of buoys and towers that could be installed is not expected to cause any more hazards to fishing than existing shipwrecks, navigational buoys, and towers currently pose to commercial and recreational fishing. Incremental impacts to finfish, invertebrates, EFH, and federally listed fish species arising from the presence of structures are expected to be negligible.

Spill effects as well as spill response vessel operations, could have a direct effect on commercial fishing operations. However, a large-scale spill response involving multiple vessels is not expected from the cumulative activities. Therefore, the incremental impacts to finfish, invertebrates, EFH, and federally listed fish species associated with a fuel spill from vessels under the cumulative activities would be negligible.

Federally-regulated commercial and recreational fishing will result in the direct mortality of fishery resources in the New York WEA. However, this activity is regulated to ensure the sustainability of the fish resources in the area and is thus not anticipated to result in negative long-term adverse impacts to the fish/invertebrate resources in the New York WEA.

The proposed action would result in a minor incremental contribution when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **negligible** to **minor** impacts depending on the fish/invertebrate species and activity.

4.7.2.2 Military Use and Navigation/Vessel Traffic

The analysis area for military use, navigation, and vessel traffic is the waters offshore New York and New Jersey, the New York WEA and the waters surrounding the WEA. BOEM estimates that the number of vessel round trips from the proposed action would range from approximately 350 to 1,000 over 6 to 7 years (Table 3-10, Section 3.2.4 *Vessel Traffic*), and estimates that one to three vessels associated with the proposed action could be present at any given time in the WEA and its vicinity. A significant amount of vessel traffic is expected to occur under the cumulative activities listed in Section 4.7.1, including high levels of vessel activity associated with shipping and marine transportation around ports along the U.S. Eastern Seaboard. Military operations and commercial and recreational fishing activity would also contribute to overall vessel activity.

Site-specific coordination with DOD would be required to minimize multiple use conflicts on the OCS in and around the WEA; therefore, cumulative impacts on military use are expected to be **negligible**. With proper scheduling and notification to the marine community, impacts to marine transportation would be minimized, and adherence to navigation regulations would minimize navigational risk related to the additional vessel traffic associated with the cumulative activities.

The proposed action would result in a negligible incremental contribution to vessel traffic and navigation when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **moderate** impacts to vessel traffic and **negligible** impacts to navigation in the analysis area.

4.7.2.3 Socioeconomic Resources

Cultural, Historical, and Archaeological Resources

Cumulative activities most impacting archaeological resources are seafloor disturbing activities in New York, New Jersey, Rhode Island, and Massachusetts federal and state waters associated with site characterization surveys (shallow hazard, geological, geotechnical, and archaeological surveys), site assessment activities (construction and decommissioning of meteorological towers and/or buoys), the construction of wind turbines, hydrokinetic turbine construction and operation, undersea transmission line installation, and marine minerals use and dredged material disposal. The activities most impacting other historic properties are disruptions of a historic setting that is important to the integrity of a historic structure and a contributing element to its significance under various criteria of eligibility for the NRHP, principally from wind energy development.

The activities analyzed under the cumulative activities are projected to minimally affect the analysis area's archaeological resources and other historic properties. Insofar as all areas of potential effect throughout the state waters and Atlantic OCS offshore New York, New Jersey, Rhode Island, and Massachusetts have been surveyed for marine or terrestrial archaeological resources and provided that identified archaeological resources are avoided by a sufficient buffer to ensure their protection during these activities, impacts to archaeological resources from the cumulative activities remain negligible to minor.

The introduction of visual elements associated with reasonably foreseeable wind energy development offshore New York, New Jersey, Rhode Island, and Massachusetts would not adversely affect the setting and integrity of historic standing structures and districts within the area of potential effect. The affected environment for onshore historic properties included a 0.25 mi (0.40 km) onshore buffer along the coastline between Ocean Grove, NJ and the northeast tip of the Fire Island National Seashore, located in Long Island, NY. Moreover, proposed structures would be located further from shore and likely would not be discernable at these distances. As such, these visual introductions would not adversely affect either the integrity of or the characteristics of the identified historic properties that qualify them for the NRHP visual impacts remain negligible.

Given that the proposed action requires surveying for and resolution of adverse effects to cultural resources, the proposed action would result in a negligible incremental contribution when combined with the past, present and reasonably foreseeable future activities. Overall, cumulative activities considered in this analysis are anticipated to cause **negligible to minor** impacts to archaeological resources and **negligible** impacts to visual resources.

Demographics and Employment

Cumulative activities most impacting demographics and employment are activities in New York and New Jersey state waters related to site assessments, wind turbine construction and operation, hydrokinetic turbine construction, marine minerals use, dredged material disposal, and transportation at New York and New Jersey ports, and renewable energy development because they use similar types of marine crews.

The cumulative activities are anticipated to minimally affect the analysis area's demography because they would involve limited duration influx of employees or would be able to utilize existing capacity in the local workforce. Potential employment activities would have a negligible impact compared to other factors such as population growth or the status of the overall economy.

BOEM anticipates that the proposed action would have beneficial, short-term impacts to demographics and employment in the coastal counties of New York and New Jersey, but would result in an imperceptible, and thus, negligible incremental contribution when combined with the past, present and reasonably foreseeable future activities. Overall, the cumulative activities considered in this analysis are anticipated to result in **negligible** impacts to employment, population growth, age, and racial distributions compared to other factors such as the status of unforeseen national economic health or changes in regional spending.

Environmental Justice

The activities that would most affect low income and minority populations are activities in New Jersey and New York state waters related to site assessments, wind turbine construction and operation, hydrokinetic turbine construction, marine minerals use, dredged material disposal, transportation at New York and New Jersey ports, and renewable energy development because these activities are closer to onshore communities and impact local employment. No disproportionately high and adverse human health effects would occur as a result of the proposed action on minority or low-income populations. The majority of past, present, and future activities analyzed under the cumulative activities would occur offshore. Offshore activities have only minor indirect impacts on the population in the study area. The cumulative activities are projected to result in **negligible** impacts due to distance from shore and the temporary nature of the onshore activities.

Recreation and Tourism

The analysis area for recreation and tourism includes areas within 0.25 mi (0.4 km) of the coastline of Suffolk, Nassau, Queens, and King Counties in New York and Monmouth County in New Jersey. Impacts to recreation and tourism within the study area from cumulative activities include vessel traffic restrictions in exclusion zones, vessel traffic, generation of trash and debris, and accidental fuel spills.

Several activities expected to occur under the cumulative impacts scenario may utilize vessel exclusion zones. Military range complexes and civilian space program use areas that include designated danger zones, restricted areas, and closure areas that may limit access by vessel traffic including recreational activities, during specific times or prior to/during specific activities or operations. In some instances, areas may be completely closed to all vessel traffic. Establishment of additional vessel exclusion zones under the proposed action would be temporary during construction and decommissioning and site characterization surveys. Because there are no significant impacts evident from the cumulative activities scenario, and a vessel exclusion zone’s primary impact is a short term displacement of use of a recreational resource, it is expected that the impacts associated with the proposed action would result in a small incremental increase in potential impact to recreational resources under the cumulative activities.

Vessel operators are required to comply with USCG (33 CFR 151.51-77) (BOEM 2014a); only accidental loss of trash and debris is anticipated. Within the cumulative activities scenario, the operation of survey vessels presents the potential additional debris. However, with the protective measures in place for commercial vessel operating offshore to minimize trash and debris discharges offshore, and based on the types of debris typically found along beaches, it is expected that more than 80 percent of trash is not generated from the activities included in the cumulative activities (CCC, 2016). Because there are no significant impacts evident from the cumulative activities scenario, it is expected that the impacts associated with proposed action would result in an extremely small incremental increase.

A significant amount of vessel traffic is expected to occur under the cumulative activities, including high levels of vessel activity associated with shipping and marine transportation around ports along the U.S. Eastern Seaboard. Military operations and commercial and recreational fishing activity would also contribute to overall vessel activity. All vessel movements are associated with a risk of collision and subsequent loss of fuel. Spill effects on recreational resources, as well as spill response vessel operations, would have a direct but limited effect on recreational activities given the small volume and distance from shore. The increased risk of spill due to the proposed action is small.

The majority of the vessels exclusions for the cumulative activities and projects identified in Section 4.7.1 are farther offshore than most recreational activity. Additionally, the majority of exclusions are for a limited amount of time. Best management practices for minimizing marine debris are in place and fuel spills are expected to be limited. The proposed action would result in a negligible incremental contribution on impacts to recreation and tourism when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **minor** impacts to recreation and tourism.

Commercial and Recreational Fisheries

The analysis area for recreational fisheries is the waters offshore New York and New Jersey, the New York WEA and the waters surrounding the WEA. This geographic area is home to substantial recreational fishing activities and the WEA is adjacent to and overlaps with recreational fishing ground (Figure 4-21). The major recreational fishing areas along the south coast of Long Island are roughly 10 to 25 nm (19 to 46 km) from the WEA (Figure 4-21). NMFS described the recreational fishery as lightly overlapping the New York WEA (Kirkpatrick et al., 2015).

The overall analysis area for commercial fisheries is the waters offshore New York and New Jersey, the New York WEA and the waters surrounding the WEA, with particular focus on the area of the squid fishery. Although the entire New York WEA is used as a squid fishery, the primary area fished by the squid fleet is in waters less than 16 fathoms (30 m) closer to Cholera Banks (Figure 4-9). BOEM determined that the commercial fisheries that use the area the most are the Atlantic sea scallop and the SMB fisheries, with other species of commercial importance having distributions that overlap the WEA including monkfish, Atlantic herring, black sea bass, summer flounder, and scup. The squid fishery operates in and around the New York Call Area primarily between June and September, and is highly variable regarding where the squid will occur and where they will be caught.

Impacts to commercial and recreational fisheries within the analysis area from cumulative activities include increased anthropogenic noise in the ocean, including underwater noise from sonars, explosives, and other active sound sources; vessel traffic and exclusion zones; seafloor disturbance; increased potential for accidental fuel spills, increased vessel discharge of trash and debris; and direct fishing mortality.

The cumulative impact to fishing from underwater noise concerns the availability and catchability of fish as a result of underwater noise exposure. Because there are no significant noise impacts evident from the cumulative activities and because there is no evidence of ambient noise levels approaching a threshold level where fisheries might be significantly affected, it is expected that there would be an extremely minor incremental decrease in the availability and catchability of fish resulting from active acoustic sound disturbances from cumulative activities.

Cumulative activities including the installation of meteorological/oceanographic buoys and meteorological towers in support of various energy development projects would likely introduce more structure and navigational obstructions offshore New York, New Jersey, Rhode Island, and Massachusetts. However, the number of buoys and towers that could be installed is not expected to cause any more hazards to fishing than existing shipwrecks, navigational buoys, and towers currently pose to commercial and recreational fishing. Incremental impacts to commercial fisheries arising from the presence of structures are expected to be negligible.

Spill effects on commercial fishes, as well as spill response vessel operations, could have a direct effect on commercial fishing operations. However, a large-scale spill response involving multiple vessels is not expected from the cumulative activities. Therefore, the incremental impacts to commercial fisheries activities associated with a fuel spill from vessels under the cumulative activities would be negligible.

Federal commercial and recreational fishing regulations will continue to result in constrained fishing effort. However, these constraints are intended to ensure that a sustainable biomass is available for the fishery on an annual basis. Neither the longfin squid nor the Atlantic sea scallop fisheries are currently overfished, therefore it is not anticipated that fishing regulations will further restrain fishing harvest and thus socio-economic impacts. If such restrictions were to occur the impacts would be evaluated by NMFS at that time.

The proposed action would result in a minor incremental contribution when combined with the past, present and reasonably foreseeable future activities, and overall cumulative activities considered in this analysis are anticipated to cause **negligible** to **minor** impacts depending on the fishery and activity.

Visual Resources

The analysis area for visual resources includes a 27 mi (43 km) buffer around the WEA, cropped at 0.25 mi (0.4 km) inland from the shoreline (Figure 4-23). The 27 mi (43 km) buffer was selected because this height represents the distance at which the tip of a meteorological tower measuring 394 ft (120 m) would drop below the horizon, thereby precluding any potential view of the structure. The onshore analysis area was restricted to within 0.25 mi (0.4 km) of the shoreline based on the likelihood for potential views of the project area to be blocked by vegetation, buildings, or other structures. This area includes portions of Long Island, New York, and New Jersey.

The landscape character of the analysis area is a combination of beaches, communities, and industry. In general, the seascape appears large in scale, panoramic, and dominated by the broad horizontal plane of the Atlantic Ocean. Dominant colors in the landscape include the varied blue tones of the ocean and sky, the pale tan of the sandy beach, and the greens of upland vegetation. The horizon appears pale tan/white as a result of the atmospheric haze and sea spray. No major structures exist on the horizon, though commercial and recreational boat traffic is common.

Impacts to visual resources from cumulative activities identified in Section 4.7.1 are expected to occur primarily from increased vessel traffic, and changes to the viewshed resulting from installation of a meteorological tower (a buoy would not be seen from shore) or wind turbines. In general, the majority of these cumulative activities would not likely be visible from the shoreline due to their distance and the likelihood vessels would be below the horizon. The proposed action would result in a negligible incremental contribution when combined with the past, present and reasonably foreseeable future activities. The introduction of visual elements associated with reasonably foreseeable wind energy development and increased vessel traffic from the cumulative activities discussed in Section 4.7.1 are expected to result in **minor** cumulative effects to viewsheds offshore New York, New Jersey, Rhode Island, and Massachusetts.

4.7.2.4 Conclusion

The hallmark of the affected environment considered in this EA is one of past, present, and foreseeable human-induced impacts over an extended period of time. The incremental contribution of the proposed action and alternative to other past, present, and reasonably foreseeable actions that may affect the environment would be **negligible to moderate**. Based on the foregoing information and the scope of this analysis, the proposed action would not result in a significant incremental contribution to cumulative effects on any resources discussed in this EA. In addition, the proposed action and alternative would facilitate the collection of meteorological, oceanographic, and biological data for the environment offshore New York.

5 CONSULTATION AND COORDINATION

As discussed in Section 1.6 *Development of New York Wind Energy Area*, BOEM held three Task Force meetings on Long Island to engage federal, state, local, and tribal stakeholders. Discussion topics included vessel traffic data, maritime concerns, fisheries, habitats, and visual impacts. Public involvement in the preparation of this EA, formal consultations, and cooperating agency exchanges are detailed below.

5.1 Public Involvement

5.1.1 Notice of Intent

On May 28, 2014, BOEM published the NOI to prepare an EA for the Commercial Wind Leasing and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York in the *Federal Register* (79 FR 30643). Input on issues and alternatives to be analyzed in the EA were solicited, with BOEM accepting comments until July 14, 2014. During the 45-day comment period, 30 comments were received from the government (state and federal), non-governmental organizations, private citizens, companies, and a university. Several of the commenters, including the Marine Mammal Commission, New Jersey Department of Environmental Protection, Oceana, the Natural Resources Defense Council, and Clean Ocean Action raised concerns about the effects of noise on the seasonal residency and migratory patterns of the North Atlantic right whale. Commenters also identified other issues of concern they would like to see analyzed/addressed in the EA, including:

- The potential harmful effects of wind power generation on birds and other fauna that depend upon the offshore ecosystem;
- The impacts of proposed action on endangered marine mammals and sea turtles, benthic marine life and habitat, protected fish species and EFH, commercial and recreational fishing, the economy, and navigation safety and vessel traffic;
- Coordinating with relevant federal, state, and local agencies throughout the environmental review process; and
- Incorporating mitigation efforts in a lease agreement.

The comments can be viewed at http://www.regulations.gov by searching for docket ID BOEM-2014-0003.

5.1.2 Notice of Availability and Public Meetings

BOEM is making this EA available for public review. Comments on the EA will be solicited for 30 days following the publication of the Notice of Availability in the *Federal Register*. BOEM will also hold public meetings in New York, New Jersey, and Rhode Island. As meeting details are finalized, this information will be provided on BOEM's website at: http://www.boem.gov/New-York/. BOEM will consider public comments on the EA in determining whether to issue a Finding of No Significant Impact, or conduct additional analysis under NEPA (i.e., prepare a revised EA).

5.2 Cooperating Agencies

Section 1500.5(b) of the CEQ implementing regulations (40 CFR 1500.5(b), November 29, 1978) encourages agency cooperation early in the NEPA process. A federal agency can be a lead, joint lead, or cooperating agency. A lead agency manages the NEPA process and is responsible for the preparation of an EA or EIS; a joint lead agency shares these responsibilities; and a cooperating agency that has jurisdiction by law or special expertise with respect to any environmental issue participates in the NEPA process upon the request of the lead agency. BOEM invited the following federal and state agencies, and tribal governments, to consider becoming cooperating agencies in the preparation of this EA: BSEE, EPA, NOAA, NPS, USACE, USCG, NYSDEC, the Narragansett Tribe, and the Shinnecock Indian Nation. Currently, BSEE, EPA, NOAA, USACE, and USCG are cooperating agencies, and agreed to participate in the development and review of this EA.

5.3 Consultations

5.3.1 Endangered Species Act

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §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 may affect a protected species or its critical habitat, that agency is required to consult with either NMFS or the USFWS, depending upon the protected species that may be affected. BOEM has or will consult with both USFWS and NMFS for activities considered in this EA and species under their respective jurisdictions. The status of consultations for each of the Services is described below.

5.3.1.1 U.S. Fish and Wildlife Service

On April 21, 2016, BOEM used USFWS Information for Planning and Consultation (IPaC) system to determine if any ESA-listed, proposed, or candidate species may be present in the NY WEA (https://ecos.fws.gov/ipac/project/YKD7HMJG65GCFECAAWHHWU5YEA). No species were under the "Endangered Species" part of the IPaC Trust Resource Report, indicating that no further consultation under ESA is required (USFWS, 2016). When the EA is publically available, BOEM will send a letter to USFWS New York Field Office indicating that suitable habitat and ESA species are absent from project area and attach a copy of the IPaC report and EA for reference.

5.3.1.2 National Marine Fisheries Service

BOEM prepared a biological assessment titled *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island, Massachusetts, New York, and New Jersey* (BOEM, 2012f) that analyzed proposed activities associated with the WEA and ESA-listed species under the jurisdiction of NMFS that have potential to occur in the project area or vicinity. BOEM completed formal consultation with receipt of a Biological Opinion on March 10, 2013 (revised on April 10, 2013) (NMFS, 2013a). The following actions in this EA have already been consulted on with NMFS:

- Issuing a renewable energy lease;
- Site characterization and archeological surveys including a) HRG surveys (primarily side scan sonars, echo sounders, and sub-bottom profilers), and b) geotechnical sub-bottom sampling (includes CPTs, geologic borings, vibracores, etc.); and
- Biological resource assessments to determine a) the presence/absence of threatened and endangered species, and b) the presence/absence of other sensitive biological resources or habitats.

NMFS's Biological Opinion concluded that the above actions may adversely affect but are not likely to jeopardize the continued existence of Kemp's ridley, green, or leatherback sea turtles; the NWA DPS of loggerhead sea turtles; North Atlantic right, humpback, fin, sei, or sperm whales, or the Gulf of Mexico, New York Bight, Chesapeake Bay, or South Atlantic DPS of Atlantic sturgeon. The SOCs in Appendix B are consistent with the Incidental Take Statement of the NMFS Biological Opinion (2013a). BOEM will request additional consultation with NMFS under Section 7 of the ESA prior to the approval of any activities in a SAP that may affect any ESA-listed species occurring in the New York WEA. Because no critical habitat is designated in the action area, none will be affected by the action.

BOEM will request additional consultation with NMFS under Section 7 of the ESA prior to the approval of any SAP for any ESA-listed species occurring in the New York WEA.

5.3.2 Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act of 1976, 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 Magnuson-Stevens Fishery Conservation and Management Act can be found at 50 CFR 600. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with NMFS. Concurrent with this EA, BOEM will consult with NMFS regarding the impacts of the proposed action on EFH. BOEM has determined that the proposed action would not significantly affect the quality and quantity of EFH.

5.3.3 Coastal Zone Management Act

The Coastal Zone Management Act requires that federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone be "consistent to the maximum extent practicable" with relevant enforceable policies of a state's federally approved coastal management program (15 CFR 930, Subpart C). If an activity will have direct, indirect, or cumulative effects, the activity is subject to a federal consistency determination. BOEM will perform a consistency review and prepare a Consistency Determination (CD) for the states of New Jersey and New York.

BOEM has determined that New Jersey and New York share common coastal management issues and have similar enforceable policies as identified by their respective coastal zone management plans. Given the proximity of the WEA to each state, the similarity of the reasonably foreseeable activities for the WEA, and the similarity of impacts on environmental and socioeconomic resources and uses within each state, BOEM will prepare a single CD under 15 CFR 930.36(a) to determine whether issuing a lease and approving site assessment activities (including the installation, operation, and decommissioning of a meteorological tower and/or buoys) in the WEA is consistent with the enforceable policies of the New Jersey and New York coastal zone management plans to the maximum extent practicable.

The EA provides the comprehensive data and information required under 30 CFR 939.39 to support BOEM's CD. The states have 60 days to review the CD once they receive it. Additionally, the states have 14 days after receiving the CD to identify any missing information required by 30 CFR 930.39(a) and notify BOEM.

5.3.4 National Historic Preservation Act

Section 106 of the NHPA (54 U.S.C. § 306108) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. BOEM has determined that its issuance of commercial leases and approval of SAPs constitute undertakings subject to Section 106 review. These undertakings have the potential to cause effects on historic properties insofar as these actions may lead to a lessee conducting geotechnical testing and installing and operating site assessment facilities (e.g., a meteorological tower and/or buoys).

BOEM is executing a Programmatic Agreement pursuant to 36 CFR 800.14(b) to fulfill its obligations under Section 106 of the NHPA for renewable energy activities on the OCS offshore New York and New Jersey. BOEM developed this agreement because BOEM's decisions to issue leases and approve SAPs, COPs, or other plans are complex and because BOEM will conduct historic property identification and evaluation in phases (36 CFR 800.4(b)(2)). The Programmatic Agreement establishes the process to document the area of potential effects for each undertaking; to identify historic properties; to assess potential adverse effects; and to resolve adverse effects. Signatories to the New York–New Jersey Programmatic Agreement include BOEM, the New York SHPO, the New Jersey SHPO, ACHP, and the Shinnecock Indian Nation.

Once the Programmatic Agreement is executed, BOEM will initiate Section 106 consultation for the undertaking of issuing a commercial lease within the New York WEA per the stipulations outlined in the agreement.

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Appendix A
Announcement of Area Identification for Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore New York

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ANNOUNCEMENT OF AREA IDENTIFICATION

Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore New York

March 16, 2016

Pursuant to 30 C.F.R. § 585.211(b), the Bureau of Ocean Energy Management (BOEM) has completed the Area Identification process to delineate a Wind Energy Area (WEA) offshore New York.

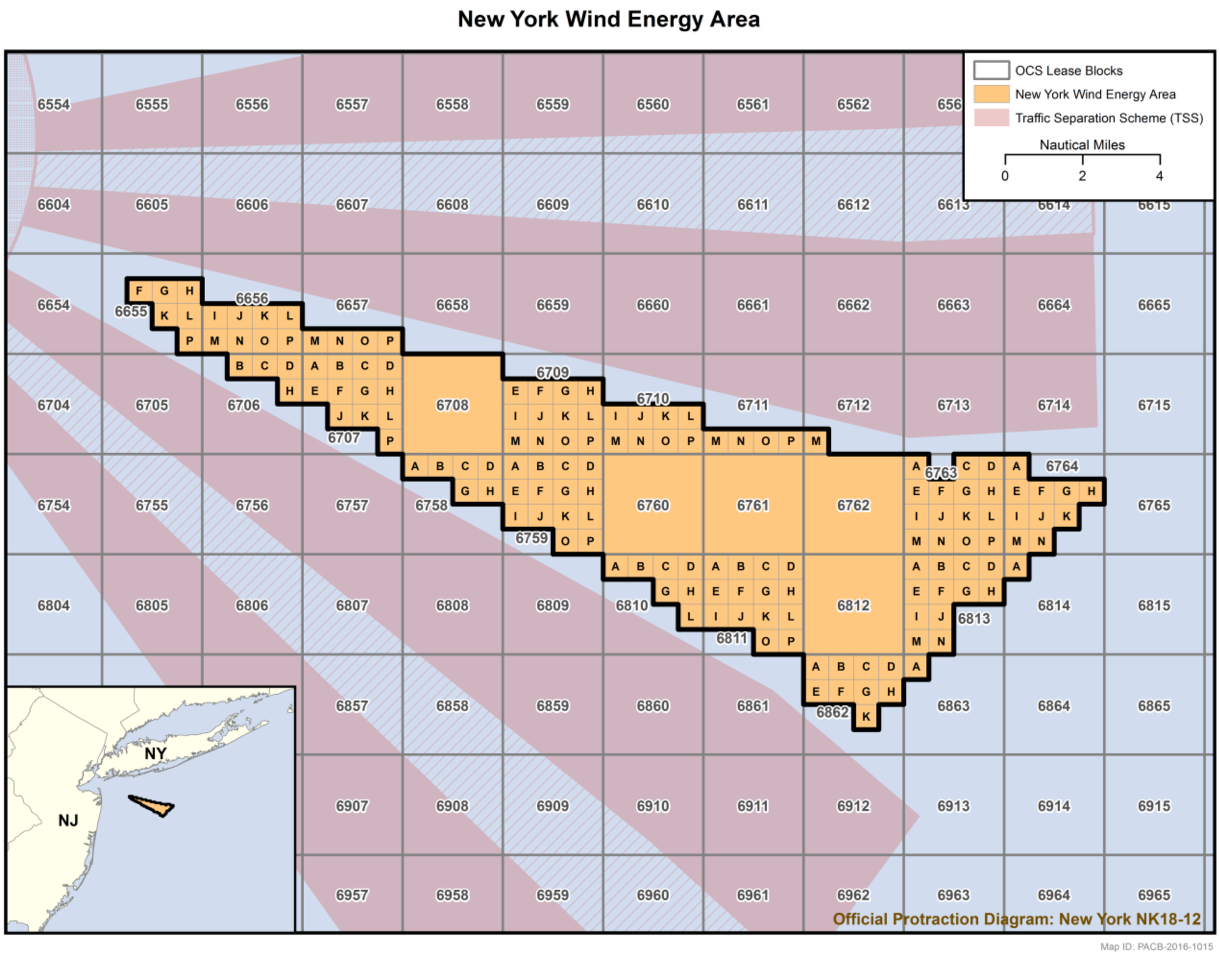
BOEM is announcing the New York WEA after concluding more than four years of review and consideration of the proposed area. The goal of BOEM's Area Identification process is to identify the offshore locations that appear most suitable for wind energy development. The New York WEA consists of five OCS blocks and 148 sub-blocks. It begins approximately 11 nautical miles (nmi) south of Long Beach, New York, and extends approximately 26 nmi southeast along its longest portion. The entire area is approximately 127 square miles, 81,130 acres, or 32,832 hectares.

The WEA being considered for leasing offshore New York is based upon an unsolicited lease application that BOEM received on September 8, 2011, from the New York Power Authority (NYPA). In that request, NYPA proposes to construct a 350-700 megawatt (MW) wind facility offshore Long Island. In analyzing this proposed area, BOEM published a Request for Interest (2013), a Call for Information and Nominations (2014), and a Notice of Intent to Prepare an Environmental Assessment (2014); held numerous stakeholder meetings; and worked with BOEM's New York Intergovernmental Renewable Energy Task Force to gather data and information about the area.

As a next step toward leasing the New York WEA, BOEM may publish a Proposed Sale Notice for public comment, which will describe the area being offered for leasing and the proposed terms and conditions of a wind energy auction. Then, upon considering public comments and completing the necessary environmental assessment (EA) and consultations, BOEM may publish a Final Sale Notice that announces the date, time, and specific conditions of the auction. BOEM expects the environmental review to be completed and the notices to be published later in 2016.

In BOEM's EA, conducted pursuant to the National Environmental Policy Act (NEPA), BOEM is only considering the issuance of a lease and approval of a site assessment plan for the New York WEA. BOEM is not considering, and the EA will not support, any decisions regarding the construction and operation of a wind energy facility. In the future, should a lessee propose to construct a commercial wind energy facility, the lessee will be required to submit a construction and operations plan for BOEM's review and approval. BOEM would then prepare a site-specific NEPA document and conduct necessary environmental consultations before making a final decision to approve the construction of the proposed project. As the process moves forward, BOEM will continue to analyze issues and work with stakeholders before a decision is made to authorize the development of a wind power facility offshore New York.

Figure 1. The New York Wind Energy Area



Appendix B
Standard Operating Conditions

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B. STANDARD OPERATING CONDITIONS FOR PROTECTED SPECIES

This section outlines and provides the substance of the standard operating conditions (SOCs) that are part of the proposed action (Alternative A) and action alterative (Alternative B), and that minimize or eliminate potential impacts to protected species including Endangered Species Act (ESA)-listed species of marine mammals and sea turtles.

These SOCs were developed by the Bureau of Ocean Energy Management (BOEM) and refined during previous consultations with the National Marine Fisheries Service (NMFS) under Section 7 of the ESA. Additional conditions and/or revisions to the conditions below may be developed during future consultation with NMFS.

B.1 GENERAL REQUIREMENTS

1. Prior to the start of operations, the Lessee must hold a briefing to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring procedures, and review operational procedures. This briefing must include all relevant personnel, crew members, and Protected Species Observers (PSOs). New personnel must be briefed as they join the work in progress.
2. The Lessee must ensure that all vessel operators and crew members, including PSOs, are familiar with, and understand, the requirements specified in Appendix B.
3. The Lessee must ensure that a copy of the SOCs (Appendix B) is made available on every project-related vessel.

B.1.1 Vessel Strike Avoidance Measures

The Lessee must ensure that all vessels conducting activity in support of a plan (i.e., Site Assessment Plan [SAP] and/or Construction and Operation Plan [COP]) submittal, including those transiting to and from local ports and the lease area, comply with the vessel strike avoidance measures specified below except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk.

1. The Lessee must ensure that vessel operators and crews maintain a vigilant watch for cetaceans, pinnipeds, and sea turtles and slow down or stop their vessel to avoid striking protected species.
2. The Lessee must ensure that all vessel operators comply with 10 knot (18.5 kilometers per hour [km/hr]) speed restrictions in any Dynamic Management Area (DMA) within the project area.
3. The Lessee must ensure that vessels 19.8 meters (65 feet) in length or greater, operating within the project area from November 1 through July 31, operate at speeds of 10 knots (18.5 km/hr) or less.
4. The Lessee must ensure that all vessel operators reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near an underway vessel.

5. North Atlantic right whales.

   a. The Lessee must ensure all vessels maintain a separation distance of 500 meters (1,640 feet) or greater from any sighted North Atlantic right whale.

   b. The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 500 meters (1,640 feet) of any North Atlantic right whale:

      i. If underway, any vessel must steer a course away from any North Atlantic right whale at 10 knots (18.5 km/h) or less until the 500-meter (1,640-foot) minimum separation distance has been established (unless ii below applies).

      ii. If a North Atlantic right whale is sighted within 100 meters (328 feet) of an underway vessel, the vessel operator must immediately reduce speed and promptly shift the engine to neutral. The vessel operator must not engage the engines until the North Atlantic right whale has moved beyond 100 meters (328 feet), at which point the vessel operator must comply with 5.b.i above.

      iii. If a vessel is stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 meters (328 feet), at which point the Lessee must comply with 5.b.i above.

6. Non-delphinoid cetaceans other than the North Atlantic right whale.

   a. The Lessee must ensure that all vessels maintain a separation distance of 100 meters (328 feet) or greater from any sighted non-delphinoid cetacean.

   b. The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 100 meters (328 feet) of a non-delphinoid cetacean:

      i. If any non-delphinoid cetacean is sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved beyond 100 meters (328 feet).

      ii. If a vessel is stationary, the vessel must not engage engines until the non-delphinoid cetacean has moved beyond 100 meters (328 feet).

7. Delphinoid cetaceans and pinnipeds.

   a. The Lessee must ensure that all vessels underway do not divert to approach any delphinoid cetacean and/or pinniped.

   b. The Lessee must ensure that if a delphinoid cetacean and/or pinniped approaches any vessel underway, the vessel underway must avoid excessive speed or abrupt changes in direction to avoid injury to the delphinoid cetacean and/or pinniped.

8. Sea Turtles.

   a. The Lessee must ensure that all vessels maintain a separation distance of 50 meters (164 feet) or greater from any sighted sea turtle.

B.2 MARINE TRASH AND DEBRIS PREVENTION

Marine debris prevention measures are intended to reduce the risk marine debris poses to protected species from ingestion and entanglement. These simple measures will reduce the potential for debris ending up in the marine environment.

The Lessee must ensure that vessel operators, employees, and contractors actively engaged in activity in support of plan (i.e., SAP and/or COP) submittal are briefed on marine trash and debris awareness and elimination, as described in the Bureau of Safety and Environmental Enforcement (BSEE) Notice to Lessee (NTL) No. 2015-G03 ("Marine Trash and Debris Awareness and Elimination") or any NTL that supersedes this NTL, except that the Lessor will not require the Lessee, vessel operators, employees, and contractors to undergo formal training or post placards. The Lessee must ensure that these vessel operator employees and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above-referenced NTL provides information the Lessee may use for this awareness training.

B.3 GEOLOGICAL AND GEOPHYSICAL (G&G) SURVEY REQUIREMENTS

General. The Lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and/or COP) submittal comply with the geological and geophysical (G&G) survey requirements specified below except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk.

Visibility. The Lessee must not conduct G&G surveys in support of plan (i.e., SAP and/or COP) submittal at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the exclusion zones for high-resolution geophysical (HRG) surveys and geotechnical surveys as specified below. This requirement may be modified as specified below.

Modification of Visibility Requirement. If the Lessee intends to conduct G&G survey operations in support of plan submittal at night or when visual observation is otherwise impaired, the Lessee must submit an alternative monitoring plan detailing the alternative monitoring methodology (e.g., active or passive monitoring technologies) to the Lessor for approval. The alternative monitoring plan must demonstrate the effectiveness of the methodology proposed to the Lessor's satisfaction. The Lessor may, after consultation with NMFS, decide to approve or disapprove the alternative monitoring plan.

Protected Species Observer (PSO). The Lessee must ensure that the exclusion zone for all G&G surveys performed in support of plan (i.e., SAP and/or COP) submittal is monitored by NMFS-approved PSOs around the sound source. The number of PSOs must be sufficient to effectively monitor the exclusion zone at all times. In order to ensure effective monitoring, PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch, unless otherwise accepted by the Lessor. PSOs must not work for more than 12 hours of any 24-hour period. PSO reporting requirements are provided in Section B.8. The Lessee must provide to the Lessor a list of PSOs and their résumés no later than 45 calendar days prior to the scheduled start of surveys performed in support of plan submittal. The résumés of any additional PSOs must be provided at least 15 calendar days prior to each PSO's start date. The Lessor will send the PSO résumés to NMFS for approval.

Observation Location. The Lessee must ensure that monitoring occurs from the highest available vantage point on the associated operational platform and allows for 360-degree scanning.

Optical Device Availability. The Lessee must ensure that reticle binoculars and other suitable equipment are available to each PSO to adequately perceive and monitor protected marine species within the exclusion zone during surveys conducted in support of plan (i.e., SAP and/or COP) submittal.

B.3.1 High Resolution Geophysical (HRG) Survey Requirements

The following requirements will apply to all HRG surveys conducted in support of plan (i.e., SAP and/or COP) submittal where one or more acoustic sound sources are operating at frequencies below 200 kilohertz (kHz).

1. Establishment of Default HRG Survey Exclusion Zone. The Lessee must ensure a 200-meter radius exclusion zone for marine mammals and sea turtles. In the case of the North Atlantic right whale, the minimum separation distance of 500 meters (1,640 feet), as required under B.1.1, must be observed.
    i) The Lessee may not use HRG survey devices that emit sound levels that exceed the 180-dB Level A harassment radius (200-meter) boundary without approval by the Lessor.
    ii) If the Lessor determines that the exclusion zone does not encompass the 180-dB Level A harassment radius, the Lessor may impose additional, relevant requirements on the Lessee including, but not limited to, required expansion of this exclusion zone.
2. Field Verification of HRG Survey Exclusion Zone. The Lessee must submit field results to verify the exclusion zone for the HRG survey equipment operating at frequencies below 200 kHz. If no applicable data are available, the Lessee must conduct field verification of the exclusion zone for HRG survey equipment operating below 200 kHz. As part of such field verification, the Lessee must take acoustic measurements at a minimum of two reference locations and in a manner that is sufficient to establish the following: source level (peak at one meter), transmission loss and distance to the 207, 180, 166, 160, and 150 dB (RMS) re 1μPa sound pressure level (SPL) isopleths as well as the 187 dB re 1 μPa cumulative sound exposure level (cSEL) and 206 dBpeak. The first location must be at a distance of 200 m from the sound source and the second location must be as close to the sound source as technically feasible. The Lessee must take such sound measurements at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately one meter [3.28 feet] above the seafloor). Sound pressure levels must be measured in the field in dB re 1 μPa (RMS) and reported by the Lessee to the Lessor and NMFS (per Section B.8.3).
3. Modification of Exclusion Zone Per Lessee Request. The Lessee may use the field verification results to request modification of the exclusion zone for the specific HRG survey equipment under consideration. The Lessee must base any proposed new exclusion zone radius on the largest safety zone configuration of the target 160 dB threshold zone as defined by NMFS. The Lessee must use this modified zone for all subsequent use of field-verified equipment. The Lessee may periodically reevaluate the modified zone using the

field verification procedures described in B.3.1.2. The Lessee must obtain Lessor approval of any new exclusion zone before it is implemented.

4. Clearance of HRG Survey Exclusion Zone. The Lessee must ensure that active acoustic sound sources must not be activated until the PSO has reported the exclusion zone clear of all marine mammals and sea turtles for at least 60 minutes.

5. HRG Survey Mid-Atlantic Seasonal Management Areas (SMAs) Right Whale Monitoring. The Lessee must ensure that between November 1 and April 30, vessel operators monitor NMFS North Atlantic Right Whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of North Atlantic right whales during HRG survey operations.

6. Dynamic Management Area (DMA) Shutdown Requirement. The Lessee must cease HRG survey activities within 24 hours of NMFS establishing a DMA in the HRG survey area. The Lessee may resume HRG surveys as soon as the DMA has expired.

7. Electromechanical Survey Equipment "Ramp Up". The Lessee must ensure that, when technically feasible, a "ramp up" of the electromechanical survey equipment occurs at the start or re-start of HRG survey activities. A ramp up must begin with the power of the smallest acoustic equipment for the HRG survey at its lowest power output. The power output must be gradually turned up and other acoustic sources added in a way such that the source level would increase in steps not exceeding 6 dB per 5-minute period.

8. Shutdown for Non-Delphinoid Cetaceans and Sea Turtles. The Lessee must ensure that any time a non-delphinoid cetacean or sea turtle is sighted at or within the exclusion zone, the PSO will notify the Resident Engineer, or other authorize individual, and call for a shutdown of the electromechanical survey equipment. The vessel operator must comply immediately with such a call by the PSO. Any disagreement or discussion must occur only after shutdown. Subsequent restart of the electromechanical survey equipment may only occur following clearance of the exclusion zone (per Section B.3.1.4) and implementation of ramp up procedures (per Section B.3.1.7).

9. Power Down for Delphinoid Cetaceans and Pinnipeds. The Lessee must ensure that any time a delphinoid cetacean or pinniped is observed within the exclusion zone, the PSO will notify the Resident Engineer, or other authorized individual, and call for a power down of the electromechanical survey equipment to the lowest power output that is technically feasible. The vessel operator must comply immediately with such a call by the PSO. Any disagreement or discussion must occur only after power down. Subsequent power up of the electromechanical survey equipment must use the ramp up provisions described in Section B.3.1.7 and may occur after (1) the exclusion zone is clear of delphinoid cetaceans and pinnipeds or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinoid cetacean or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment.

10. Pauses in Electromechanical Survey Sound Source. If the electromechanical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, (for instance, mechanical or electronic failure), resulting in the cessation of the sound source for a period greater than 20 minutes, the Lessee must ensure that restart of the electromechanical survey equipment commences only after clearance of

the exclusion zone (per Section B.3.1.4) and implementation of ramp-up procedures (per Section B.3.1.7). If the pause is 20 minutes or less, the equipment may be restarted as soon as practicable at its operational level as long as the Lessee has continued visual surveys diligently throughout the silent period and the exclusion zone remained clear of all marine mammals and sea turtles. If visual surveys were not continued diligently during the pause of 20 minutes or less, the Lessee must restart the electromechanical survey equipment following clearance of the exclusion zone (per Section B.3.1.4) and implementation of ramp-up procedures (per Section B.3.1.7).

B.4 GEOTECHNICAL EXPLORATION REQUIREMENTS

The following requirements will apply to geotechnical exploration limited to borings and vibracores and conducted in support of plan (i.e., SAP and/or COP) submittal.

1. Establishment of Default Exclusion Zone. The Lessee must ensure that a PSO monitors the 200-meter (656-foot) radius exclusion zone for all marine mammals and sea turtles around any vessel conducting geotechnical surveys.
2. Modification of Default Geotechnical Exclusion Zone Per Lessee Request. If the Lessee wishes to modify the 200-meter (656-foot) default exclusion zone for specific geotechnical exploration equipment, the Lessee must submit a plan for verifying the sound source levels of the specific geotechnical exploration equipment to the Lessor. The plan must demonstrate how the field verification activities will comply with the requirements in Section B.3.2.3. The Lessor may require that the Lessee modify the plan to address any comments the Lessor submits to the Lessee on the contents of the plan in a manner deemed satisfactory to the Lessor prior to the commencement of field verification activities. Any new exclusion zone radius proposed by the Lessee must be based on the largest safety zone configuration of the target Level A or Level B harassment acoustic threshold zone as defined by NMFS. The Lessee must use this modified zone for all subsequent use of field- verified equipment. The Lessee may periodically reevaluate the modified zone using the field verification procedures (per Section B.3.2.3). The Lessee must obtain Lessor approval of any new exclusion zone before it is implemented.
3. Field Verification of Geotechnical Exclusion Zone. If the Lessee wishes to modify the existing exclusion zone, the Lessee must submit the results to verify the exclusion zone for the specific active geotechnical sound sources operating below 200 kHz. The Lessee must use the results to establish a new exclusion zone. If no applicable data are available, the Lessee must conduct field verification of the exclusion zone for the specific active geotechnical sound sources being used. As part of such field verification, the Lessee must take acoustic measurements at a minimum of two reference locations and in a manner that is sufficient to establish the following: source level (peak at 1 meter), transmission loss and distance to the 207, 180, 166, 160, and 150 dB (RMS) re 1 μPa SPL isopleths as well as the 187 dB re 1 μPa cumulative sound exposure level (cSEL) and 206 dB_{peak}. The first location must be at a distance of 200 m from the sound source and the second location must be as close to the sound source as technically feasible. The Lessee must take these sound measurements at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 meter above the seafloor). Sound pressure levels must be measured in the

field in dB re 1 μPa (RMS) and reported by the Lessee to the Lessor and NMFS (per Section B.8.3).

4. Clearance of Geotechnical Exclusion Zone. The Lessee must ensure that geotechnical sound sources must not be activated until the PSO has reported the exclusion zone clear of all marine mammals and sea turtles for at least 60 minutes.

5. Shutdown for Non-Delphinoid Cetaceans and Sea Turtles. The Lessee must ensure that any time a marine mammal or sea turtle is observed within the exclusion zone, the PSO will notify the Resident Engineer (or other authorized individual) and call for a shutdown of the geotechnical survey equipment. Any disagreement or discussion should occur only after shutdown, unless such discussion relates to the safety of the timing of the cessation of the geotechnical activity. Subsequent restart of the geotechnical survey equipment may only occur following clearance of the exclusion zone (per Section B.3.1.4).

6. Pauses in Geotechnical Exploration Sound Source. The Lessee must ensure that if the geotechnical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle (for instance, mechanical or electronic failure) resulting in the cessation of the sound source for a period greater than 20 minutes, the Lessee must ensure that restart of the geotechnical survey equipment commences only after clearance of the exclusion zone (per Section B.3.1.4.). If the pause is 20 minutes or less, the equipment may be restarted as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of marine mammals and sea turtles. If visual surveys were not continued diligently during the pause of 20 minutes or less, the Lessee must restart the geotechnical survey equipment following clearance of the exclusion zone (per Section B.3.1.4).

B.5 CONSTRUCTION OF METEOROLOGICAL TOWERS

BOEM has developed SOCs that would be required during meteorological tower installation by a lessee. These SOCs would minimize or eliminate potential impacts to protected species including ESA-listed species of marine mammals and sea turtles. These SOCs were developed by BOEM and refined during consultations under Section 7 of the ESA with NMFS.

Because of the greater risk of injury to cetaceans, pinnipeds, and sea turtles from pile driving, BOEM has adopted a very conservative shutdown requirement that would apply to all incursions into the exclusion zone during pile driving. The 3,281-foot (1,000-meter) default exclusion zone is based upon the field of ensonification at the 180 dB re 1 μPa (RMS) level and based upon previous reports to BOEM on modeled areas of ensonification from pile driving activities. The following outlines the SOCs that BOEM will require to minimize or eliminate potential impacts on marine mammals.

1. Visibility. The Lessee must not conduct pile driving for a meteorological tower foundation at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zones for meteorological tower foundation pile driving as specified below. This requirement may be modified as specified below.

2. Modification of Visibility Requirement. If the Lessee intends to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired,

an alternative monitoring plan detailing the alternative monitoring technologies (e.g., active or passive acoustic monitoring technologies) must be submitted to the Lessor. The alternative monitoring plan must demonstrate the effectiveness of the methodology proposed to the Lessor's satisfaction. The Lessor may, after consultation with NMFS, decide to approve, approve with conditions, or disapprove the alternative monitoring plan.

3. Continuation of Pile Driving After Daylight Hours. If the driving of a pile commenced during daylight hours, then the Lessee may complete driving that pile after daylight hours. However, the Lessee may not start driving a new pile after daylight hours, unless allowed to pursuant to an alternative monitoring plan as described in B.5.2.

4. Protected Species Observer (PSO). The Lessee must ensure that the exclusion zone for all pile driving for a meteorological tower foundation is monitored by NMFS-approved PSOs around the sound source. The number of PSOs must be sufficient to effectively monitor the exclusion zone at all times. In order to ensure effective monitoring, PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch, unless otherwise accepted by the Lessor. PSOs must not work for more than 12 hours of any 24-hour period. PSO reporting requirements are provided in Section B.8. The Lessee must provide to the Lessor a list of PSOs and their résumés no later than forty-five (45) calendar days prior to the scheduled start of meteorological tower construction activity. The résumés of any additional PSOs must be provided fifteen (15) calendar days prior to each PSO's start date. The Lessor will send the PSO résumés to NMFS for approval.

5. Observation Location. The Lessee must ensure that monitoring occurs from the highest available vantage point on the associated operational platform and allows for 360-degree scanning.

6. Optical Device Availability. The Lessee must ensure that reticle binoculars and other suitable equipment are available to each PSO to adequately perceive and monitor protected species within the exclusion zone during construction activities.

7. Limitations on Pile Driving. The Lessee must ensure that no pile driving activities occur from November 1–April 30, or within an active Dynamic Management Area (DMA) as established by NMFS. Any pile driving activities outside of the DMA are required to remain beyond 1 kilometer of the boundaries of the DMA.

8. Establishment of Exclusion Zone. The Lessee must ensure the establishment of a default 3,281-foot (1,000-meter) radius exclusion zone for marine mammals and sea turtles around each pile driving site. The 3,281-foot (1,000-meter) exclusion zone must be monitored from two locations. At least two PSOs on simultaneous watch must be based at or near the sound source and will be responsible for monitoring out to 1,640 feet (500 meters) from the sound source. At least two additional PSOs on simultaneous watch must be located on a separate vessel navigating approximately 3,281 feet (1,000 meters) around the pile hammer and will be responsible for monitoring the area between 500 and 1,000 meters from the sound source.

9. Field Verification of Exclusion Zone. The Lessee must submit results to verify the 180 dB (RMS) re 1 µPa exclusion zone for pile driving activities. If no applicable data are available, the Lessee must conduct acoustic monitoring of pile driving activities during the installation of each pile. The Lessee must take acoustic measurements during the driving of the last half (deepest pile segment) for any given open water pile. As part of such field verification, the

Lessee must take acoustic measurements at a minimum of two reference locations that would be sufficient to establish the following: source level (peak at 1 m), transmission loss and distance to the 207, 180, 166, 160, and 150 dB re 1 μPa (RMS) SPL isopleths as well as the 187 dB re 1 μPa cSEL and 206 dB_{peak}. The first location must be at a distance of 200 m from the sound source and the second location must be as close to the sound source as technically feasible. Such sound measurements must be taken at the reference locations at two depths (i.e., a depth at midwater and a depth at approximately 1 m above the seafloor). SPLs must be measured in the field in dB re 1 μPa (RMS) and reported by the Lessee to the Lessor and NMFS (per Section B.8.5). The Lessee must report the azimuthal bearing from the central pile to the receivers. Additionally, the Lessee must record the bearings from the central caisson to the strike surfaces of each brace pile, as well as the bearing from the central caisson to where each brace pile enters the ocean floor.

10. Modification of Exclusion Zone. The Lessee, by itself or through its designated operator, must submit results of the acoustic monitoring for field verification of the exclusion zone to the Lessor (per Section B.8.5). Based on the results of this field verification:

    10.1 If the Lessor determines that the exclusion zone does not encompass the 180 dB Level A harassment radius (and notifies the Lessor and NMFS per Section B.8.6), the Lessor may impose additional, relevant requirements on the Lessee, including but not limited to, expansion of this exclusion zone.

    10.2 If multiple piles are being driven, the Lessee may modify the default exclusion zone for pile driving activities. The Lessee should use the results of its field verification in establishing any new exclusion zone, regardless of whether it is greater than or less than the default exclusion zone. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 180 dB zone. The Lessee must obtain the Lessor's approval for any new exclusion zone before it may be implemented.

11. Clearance of Exclusion Zone. The Lessee must ensure that visual monitoring of the exclusion zone begins no less than 60 minutes prior to the start of any pile driving operations and continues for at least 60 minutes after pile driving operations cease, unless sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness) (per Sections B.5.1.1. and B.5.1.2. above). If a marine mammal or sea turtle is observed, the PSO must note and monitor the position, relative bearing and estimated distance to the animal until the animal dives or moves out of visual range of the observer. The PSO must continue to watch for additional animals that may surface in the area. The Lessee must ensure that pile driving operations do not begin until the PSO has reported the exclusion zone clear of all marine mammals and sea turtles for at least 60 minutes.

12. Implementation of "Soft Start." The Lessee must ensure that a "soft start" be implemented at the beginning of each pile installation in order to provide additional protection to marine mammals and sea turtles near the project area by allowing them to vacate the area prior to the commencement of pile driving activities. The Lessee must ensure the following at the beginning of all in-water pile driving activities or when pile driving has ceased for 1 hour or more: The impact hammer soft start requires three strike sets, with a 1-minute wait period between each strike set. The initial strike set will be at approximately 10 percent energy, the second strike set at approximately 25 percent energy and the third strike set at approximately

40 percent energy. The soft start procedure must not be less than 20 minutes. Strikes may continue at full operational power following the soft start period.

13. Shutdown for Marine Mammals and Sea Turtles. The Lessee must ensure that any time a marine mammal or sea turtle is observed within the exclusion zone, the PSO will notify the Resident Engineer (or other authorized individual) and call for a shutdown of pile driving activity. Any disagreement or discussion should occur only after shutdown, unless such discussion relates to the safety of the timing of the cessation of the pile driving activity. Subsequent restart of the pile driving equipment may only occur following clearance of the exclusion zone of any marine mammal or sea turtle for 60 minutes. Thereafter the Lessee must undertake a soft start prior to proceeding with pile driving operations (per Section B.5.12).

14. Pauses in Pile Driving Activity. The Lessee must ensure that visual surveys are continued diligently during any pause in pile driving activity. If visual surveys are not able to be continued diligently during any pause in pile driving activity due to diminished lighting or weather conditions (e.g., darkness, rain, fog, sea state), the Lessee must restart the pile driving activity following clearance of the exclusion zone (per Section B.5.11) and implementation of soft start procedures (per Section B.5.12). If pile driving activity shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle (for instance, mechanical or electronic failure), resulting in the cessation of the sound source for a period of 60 minutes or more, the Lessee must ensure that restart of the pile driving activity commences only after clearance of the exclusion zone (per Section B.5.11) and implementation of soft start procedures (per Section B.5.12).

B.6 DYNAMIC POSITIONING (DP) THRUSTER USE

1. Visibility. The Lessee must not conduct operations using DP thrusters for a meteorological tower foundation at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the monitoring zone for DP thruster use as specified below. This requirement may be modified as specified below.

2. Establishment of Default Monitoring Zone. In order to minimize potential entrainment and/or acoustic impacts, the Lessee must ensure the establishment of a 50-meter radius monitoring zone for marine mammals and sea turtles. The Lessee must ensure that the monitoring zone is established and maintained from when DP thrusters are engaged, throughout the construction activity, and until the DP thrusters are disengaged.

3. Clearance of DP Thruster Monitoring Zone. The Lessee must ensure that DP thrusters must not be activated until the PSO has reported the monitoring zone clear of all marine mammals and sea turtles for at least 60 minutes.

4. Field Verification of Monitoring Zone. The Lessee must conduct acoustic field verification of DP thrusters (per Section B.8.2). The Lessee must take acoustic measurements sufficient to establish the following: source level (peak at 1 m) and distance to the 207, 180, 166, 160, 150 and 120 dB re 1 μPa (RMS) SPL isopleths as well as the 187 dB re 1 μPa cSEL and 206 dBpeak. Sound pressure levels must be measured in the field in dB re 1 μPa (RMS) and reported by the Lessee, by itself or through its designated operator, to the Lessor and NMFS (per Section B.8.4). If, based on the results of this field verification, the Lessor determines that the monitoring zone does not encompass the 160 dB Level B harassment radius (and

notifies the Lessee and NMFS per Section B.8.6), the Lessor may impose additional, relevant requirements on the Lessee, including but not limited to, a requirement to expand this monitoring zone.

5. Protected Species Observer (PSO). The Lessee must ensure that the monitoring zone during DP thruster use is monitored by NMFS-approved PSOs around the sound source. The number of PSOs must be sufficient to effectively monitor the monitoring zone at all times. In order to ensure effective monitoring, PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch, unless a different schedule is approved by the Lessor. PSOs must not work for more than 12 hours in a 24-hour period. PSO reporting requirements are provided in Section B.8. The Lessee must provide the Lessor with a list of PSOs and their résumés no later than 45 calendar days prior to the scheduled start of surveys. The résumés of any additional PSOs must be provided at least 15 calendar days prior to each PSO's start date. The Lessor will send the PSO résumés to NMFS for approval.

6. Observation Location. The Lessee must ensure that monitoring occurs from the highest available vantage point on the associated operational platform and allows for 360-degree scanning.

7. Optical Device Availability. The Lessee must ensure that reticle binoculars and other suitable equipment are available to each PSO to adequately perceive and monitor protected marine species within the monitoring zone during DP thruster use.

8. Mid-Atlantic Seasonal Management Areas (SMAs) Right Whale Monitoring. The Lessee must ensure that between November 1 and April 30, vessel operators monitor NMFS North Atlantic Right Whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of North Atlantic right whales during DP thruster operations.

9. DP Thruster "Ramp Up." The Lessee must ensure that, when technically feasible, a "ramp up" of the DP thrusters occurs at the start or re-start of DP thruster use. The ramp up must begin with the power output gradually increased such that power output begins at the minimum output possible and doubles in 5-minute periods, once the monitoring zone is clear of any marine mammal and/or sea turtle for at least 60 minutes.

10. Implementation of Power Down for Marine Mammals and Sea Turtles. The Lessee must ensure that any time a marine mammal or sea turtle is observed within the monitoring zone, the PSO notifies the Resident Engineer, or other authorized individual. The PSO must then call for a power down of the DP thrusters, as long as such a power down would be technically feasible and would not cause damage to equipment and facilities being installed. Power down of the DP thrusters to the minimum output possible must occur as soon as it is safe to do so. Any disagreement or discussion should occur only after power down, unless such discussion relates to the safety of the timing of the power down of the DP thrusters. Following the clearance of the monitoring zone (per Section B.6.3.), the Lessee must follow ramp up procedures (per Section B.6.8.) in order to power up the DP thrusters to full operational power.

B.7 STANDARD OPERATING CONDITIONS FOR BIRDS

The following SOCs are intended to ensure that the potential for adverse impacts on birds is minimized, if not eliminated. These SOCs are considered part of the proposed action and will be incorporated as stipulations to any future lease:

1. The lessee will use only red flashing strobe-like lights for aviation obstruction lights, and mist ensure that these aviation obstruction lights emit infrared energy within 675 - 900 nanometers wavelength to be compatible with Department of Defense night vision goggle equipment.. These aviation obstruction lights shall also emit infrared energy within 675 - 900 nanometers wavelength to be compatible with Department of Defense night vision goggle equipment.
2. Any lights used to aid marine navigation by the Lessee during construction, operations and decommissioning of a meteorological tower or buoys must meet U.S. Coast Guard requirements for private aids to navigation [https://www.uscg.mil/forms/cg/CG_2554.pdf].
3. For any additional lighting not described in (1) or (2) above, the lessee must use such lighting only when necessary, and the lighting must be hooded downward and directed when possible, to reduce upward illumination and illumination of adjacent waters.
4. A meteorological tower should be designed so as to preclude the necessity for guy wires, which present the birds with something difficult to see that they could potentially collide with.
5. An annual report shall be provided to the Lessor documenting any dead birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the U.S. Geological Society Bird Band Laboratory, available at https://www.pwrc.usgs.gov/bbl/.
6. Anti-perching devices must be installed on the meteorological tower and buoys in order to minimize the attraction of birds.

B.8 PROTECTED SPECIES REPORTING REQUIREMENTS

The Lessee must ensure compliance with the following reporting requirements for site characterization activities performed in support of plan (i.e., SAP and/or COP) submittal and must use the contact information provided, or updated contact information as provided by the Lessor, to fulfill these requirements:

1. <u>HRG Plan for Field Verification of the Exclusion Zone</u>. No later than 45 days prior to the commencement of the field verification activities, the Lessee must submit a plan to the Lessor for verifying the sound source levels of any electromechanical survey equipment operating at frequencies below 200 kHz. The Lessee must obtain the Lessor's approval of the plan prior to conducting field verification activities.
2. <u>DP Thruster Plan for Field Verification of the Monitoring Zone</u>. No later than 45 calendar days prior to the commencement of the required DP thruster field verification activities, the Lessee must submit a plan to the Lessor for verifying the sound source levels of DP

thrusters. The Lessee must obtain the Lessor's approval of the plan prior to conducting field verification activities.

3. Preliminary Report from the Field Verification of HRG Survey Equipment. The Lessee must ensure that the results of the field verification are reported to the Lessor and NMFS prior to the HRG equipment being used for project-related activities. The Lessee must include in its report a preliminary interpretation of the results for all sound sources, which will include details of the operating frequencies, SPLs (RMS), received cSELs, and frequency bands covered, as well as associated latitude/longitude positions, ranges, depths and bearings between sound sources and receivers.

4. Field Verification of Monitoring Zone Reporting for DP Thruster Use. The Lessee must report the results of the DP thruster use field verification to the Lessor within 7 calendar days of the commencement of the field verification activities. The Lessee must include in its report a preliminary interpretation of the results for DP thruster use, which will include details of the operating frequencies, sound pressure levels (RMS), received cSELs, and frequency bands covered, as well as associated latitude/longitude positions, ranges, depths and bearings between sound sources and receivers.

5. Acoustic Monitoring Reporting and Field Verification of Exclusion Zone Reports for Pile Driving. The Lessee must ensure that the preliminary results of acoustic monitoring of pile driving activities are submitted to the Lessor and NMFS within 24 hours of installation. The Lessee must include in its report a preliminary interpretation of the results which will include details of the operating frequencies, SPLs (RMS), received cSELs and frequency bands covered, as well as associated latitude/longitude positions, ranges, depths and bearings between sound sources and receivers.

6. Required Modification of Exclusion or Monitoring Zone Notification. The Lessee must notify the Lessor and NMFS within 24 hours of receiving any acoustic monitoring results which indicate that any exclusion or monitoring zones do not cover the 180 dB Level A (or 160 dB Level B for DP thruster use) harassment thresholds. The Lessee must cease the relevant activity and may only modify an exclusion zone or monitoring zone with written approval from the Lessor and NMFS.

7. Reporting Injured or Dead Protected Species. The Lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals, sea turtles, or sturgeon) are reported to the Lessor, NMFS, and the NMFS Northeast Region Stranding Hotline within 24 hours of sighting, regardless of how the injury or death was caused. The Lessee must use the form provided in Attachment 2 to report the sighting or incident. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure that the vessel assists in any salvage effort as requested by NMFS.

8. Reporting Observed Impacts to Protected Species.

   a. The Lessee must report any observed take of listed marine mammals, sea turtles, or sturgeon to the Lessor and the NMFS Northeast Region Stranding Hotline within 48 hours.

   b. The Lessee must report any observations concerning any impacts on ESA-listed marine mammals, sea turtles or sturgeon to the Lessor and NMFS Northeast Region's Stranding Hotline within 48 hours.

9. Protected Species Observer Reports. The Lessee must ensure that the PSOs record all observations of protected species using standard marine mammal observer data collection protocols. The list of required data elements for these reports is provided in Attachment 1.
10. Final Technical Report for G&G Survey Activities and Observations. The Lessee must provide the Lessor and NMFS with reports every 90 calendar days following the commencement of HRG and/or geotechnical exploration activities, and a final report at the conclusion of the HRG and/or geotechnical exploration activities. Each report must include a summary of survey activities, all PSO and incident reports (see Attachments 1 and 2), a summary of the survey activities, and an estimate of the number of listed marine mammals and sea turtles observed and/or taken during these survey activities. The report must also include the results and analysis of the data collected during the sound source field verification of the G&G survey equipment.
11. Final Technical Report for DP Thruster Use and Observations. The Lessee must provide to the Lessor and NMFS a final technical report of the observation data recorded during DP thruster use monitoring within 120 calendar days of final DP thruster use. The report must include full documentation of methods and monitoring protocols, summarize the data collected during monitoring, estimate the number of listed marine mammals and sea turtles that may have been taken during DP thruster use, and provide an interpretation of the results and effectiveness of all monitoring tasks. The report must also include the results and analysis of the data collected during the sound source field verification of the DP thrusters.
12. Final Technical Report for Pile Driving and Observations. The Lessee must provide the Lessor and NMFS a report within 120 calendar days of completion of the pile driving and other construction activities. The report must include full documentation of methods and monitoring protocols, summarize the data recorded during monitoring, estimate the number of listed marine mammals and sea turtles that may have been taken during construction activities, and provide an interpretation of the results and effectiveness of all monitoring tasks. The report must also include the results and analysis of the sound source field verification data collected during pile driving activity.
13. Marine Mammal Protection Act Authorization(s). If the Lessee is required to obtain an authorization pursuant to section 101(a)(5) of the Marine Mammal Protection Act prior to conducting survey activities in support of plan submittal, the Lessee must provide to the Lessor a copy of such authorization prior to commencing such activities.

CONTACT INFORMATION FOR REPORTING REQUIREMENTS

The following contact information must be used for the reporting and coordination requirements specified in the terms and conditions for SAP approval:

United States Fleet Forces (USFF) N46
1562 Mitscher Ave, Suite 250
Norfolk, VA 23551
(757) 836-6206

The following contact information must be used for the reporting requirements in the terms and conditions for SAP approval:

Reporting Injured or Dead Protected Species

NOAA Fisheries Northeast Region's Stranding Hotline: **866-755-6622**
Collected dead sea turtles and/or Atlantic Sturgeon: Fax: (978) 281-9394 or e-mail: incidental.take@noaa.gov; renewable_reporting@boem.gov

All other reporting requirements

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
Phone: 703-787-1340
Email: renewable_reporting@boem.gov

National Marine Fisheries Service
Northeast Regional Office, Protected Resources Division
Section 7 Coordinator
Phone: 978-281-9328
Email: incidental.take@noaa.gov

Vessel operators may send a blank email to ne.rw.sightings@noaa.gov for an automatic response listing of all current DMAs.

Attachment 1

REQUIRED DATA ELEMENTS FOR PROTECTED SPECIES OBSERVER REPORTS

The Lessee must ensure that the protected species observers record all observations of protected species using standard marine mammal observer data collection protocols. The list of required data elements for these reports is provided below:

1) Vessel name;
2) Observer names and affiliations;
3) Date;
4) Time and latitude/longitude when visual survey began;
5) Time and latitude/longitude when visual survey ended; and
6) Average environmental conditions during visual surveys including:
   a) Wind speed and direction;
   b) Sea state (glassy, slight, choppy, rough, or Beaufort scale);
   c) Swell (low, medium, high, or swell height in meters); and
   d) Overall visibility (poor, moderate, good);
7) Species (or identification to lowest possible taxonomic level);
8) Certainty of identification (sure, most likely, best guess);
9) Total number of animals;
10) Number of juveniles;
11) Description (as many distinguishing features as possible of each individual seen, including length, shape, color and pattern, scars or marks, shape and size of dorsal fin, shape of head, and blow characteristics);
12) Direction of animal's travel relative to the vessel (preferably accompanied by a drawing);
13) Behavior (as explicit and detailed as possible; note any observed changes in behavior);
14) Activity of vessel when sighting occurred.

Attachment 2

Incident Report: Protected Species Injury or Mortality

Photographs/Video should be taken of all injured or dead animals.

Observer's full name: ____

Reporter's full name: ____

Species Identification: ____

Name and type of platform: ____

Date animal observed: ____________________ Time animal observed: ____________________

Date animal collected: ____________________ Time animal collected: ____________________

Environmental conditions at time of observation (i.e., tidal stage, Beaufort Sea State, weather):

____

____

Water temperature (°C) and depth (m/ft) at site: ____

Describe location of animal and events 24 hours leading up to, including and after, the incident (incl. vessel speeds, vessel activity and status of all sound source use): ____________________

____

____

____

____

____

Photograph/Video taken: YES / NO If Yes, was the data provided to NMFS? YES / NO
(Please label *species*, *date*, *geographic site* and *vessel name* when transmitting photo and/or video)

Date and Time reported to NMFS Stranding Hotline: ____

<u>Sturgeon Information</u>: *(please designate cm/m or inches and kg or lbs)*

Species: ____

Fork length (or total length): ____________________ Weight: ____________________

Condition of specimen/description of animal: ____

____

____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY

Fish tagged: YES / NO If Yes, p*lease record all tag numbers.*

Tag #(s): ____

Genetic samples collected: YES / NO

Genetics samples transmitted to:______________________________________on____/______/201….

<u>Sea Turtle Species Information</u>: *(please designate cm/m or inches)*

Species:______________________________________Weight (kg or lbs):_________________________

Sex: Male Female Unknown

How was sex determined?:____

Straight carapace length:_________________________Straight carapace width:____________________

Curved carapace length:__________________________Curved carapace width:_____________________

Plastron length:________________________________Plastron width:___________________________

Tail length:____________________________________Head width:_____________________________

Condition of specimen/description of animal:____

____

____

Existing Flipper Tag Information

Left:____Right:__________________________________

PIT Tag#:____

Miscellaneous:

Genetic biopsy collected: YES NO Photographs taken: YES NO

Turtle Release Information:

Date:____Time:__________________________________

Latitude:______________________________________Longitude:______________________________

State:____County:________________________________

Remarks: (note if turtle was involved with tar or oil, gear or debris entanglement, wounds, or mutilations, propeller damage, papillomas, old tag locations, etc.)________________________________

____

____

____

____

<u>Marine Mammal information</u>: *(please designate cm/m or ft/inches)*

Length of marine mammal (note direct or estimated): ____

Weight (*if possible, kg or lbs*):____

Sex of marine mammal (if possible):____

How was sex determined?:____

Confidence of Species Identification: SURE UNSURE BEST GUESS

Description of Identification characteristics of marine mammal:__________________________________

____

____

____

____

Genetic samples collected: YES / NO

Genetic samples transmitted to:____on____/______/201….

Fate of marine mammal:____

____

____

____

Description of Injuries Observed:____

____

____

____

Other Remarks/Drawings:____

____

____

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Appendix C

Vessel Trip Calculations

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Avian Surveys							
Alternative	# whole OCS blocks in survey area available for structure placement	# of OCS blocks surveyed per day	# days to complete survey of WEA	# months of surveying - low	# months of surveying - high	# trips for surveying - low	# trips for surveying - high
A	10	10	1	24	36	24	36

HRG Surveys					
Alternative	# whole OCS blocks in entire WEA	time to survey one whole OCS block in days	total # days to survey - 10hr day	ratio of 10hr to 24hr day	total # days to survey - 24hr day
A	14.25	11	157	0.42	65

Assumptions used to calculate trips associated with surveying of a hypotehtical cable route:
1. 5 nautical miles (9.3 km) of survey line per mile of cable corridor equals 1 hour of survey per mile of cable
2. Survey corridor would be 984 feet (300 meters) wide and surveyed at a 30-meter line spacing, which equals 10 survey lines
3. Perpindicular tie lines would occur every 1,650 feet (500 meters)

HRG surveying of cable route - primary (longitudinal) survey lines - 10 hour long survey days

Alternative	miles/ route	width of survey corridor (meters)	spacing between primay survey lines	primary survey lines required	total miles of surveying	speed of vessel (knots)	total hours of surveys	total days (round trips)
A	44	300	30	10	440	4.5	98	10

HRG surveying of cable route - perpendicular tie lines - 10 hour long survey days

Alternative	miles/ route	width of survey corridor (meters)	spacing between perpindular survey lines (meters)	convert length of route from miles to meters	number of perpindular lines	total meters of surveys	total miles of surveys	speed of vessel (knots)	total hours of surveys	total days (round trips)
A	44	300	500	70810.96	142	42487	26.4	4.5	6	0.6

HRG surveying of cable route - primary (longitudinal) survey lines - 24 hour continual surveying

Alternative	miles/ route	width of survey corridor	spacing between primay survey lines	primary survey lines required	total miles of surveying	speed of vessel (knots)	total hours of surveys	total days but assuming 1 round trip
A	44	300m	30	10	440	4.5	98	4

HRG surveying of cable route - perpendicular tie lines - 24 hour continual surveying

Alternative	miles/ route	width of survey corridor (meters)	spacing between perpindular survey lines (meters)	convert length of route from miles to meters	number of perpindular lines	total meters of surveys	total miles of surveys	speed of vessel (knots)	total hours of surveys	total days but assuming 1 round trip
A	44	300	500	70810.96	142	42487	26.4	4.5	6	0.2

Vessel Trip Calculations for Site Assessment - Meteorological Towers

Construction			
Alternative	# towers	round trips for construction per tower	total round trips
A	1	40	40

Maintenance - quarterly and weekly				
Quarterly				
Alternative	# towers	# visits	years	total trips
A	1	4	5	20
Weekly				
A	1	52	5	260

Decommission			
Alternative	# towers	round trips for construction per tower	total round trips
A	1	40	40

Total		
Alternative	Low Range	High Range
A	100	340

Construction					
Alternative	# buoys	round trips for construction per buoy - low	total round trips - low	round trips for construction per buoy - high	total round trips - high
A	2	1	2	2	4

Maintenance - Quarterly and Monthly				
Quarterly				
Alternative	# buoys	# visits	years	total trips
A	2	4	5	40
Monthly				
A	2	12	5	120

Decommission					
Alternative	# buoys	round trips for construction per buoy - low	total round trips - low	round trips for construction per buoy - high	total round trips - high
A	2	1	2	2	4

Total		
Alternative	Low Range	High Range
A	44	128

Below is the list of assumptions used to calculate the total number of surveys and vessel trips in the WEA associated with geotechnical/sub-bottom sampling:

1. Maximum of 20 wind turbines per whole OCS block
2. Maximum of 10 wind turbines per partial OCS block
3. One sub-bottom sample (vibracore, CPT, and/or deep boring) at every potential wind turbine location
4. One sub-bottom sample every nautical mile of transmission cable corridor
5. One sub-bottom sample at the meteorological tower and/or each buoy site
6. One sample (vibracore, CPT, and/or deep boring) conducted per work day. Each work day would be associated with one round trip

Sub-bottom Sampling Surveys and Vessel Trips for the Proposed Action (Alternative A)	
Description	**No.**
Number of Whole OCS Blocks in WEA[1]	**10**
Approximate Number of Sub-bottom Samples by OCS Block	**200**
Approximate Number of Sub-bottom Samples for Cable Route	**44**
Approximate Number of Sub-bottom Samples for Meteorological Tower and/or Buoy	**3**
Total Number of Sub-bottom Samples	**247**
Total Number of Vessel Round Trips - 1 round trip per day	**247**

[1]See Table 2-2 in Section 2.1 of the EA for an explanation of the value of 10 whole OCS blocks under Alternative A

<u>Sampling trips based on August 13, 2015 Guidelines</u>

1. Trawl Survey Protocols. Demersal fish
2 years x 4 quarters = 8 surveys
30 trawls per survey = 240 samples (trawls)
Vessel trips = 2 days travel RT + 3 days on site = 5 days per survey
5 days/survey x 8 surveys = 40 vessel days

2. Gill Net and Beam Trawls Protocols. Microscale distribution of fish
<u>Gill net:</u>
1 year x 2 quarters (spring and fall) x 3 events/quarter = 6 surveys
6 samples per survey = 36 samples
Vessel trips = 2 days RT + 2 day (1-2 days) on site = 4 days per survey
4 days/survey x 6 surveys = 24 vessel days

<u>Beam Trawl (might be able to piggyback with trawl survey)</u>
1 year x 4 quarters = 4 surveys
6 samples/survey = 24 samples
Vessel Trips = 2 days RT + 1 day on site= 3 days per survey
3 days/survey x 4 surveys = 12 vessel days

3. Ventless Trap Survey
2 years x 4 quarters = 8 surveys
3 locations/survey = 24 samples (each sample consists of a 5 trap trawl)
Vessel Trips = 2 days RT (day 1 travel and set, three days later day 2 travel and haul)
2 days/survey x 8 surveys = 16 vessel days

4. Molluscan Shellfish Survey
Assume piggyback with geotech survey

Survey	Vessel Trips
1. Trawl	40
2a. Gill net	24
2b. Beam trawl	12
3. Ventless trap	16
4. Molluscan shellfish	Piggyback
TOTAL	**92**

Appendix D

Air Emissions Calculations

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Table 4-1

Summary of Annual Estimated Criteria Emissions by Activity for Alternatives A and B

BOEM New York Environmental Assessment

Action Alternative	Activity	Average Emissions by Activity for One Year					
		CO	NO_x	VOCs	$PM_{2.5}$	PM_{10}	SO_x
A or B	Site Characterization Surveys	1.41	15.57	0.91	0.85	0.85	1.53
	Site Assessment: Installation of Meteorological Tower and Buoys	0.20	1.31	0.38	0.07	0.07	0.12
	Site Assessment: Operation of Meteorological Tower and Buoys	4.98	23.47	2.19	1.65	1.65	1.57
	Site Assessment: Decommissioning of Meteorological Tower and Buoys	0.15	1.15	0.36	0.07	0.07	0.11
C	No Action	No Action and, therefore, no emissions					

This appendix and its calculations are adapted from Appendix D of *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina: Revised Environmental Assessment (NC EA).*
BOEM 2015-038, September 2015. Available at: http://www.boem.gov/North-Carolina/
Assumptions, data, table footnotes, and references—other than NY/NJ-specific WEA locations, port locations, vessel trip volumes and distances—are taken from the NC EA.

Table 4-2
Summary of Annual Criteria Emissions by Activity for Alternatives A and B
Project Lifecycle Emission Estimate on Annual Basis
BOEM New York Environmental Assessment

Action Alternative	Activity/Year[1]	Emissions (tons/year)						Emissions (metric tons/year)		
		CO	NO_x	VOCs	$PM_{2.5}$	PM_{10}	SO_x	CO_2[2]	N_2O	CH_4
A or B	Year 1 - Site Characterization	1.41	15.57	0.91	0.85	0.85	1.53	747.32	0.02	0.10
	Year 2 - Site Characterization, Construction, and Operation	6.59	40.35	3.47	2.58	2.58	3.23	1664.91	0.02	0.11
	Year 3 - Site Characterization and Operation	6.39	39.04	3.09	2.50	2.50	3.11	1579.63	0.02	0.10
	Year 4- Site Characterization and Operation	6.39	39.04	3.09	2.50	2.50	3.11	1579.63	0.02	0.10
	Year 5 - Site Characterization and Operation	6.39	39.04	3.09	2.50	2.50	3.11	1579.63	0.02	0.10
	Year 6 - Operation	4.98	23.47	2.19	1.65	1.65	1.57	832.32	0.00	0.00
	Year 7 - Decommissioning	0.15	1.15	0.36	0.07	0.07	0.11	64.33	0.00	0.01
C	No Action	No Action and, therefore, no emissions								

This appendix and its calculations are adapted from Appendix D of *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina: Revised Environmental Assessment (NC EA).*
BOEM 2015-038, September 2015. Available at: http://www.boem.gov/North-Carolina/
Assumptions, data, table footnotes, and references—other than NY/NJ-specific WEA locations, port locations, vessel trip volumes and distances—are taken from the NC EA.

1. Construction (installation) of a meteorological tower and buoys could take 8 days to 10 weeks and decommission could take one day to one week. Because the installation and decommissioning timeframes are variable, operational years were not prorated to account for the installation and decommission in order to provide a conservative estimate.
2. The CO_2 value for generators (included in the Operation) is in CO_2^e (carbon dioxide equivalent) which provides an expression of CO_2, N_2O, and CH_4 emissions combined.

Table 4-3

Detail Emission Estimation of Annual Criteria Emissions by Activities for Average Year

Alternative A and B

BOEM New York Environmental Assessment

Emissions Summary for Average Year -- Alternative A or B

Phase/Source Description	Emissions (tons/year)						Emissions (metric tons/year)		
	CO	**NO_x**	**VOC**	**$PM_{2.5}$**	**PM_{10}**	**SO_x**	**CO_2[1]**	**N_2O**	**CH_4**
Site Characterization - Staff Commuting for Surveys									
- POVs	1.11E-01	5.03E-03	6.71E-03	3.91E-04	6.71E-04	2.79E-04	9.33E+00	9.13E-05	4.39E-04
Site Characterization - Offshore Surveys									
- Vessel Travel	1.30	15.56	0.59	0.85	0.85	1.53	737.99	0.02	0.10
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL Site Characterization - One Year from Years 1-5	**1.41**	**15.57**	**0.91**	**0.85**	**0.85**	**1.53**	**747.32**	**2.15E-02**	**9.67E-02**
One Meteorological Tower and Two Buoys									
Site Assessment - Onshore Construction									
- POVs	1.94E-02	3.91E-03	2.99E-03	4.02E-04	6.13E-04	2.11E-04	1.11E+01	3.62E-05	7.07E-05
- Construction Equipment	6.78E-02	2.02E-01	1.44E-02	1.20E-02	1.24E-02	1.40E-02	1.82E+01	1.64E-04	3.59E-04
Site Assessment - Offshore Construction									
- Vessel Travel	8.41E-02	1.01E+00	3.82E-02	5.51E-02	5.51E-02	9.94E-02	4.79E+01	1.39E-03	6.25E-03
- Construction Equipment	2.63E-02	9.62E-02	7.02E-03	5.23E-03	5.43E-03	6.23E-03	8.12E+00	7.34E-05	1.61E-04
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL Construction - Year 2	**0.20**	**1.31**	**0.38**	**0.07**	**0.07**	**0.12**	**85.28**	**1.66E-03**	**6.84E-03**
Site Assessment - Onshore O&M									
- POVs	1.68E-02	7.64E-04	1.02E-03	5.94E-05	1.02E-04	4.24E-05	1.42E+00	1.39E-05	6.66E-05
Site Assessment - Offshore O&M									
- Vessel Travel	5.90E-02	7.08E-01	2.68E-02	3.86E-02	3.86E-02	6.98E-02	3.36E+01	9.74E-04	4.38E-03
- Generators	4.90	22.76	1.85	1.62	1.62	1.51	797.31	-	-
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL O&M - One Year from Years 2-6	**4.98**	**23.47**	**2.19**	**1.65**	**1.65**	**1.57**	**832.32**	**9.88E-04**	**4.45E-03**
Site Assessment - Onshore Decommission									
- POVs	1.41E-02	2.38E-03	1.32E-03	1.27E-04	2.01E-04	7.34E-05	3.65E+00	1.84E-05	5.75E-05
Site Assessment - Offshore Decommission									
- Vessel Travel	8.41E-02	1.01E+00	3.82E-02	5.51E-02	5.51E-02	9.94E-02	4.79E+01	1.39E-03	6.25E-03
- Construction Equipment	5.42E-02	1.39E-01	1.17E-02	9.81E-03	1.01E-02	9.79E-03	1.28E+01	1.12E-04	2.47E-04
- Fuel Spills	-	-	0.31	-	-	-	-	-	-
SUBTOTAL Decommissioning - Year 7	**0.15**	**1.15**	**0.36**	**0.07**	**0.07**	**0.11**	**64.33**	**1.52E-03**	**6.55E-03**

CO = carbon monoxide, NO_x = nitrogen oxides, VOCs = volatile organic compounds, PM_{10} = particulate matter with aerodynamic diameters of 10 microns or less, $PM_{2.5}$ = particulate matter with aerodynamic diameters of 2.5 microns or less, SO_x = sulfur oxides, CO_2 = carbon dioxide, N_20 = nitrogen dioxide, CH_4 = methane

Table 4-5

Site Characterization Activities Alternative A and B

Onshore Activities - Staff Commuting to Job Site

BOEM New York Environmental Assessment

Personal Vehicle Round Trips for Vessel Trips Associated with Site Characterization Activities

Survey Task	Alternative A or B[4]			
	Total No. of Vessel Round Trips[1]	Duration of Survey Task (years)	No. of Vessel Round Trips (per year)[2]	No. of POV Round Trips (per year)[3]
HRG Survey of OCS blocks within WEA	157	5	31	94
HRG surveys of 3 cable routes	10	5	2	6
Geotechnical Sampling	247	5	49	148
Avian surveys (max. of 171-252 range)	36	3	12	36
Fish surveys	92	2	46	138
TOTAL	**542**	**--**	**141**	**422**

1. Total number of vessel round trips conservatively based on 10-hour survey days.
2.Round trips per year estimated by dividing total round trips per task by the number of years over which the surveys will be conducted.
3.Assume an average of three staff per vessel. Therefore, personal vehicle (POV) round trips assumed to equal three times the number of vessel round trips per year.
4. Since site characterization activities for Alternative A and B take place over an area of the same size, the total number of POV round trips is assumed to be the same for each Alternative.

Personal Vehicle Emission Factors[1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NO_x	VOC	PM2.5[3]	PM10[3]	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02

Personal Vehicle Emissions -- Average Year Over 5 Years

Personal Vehicle Type	Total No. of Round Trips	Total Miles (per trip)[4]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NO_x	VOC	PM2.5[3]	PM10[3]	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles - Alt. A	422	60	**1.11E-01**	**5.03E-03**	**6.71E-03**	**3.91E-04**	**6.71E-04**	**2.79E-04**	**9.33E+00**	**9.13E-05**	**4.39E-04**
Light Duty Gasoline Vehicles - Alt. B	422	60	**1.11E-01**	**5.03E-03**	**6.71E-03**	**3.91E-04**	**6.71E-04**	**2.79E-04**	**9.33E+00**	**9.13E-05**	**4.39E-04**

1.Emission factors and methodology from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 4. Emission Factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-4, for Tier 2 gasoline passenger cars.
2.Assume staff drive Light Duty Gasoline Vehicles, with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.
3.Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.
4.Assume each employee drives 60 miles round trip.

Table 4-6

Site Characterization Activities Alternative A and B

HRG Survey Details

BOEM New York Environmental Assessment

HGR Survey of Cable Routes		
Line spacing (m)	30	
Cable corridor width (m)	300	
No. of survey lines = Survey miles/corridor mile (nm)	5	
Results by EA Alternative	**A**	**B**
Cable corridor length (nm)	44	44
Total survey distance (nm)	220	220
Vessel-hours required	40	40

Calculation of HRG Survey Vessel-Hours		
HRG Survey of OCS Blocks		
Length of surveys per OCS block (nm)	500	
Vessel speed (kt)	4.5	
Survey time required per OCS block (hr)	111	
Survey period duration (yr)	5	
Results by EA Alternative	**A**	**B**
No. of OCS blocks	10	10
Vessel-hours required	5,550	5,550
Vessel-hours required/yr	1,110	1,110

Table 4-7
Site Characterization Activities Alternative A and B
Offshore Activities - Surveys
BOEM New York Environmental Assessment

Survey Vessel Details

Survey Task	Vessel Type	Alternative A or B[7]					
		Total No. of Vessel Round Trips[2]	Duration of Survey Task (years)	No. of Vessel Round Trips (per year)[3]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)[4]	Activity (hrs/yr)[5]
HRG Survey of OCS blocks within WEA	Crew Boat	157	5	31	-	4,995	1,110
HRG surveys of cable route	Crew Boat	10	5	2	-	180	40
Geotechnical Sampling[1]	Small Tug Boat	247	5	49	37	1,828	152
Geotechnical Sampling[1]	Cargo Barge	247	5	49	37	1,828	152
Avian surveys[6]	Crew Boat	36	3	12	37	444	61
Fish Surveys[6]	Crew Boat	92	2	46	37	1,702	1246

1. Assume all round trips over the 5 year period were performed using Small Tug Boat in conjunction with small Cargo Barge, which does not have an engine. Assume all Avian surveys completed by boat to obtain worst case scenario.
2. Total number of vessel round trips conservatively based on 10-hour survey days.
3. Round trips per year estimated by dividing total round trips per task by the number of years over which the surveys will be conducted.
4. Distances for HRG Survey and HRG Survey Cable Routes are based on vessel-hours and speed. Distances for other surveys based on calculated round trips multiplied by average round trip nm.
5. Assume an average speed of 4.5 knots for HRG surveys, 12 knots for the tug boats/barges, and 12 knots (average based on a speed of 18 knots while traveling to and from WEA and a speed of 6 knots while surveying) for avian and fish surveys to estimate activity hours based upon total nautical miles traveled. No time for the vessels spent at idle was captured in this calculation.
http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat
6. Assume each avian survey takes 2 hours, and each fish survey takes 24 hours.
7. Since site characterization activities for Alternative A and B take place over an area of the same size, the total number of vessel round trips is assumed to be the same for each alternative.

Table 4-8
Site Characterization Activities Alternative A and B
Estimated Annual Emissions for Vessels
BOEM New York Environmental Assessment

Emission Factors for Vessels

Vessel Type	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[3] CO	NO_x	VOC	$PM_{2.5}$[4]	PM_{10}	SO_x[5]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,493	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1.Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
2.Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.
3.Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for both types of boats since the crew boat is almost within that category, and it provides a conservative assumption for pollutants for which the areas are in non-attainment.
4.Assume $PM_{2.5} = PM_{10}$
5.SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels -- Average Year Over 5 Years

Alternative	Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2] CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Alt. A & B	Crew Boat	1.17E+00	1.40E+01	5.31E-01	7.65E-01	7.65E-01	1.38E+00	665.05	1.93E-02	8.67E-02
	Small Tug Boat	1.28E-01	1.54E+00	5.83E-02	8.39E-02	8.39E-02	1.51E-01	72.94	2.11E-03	9.51E-03
	TOTAL Alt. A	**1.30**	**15.56**	**0.59**	**0.85**	**0.85**	**1.53**	**737.99**	**0.02**	**0.10**
	TOTAL Alt. B	**1.30**	**15.56**	**0.59**	**0.85**	**0.85**	**1.53**	**737.99**	**0.02**	**0.10**

1.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.
2.Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Offshore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1.Assume a spill of 88 gallons of diesel occurs each year.
2.Liquid fuel density values obtained from *Air Emissions Factor Guide to Air Force Stationary Sources* , December 2009, Table 14-2.
3. To be conservative, assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Table 4-9
Site Assessment Activities Alternative A and B - Installation
Onshore Activities - Staff Commuting to Job Site and Material/Equipment Delivery
BOEM New York Environmental Assessment

Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NO_x	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SO_x	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	2009	2015	0.15	1.68	0.18	0.02	0.03	0.01	1,029.9	4.80E-03	5.10E-03
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.0	3.60E-03	1.73E-02
Light Duty Diesel Trucks	2009	2015	0.35	0.11	0.12	0.02	0.03	0.01	598.6	1.40E-03	9.00E-04

Personal Vehicle Emissions -- One Year

Personal Vehicle Type	Total No. of Round Trips/year[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	13	60	1.29E-04	1.44E-03	1.55E-04	1.72E-05	2.58E-05	8.60E-06	8.03E-01	3.74E-06	3.98E-06
Light Duty Gasoline Vehicles	51	60	1.34E-02	6.07E-04	8.10E-04	4.72E-05	8.10E-05	3.37E-05	1.13E+00	1.10E-05	5.29E-05
Light Duty Diesel Trucks	51	60	5.90E-03	1.86E-03	2.02E-03	3.37E-04	5.06E-04	1.69E-04	9.16E+00	2.14E-05	1.38E-05
TOTAL Alt. A - 1 tower, 2 buoys	-	-	**1.94E-02**	**3.91E-03**	**2.99E-03**	**4.02E-04**	**6.13E-04**	**2.11E-04**	**1.11E+01**	**3.62E-05**	**7.07E-05**
TOTAL Alt. B - 1 tower, 2 buoys	-	-	**1.94E-02**	**3.91E-03**	**2.99E-03**	**4.02E-04**	**6.13E-04**	**2.11E-04**	**1.11E+01**	**3.62E-05**	**7.07E-05**

1.Emission factors and methodology from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 4. Emission factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1 for Tier 2 gasoline passenger cars, moderate diesel light trucks, and moderate diesel heavy-duty trucks.
2.Assume contractors drive Light Duty Diesel Trucks (Type 3/4), staff drive Light Duty Gasoline Vehicles, and material/equipment deliveries are made using Heavy Duty Diesel Trucks (Type 5), with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.
3.Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.
4.Assume construction, transportation, and installation of tower and buoys will take place over the course of one year. Assume an average of 5 contractors travel to the site over 51 days total. In addition, assume an average of one staff travel to the site over 51 days total. Lastly, assume one heavy duty truck travels to the site over 13 days total.
5.Assume each employee drives 60 miles round trip.

Table 4-10
Site Assessment Activities Alternative A and B - Installation
Onshore Activities - Heavy Equipment Use - One Year
BOEM New York Environmental Assessment

Heavy Equipment Emission Factors [1]

Construction Equipment	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[1] CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Crane	194	145	43%	1.84	7.34	0.51	0.38	0.39	0.50	714.75	6.48E-03	1.42E-02
Rubber Tired Loader	158	118	59%	2.96	7.15	0.52	0.48	0.50	0.51	722.80	6.48E-03	1.42E-02

1. Emission factors from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 3; converted from g/hp-hr to g/kW-hr. Emission factors for N_2O and CH4 were not available.

2. Emission factors for N_2O and CH_4 from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub, November 2015, Table 5, factors for Diesel Construction Equipment were used and converted from g/gallon to g/kW-hr.

Construction Equipment	Usage (hrs)	Emission (tons/year, metric tons/year for GHG pollutants)[4] CO	NO_x	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SO_x	CO_2	N_2O	CH_4
Cranes	192	2.42E-02	9.66E-02	6.71E-03	4.94E-03	5.12E-03	6.53E-03	8.54E+00	7.73E-05	1.70E-04
Rubber Tired Loaders	192	4.36E-02	1.05E-01	7.69E-03	7.10E-03	7.30E-03	7.50E-03	9.65E+00	8.64E-05	1.89E-04
TOTAL Alt. A - 1 tower	-	**6.78E-02**	**2.02E-01**	**1.44E-02**	**1.20E-02**	**1.24E-02**	**1.40E-02**	**1.82E+01**	**1.64E-04**	**3.59E-04**
TOTAL Alt. B - 1 tower	-	**6.78E-02**	**2.02E-01**	**1.44E-02**	**1.20E-02**	**1.24E-02**	**1.40E-02**	**1.82E+01**	**1.64E-04**	**3.59E-04**

1.Only cranes and loaders were assumed to be used on shore during assembly of the tower to move and lift the pieces into place.

2.Assume crane and rubber tire loader operate half of the 48 days estimated to complete the construction of the tower, for 8 hours per day (i.e., 192 hours).

3.Assume $PM_{2.5} = PM_{10}$

4.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.

Table 4-11

Site Assessment Activities Alternative A and B - Installation

Offshore Activities - Transport of Tower and Buoys to Sites from Ports

BOEM New York Environmental Assessment

Vessel Details for Construction of Tower and Buoys

Vessel Type	Total No. of Vessel Round Trips/Yr[1]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[2]
Crane Barge	2	37	74	6
Deck Cargo	2	37	74	6
Small Cargo Barge	2	37	74	6
Crew Boat	21	37	777	43
Small Tug Boat	4	37	148	12
Large Tug Boat	10	37	370	31

1. Average to build one meteorological tower, per note in corresponding table in NC EA Appendix D, plus two trips for each of the 2 buoys being transported by a large tug-boat.

2.Assume an average speed of 12 knots for the tug boats/barges and 18 knots for the crew boat to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.

http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat

Table 4-12

Site Assessment Activities Alternative A and B - Installation

Estimated Annual Emissions for Vessels

BOEM New York Environmental Assessment

Emission Factors for Vessels

Vessel Type[1]	Engine Size (hp)	Engine Power (kW)[2]	Load Factor (%)[3]	Emission Factors (g/kW-hr)[4]								
				CO	NO_x	VOC	$PM_{2.5}$[5]	PM_{10}	SO_x[6]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,491	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Large Tug Boat	4,200	3,132	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1.The Small and Large Tug Boats are used in conjunction with the Crane Barge, Deck Cargo, and Small Cargo Barge, which do not have an engine. Therefore, only the Crew Boat, Small Tug Boat, and Large Tug Boat have emission factors.

2.Engine power (kW) estimated by dividing horsepower by a factor of 1.341.

3.Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.

4.Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat, small tug boat, and large tug boat since the crew boat and large tug boat are approximately within that category.

5.Assume $PM_{2.5} = PM_{10}$

6.SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels -- One Year

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Crew Boat	1.93E-02	2.32E-01	8.79E-03	1.27E-02	1.27E-02	2.28E-02	1.10E+01	3.19E-04	1.43E-03
Small Tug Boat	1.04E-02	1.24E-01	4.71E-03	6.79E-03	6.79E-03	1.23E-02	5.90E+00	1.71E-04	7.70E-04
Large Tug Boat	5.44E-02	6.53E-01	2.47E-02	3.56E-02	3.56E-02	6.43E-02	3.10E+01	8.98E-04	4.04E-03
TOTAL Alt. A - 1 tower, 2 buoys	**8.41E-02**	**1.01E+00**	**3.82E-02**	**5.51E-02**	**5.51E-02**	**9.94E-02**	**4.79E+01**	**1.39E-03**	**6.25E-03**
TOTAL Alt. B - 1 tower, 2 buoys	**8.41E-02**	**1.01E+00**	**3.82E-02**	**5.51E-02**	**5.51E-02**	**9.94E-02**	**4.79E+01**	**1.39E-03**	**6.25E-03**

1.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.

2.Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Table 4-13
Site Assessment Activities Alternative A and B - Installation
Offshore Activities - Construction of Pilings -- One Year
BOEM New York Environmental Assessment

Heavy Equipment Emission Factors [1]

Construction Equipment	Engine Size (hp)	Engine Power (kW)	Load Factor (%)[2]	Emission Factors (g/kW-hr)[1] CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Bore/Drill Rigs	209	156	43%	3.34	9.35	0.80	0.62	0.64	0.51	722.80	6.48E-03	1.42E-02
Crane	194	145	43%	1.84	7.34	0.51	0.38	0.39	0.50	714.75	6.48E-03	1.42E-02

1. Emission factors from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 3; converted from g/hp-hr to g/kW-hr. Emission factors for N_2O and CH_4 were not available.
2. Emission factors for N_2O and CH_4 from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub, November 2015, Table 5, factors for Diesel Construction Equipment were used and converted from g/gallon to g/kW-hr.

Construction Equipment[1]	Usage[2] (hrs)	Emission (tons/year, metric tons/year for GHG pollutants) CO	NO_x	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SO_x	CO_2	N_2O	CH_4
Bore/Drill Rigs	30	7.40E-03	2.07E-02	1.78E-03	1.37E-03	1.43E-03	1.13E-03	1.45E+00	1.30E-05	2.85E-05
Cranes	150	1.89E-02	7.54E-02	5.24E-03	3.86E-03	4.00E-03	5.10E-03	6.67E+00	6.04E-05	1.32E-04
TOTAL Alt. A - 1 tower	**-**	**2.63E-02**	**9.62E-02**	**7.02E-03**	**5.23E-03**	**5.43E-03**	**6.23E-03**	**8.12E+00**	**7.34E-05**	**1.61E-04**
TOTAL Alt. B - 1 tower	**-**	**2.63E-02**	**9.62E-02**	**7.02E-03**	**5.23E-03**	**5.43E-03**	**6.23E-03**	**8.12E+00**	**7.34E-05**	**1.61E-04**

1.Only bore/drill rigs and cranes were assumed to be used off shore during the construction of the pilings.
2.Assume bore/drill rigs operate for three days, 10 hours per day (i.e., 30 hours) and cranes operate for three weeks total, 10 hours per day (i.e., 150 hours) for the tower.
3.Assume $PM_{2.5} = PM_{10}$
4.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.

Offshore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1.Assume a spill of 88 gallons of diesel occurs each year.
2.Liquid fuel density values obtained from *Air Emissions Factor Guide to Air Force Stationary Sources* , December 2009, Table 14-2.
3. To be conservative, assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Table 4-14
Site Assessment Activities Alternative A and B - Operation and Maintenance
Onshore Activities - Staff Commuting to Job Site
BOEM New York Environmental Assessment

Personal Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NOx	VOC	PM2.5[3]	PM10[3]	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02

Personal Vehicle Emissions -- Average Year Over 5 Years

Personal Vehicle Type	Total No. of Round Trips/Yr[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NOx	VOC	PM2.5	PM10	SOx	CO_2	N_2O	CH_4
Light Duty Gasoline Vehicles	64	60	1.68E-02	7.64E-04	1.02E-03	5.94E-05	1.02E-04	4.24E-05	1.42E+00	1.39E-05	6.66E-05
TOTAL Alt. A - 1 tower, 2 buoys	**-**	**-**	**1.68E-02**	**7.64E-04**	**1.02E-03**	**5.94E-05**	**1.02E-04**	**4.24E-05**	**1.42E+00**	**1.39E-05**	**6.66E-05**
TOTAL Alt. B - 1 tower, 2 buoys	**-**	**-**	**1.68E-02**	**7.64E-04**	**1.02E-03**	**5.94E-05**	**1.02E-04**	**4.24E-05**	**1.42E+00**	**1.39E-05**	**6.66E-05**

1.Emission factors and methodology from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 4. Emission Factors for N_2O and CH_4 obtained from the Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document (2010), Table D-1, for Tier 2 gasoline passenger cars.

2.Assume staff drive Light Duty Gasoline Vehicles, with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.

3.Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.

4.Assume one weekly trip by one person to observe/service the tower, and to refuel/perform maintenance of the potential generator. Assume one monthly trip by one person to observe/service the buoys.

5.Assume 60 miles round trip.

Table 4-15
Site Assessment Activities Alternative A and B - Operation and Maintenance
Offshore Activities - Routine Maintenance and Evaluation
BOEM New York Environmental Assessment

Maintenance Vessel Details

Task	Vessel Type	Total No. of Vessel Round Trips	Duration of Task (years)	No. of Vessel Round Trips (per year)[2]	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[3]
Routine Maintenance	Crew Boat	321	5	64	37	2,373	132

1.Assume one round trip each week using a crew boat to observe/service the tower, including fueling/performing maintenance on the assumed generators. Assume one monthly trip by crew boat to observe/service the buoys.
2.Round trips per year estimated by dividing total round trips per task by the number of years (only one year was modeled) needed to complete task.
3.Assume an average speed of 18 knots to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation.

Emission Factors for Vessels

Vessel Type	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[3]								
				CO	NO_x	VOC	$PM_{2.5}$[4]	PM_{10}	SO_x[5]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690.0	0.02	0.09

1.Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
2.Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes crew boats as Harbor Vessels; therefore, the load factor (Table 3.8) is for Harbor Vessels.
3.Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat since it is almost within that category, and it provides a conservative assumption for pollutants for which the areas are in non-attainment.
4.Assume $PM_{2.5} = PM_{10}$
5.SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels -- Average Year Over 5 Years

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	Sox	CO_2	N_2O	CH_4
Crew Boat	5.90E-02	7.08E-01	2.68E-02	3.86E-02	3.86E-02	6.98E-02	3.36E+01	9.74E-04	4.38E-03
TOTAL Alt. A - 1 tower, 2 buoys	**5.90E-02**	**7.08E-01**	**2.68E-02**	**3.86E-02**	**3.86E-02**	**6.98E-02**	**3.36E+01**	**9.74E-04**	**4.38E-03**
TOTAL Alt. B - 1 tower, 2 buoys	**5.90E-02**	**7.08E-01**	**2.68E-02**	**3.86E-02**	**3.86E-02**	**6.98E-02**	**3.36E+01**	**9.74E-04**	**4.38E-03**

1.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000.
2.Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Table 4-16
Site Assessment Activities Alternative A and B - Operation and Maintenance
Offshore Activities - Operation of Prime Generator
BOEM New York Environmental Assessment

Unit Information

Source	Estimated Rated Capacity (hp)	Operating Hours (hours/year)	Fuel
One 75 kW diesel-fired generator to serve as primary source of electricity for tower	101	8,760	Diesel
One 25 kW diesel-fired generator to serve as primary source of electricity for buoy	34	8,760	Diesel
One 25 kW diesel-fired generator to serve as primary source of electricity for buoy	34	8,760	Diesel

Emission Factors [1,2]

Pollutant	NO_x	CO	PM	SO_2	VOC	CO_2^e
Diesel (lb/hp-hr)	0.031	0.007	0.002	0.002	0.003	1.15

Potential Criteria Pollutant Emissions [3]

Source	NO_x (tpy)	CO (tpy)	PM/ PM_{10}/ $PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	CO_2^e (metric tpy)
One 75 kW diesel-fired generator to serve as primary source of electricity for tower	13.66	2.94	0.97	0.90	1.11	459.58
One 25 kW diesel-fired generator to serve as primary source of electricity for buoy	4.55	0.98	0.32	0.30	0.37	168.87
One 25 kW diesel-fired generator to serve as primary source of electricity for buoy	4.55	0.98	0.32	0.30	0.37	168.87
TOTAL Alt. A - 3 generators	**22.76**	**4.90**	**1.62**	**1.51**	**1.85**	**797.31**
TOTAL Alt. B - 3 generators	**22.76**	**4.90**	**1.62**	**1.51**	**1.85**	**797.31**

1.Emission factors were obtained from AP-42, Section 3.3.
2.Conservatively assumed PM = PM_{10} = $PM_{2.5}$.
3.Emissions were calculated for one year.

Offshore Activities – Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1.Assume a spill of 88 gallons of diesel occurs each year.
2.Liquid fuel density values obtained from *Air Emissions Factor Guide to Air Force Stationary Sources* , December 2009, Table 14-2.
3.Assume none of the spill could be recovered, and that 100% of the fuel evaporates.

Table 4-17
Site Assessment Activities Alternative A and B - Decommission
Onshore Activities - Contractors Commuting to Job Site for Decommission
BOEM New York Environmental Assessment

Vehicle Emission Factors [1]

Personal Vehicle Type	Model Year[2]	Calendar Year[2]	Emission Factors (grams/mile)								
			CO	NO_x	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SO_x	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	2009	2015	0.15	1.68	0.18	0.02	0.03	0.01	1,029.90	4.80E-03	5.10E-03
Light Duty Gasoline Vehicles	2009	2015	3.97	0.18	0.24	0.014	0.024	0.01	368.00	3.60E-03	1.73E-02
Light Duty Diesel Trucks	2009	2015	0.35	0.11	0.12	0.02	0.03	0.01	598.60	1.40E-03	9.00E-04

Personal Vehicle Emissions -- One Year

Personal Vehicle Type	Total No. of Round Trips[4]	Total Miles (per trip)[5]	Emission (tons/year, metric tons/year for GHG pollutants)								
			CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Heavy Duty Diesel Vehicles	13	60	1.29E-04	1.44E-03	1.55E-04	1.72E-05	2.58E-05	8.60E-06	8.03E-01	3.74E-06	3.98E-06
Light Duty Gasoline Vehicles	49	60	1.29E-02	5.83E-04	7.78E-04	4.54E-05	7.78E-05	3.24E-05	1.08E+00	1.06E-05	5.09E-05
Light Duty Diesel Trucks	49	60	1.13E-03	3.57E-04	3.89E-04	6.48E-05	9.72E-05	3.24E-05	1.76E+00	4.12E-06	2.65E-06
TOTAL Alt. A - 1 tower, 2 buoys	**-**	**-**	**1.41E-02**	**2.38E-03**	**1.32E-03**	**1.27E-04**	**2.01E-04**	**7.34E-05**	**3.65E+00**	**1.84E-05**	**5.75E-05**
TOTAL Alt. B - 1 tower, 2 buoys	**-**	**-**	**1.41E-02**	**2.38E-03**	**1.32E-03**	**1.27E-04**	**2.01E-04**	**7.34E-05**	**3.65E+00**	**1.84E-05**	**5.75E-05**

1.Emission factors and methodology from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 4. Emission factors for N_2O and CH_4 obtained from the *Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document* (2010), Table D-1 for Tier 2 gasoline passenger cars, moderate diesel light trucks, and moderate diesel heavy-duty trucks.

2.Assume contractors drive Light Duty Diesel Trucks (Type 3/4), staff drive Light Duty Gasoline Vehicles, and material/ equipment deliveries are made using Heavy Duty Diesel Trucks (Type 5), with average of Model Year 2009 in Calendar Year 2015. CY2015 is the latest year provided in the guidance, and provides an approximate median year for the project.

3.Emission factors for $PM_{2.5}$ an PM_{10} include fugitive sources of PM from brake and tire.

4.Assume decommissioning of tower and buoys will take place over one year. Assume an average of 5 contractors travel to the site over 49 days total. In addition, assume an average of one staff travel to the site over 49 days total. Lastly, assume one heavy duty trucks travel to the site over 13 days total.

5.Assume each employee drives 60 miles round trip.

Table 4-18
Site Assessment Activities Alternative A and B - Decommission
Offshore Activities - Vessel Details for Decommissioning
BOEM New York Environmental Assessment

Vessel Details for Decommissioning of Tower and Buoys

Vessel Type	Total No. of Vessel Round Trips	Avg. Miles Per Round Trip (nautical miles)	Total (nautical miles/yr)	Activity (hrs/yr)[1]
Crane Barge	2	37	74	6
Deck Cargo	2	37	74	6
Small Cargo Barge	2	37	74	6
Crew Boat	21	37	777	43
Small Tug Boat	4	37	148	12
Large Tug Boat	10	37	370	31

1.Average to decommission one meteorological tower, per note in corresponding table in NC EA Appendix D, plus 2 trips for each of the 2 buoys being transported by a large tug-boat.

2.Assume an average speed of 12 knots for the tug boats/barges and 18 knots for the crew boat to estimate Activity hours based upon Total nautical miles traveled. No time for the vessels spent at idle at the towers was captured in this calculation. http://www.scrutonmarine.com/Crew%20Boats.htm and http://www.chacha.com/question/what-is-the-average-top-speed-of-a-tug-boat

Table 4-19
Site Assessment Activities Alternative A and B - Decommission
Estimated Annual Emissions for Vessels
BOEM New York Environmental Assessment

Emission Factors for Vessels

Vessel Type[1]	Engine Size (hp)	Engine Power (kW)[2]	Load Factor (%)[3]	Emission Factors (g/kW-hr)[4]								
				CO	NO_x	VOC	$PM_{2.5}$[5]	PM_{10}	SO_x[6]	CO_2	N_2O	CH_4
Crew Boat	1,000	746	45%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Small Tug Boat	2,000	1,491	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09
Large Tug Boat	4,200	3,132	31%	1.1	13.2	0.5	0.72	0.72	1.3	690	0.02	0.09

1.The Small and Large Tug Boats are used in conjunction with the Crane Barge, Deck Cargo, and Small Cargo Barge, which do not have an engine. Therefore, only the Crew Boat, Small Tug Boat, and Large Tug Boat have emission factors. Assume decommissioning of towers instead of buoys for a worst case scenario.
2.Engine power (kW) estimated by dividing horsepower by a factor of 1.341.
3.Load factor based upon Table 3.4 of *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories* , U.S. EPA, April 2009. Table 3-1 describes both crew boats and tug boats as Harbor Vessels; therefore, load factors (Table 3.8) are for Harbor Vessels.
4.Emission factors were provided in the *Current Methodologies* document, Table 3-8. Category 2 (typically between 1,000 and 3,000 kW) factors were used for the crew boat, small tug boat, and large tug boat since the crew boat and large tug boat are approximately within that category.
5.Assume $PM_{2.5} = PM_{10}$
6.SOx emission factor overestimates emissions since it assumes a higher sulfur content fuel than will likely be used.

Emissions from Vessels -- One Year

Vessel Type	Emission (tons/year, metric tons/year for GHG pollutants)[1,2]								
	CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Crew Boat	1.93E-02	2.32E-01	8.79E-03	1.27E-02	1.27E-02	2.28E-02	1.10E+01	3.19E-04	1.43E-03
Small Tug Boat	1.04E-02	1.24E-01	4.71E-03	6.79E-03	6.79E-03	1.23E-02	5.90E+00	1.71E-04	7.70E-04
Large Tug Boat	5.44E-02	6.53E-01	2.47E-02	3.56E-02	3.56E-02	6.43E-02	3.10E+01	8.98E-04	4.04E-03
TOTAL Alt. A - 1 tower, 2 buoys	**8.41E-02**	**1.01E+00**	**3.82E-02**	**5.51E-02**	**5.51E-02**	**9.94E-02**	**4.79E+01**	**1.39E-03**	**6.25E-03**
TOTAL Alt. B - 1 tower, 2 buoys	**8.41E-02**	**1.01E+00**	**3.82E-02**	**5.51E-02**	**5.51E-02**	**9.94E-02**	**4.79E+01**	**1.39E-03**	**6.25E-03**

1.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) x Power Adjustment ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.
2.Power adjustment of 1.1 was assumed for a crew boat to account for auxiliary engines, and 1.5 for a harbor tug, based upon Table 3.5 of the *Current Methodologies* document.

Table 4-20
Site Assessment Activities Alternative A and B - Decommission
Offshore Activities - Deconstruction of Pilings
BOEM New York Environmental Assessment

Heavy Equipment Emission Factors [1]

Construction Equipment	Engine Size (hp)	Engine Power (kW)[1]	Load Factor (%)[2]	Emission Factors (g/kW-hr)[1] CO	NO_x	VOC	$PM_{2.5}$	PM_{10}	SO_x	CO_2	N_2O	CH_4
Concrete Indus. Saw	56	42	59%	5.34	7.11	0.86	0.86	0.89	0.55	792.53	6.48E-03	1.42E-02
Crane	194	145	43%	1.84	7.34	0.51	0.38	0.39	0.50	714.75	6.48E-03	1.42E-02

1. Emission factors for all but N_2O and CH_4 from *Air Emissions Factor Guide to Air Force Mobile Sources* , December 2009, Section 3; converted from g/hp-hr to g/kW-hr.
2. Emission factors for N_2O and CH_4 from EPA's Center for Corporate Climate Leadership GHG Emission Factors Hub, November 2015, Table 5, factors for Diesel Construction Equipment were used and converted from g/gallon to g/kW-hr.

Construction Equipment	Usage (hrs)	Emission (tons/year, metric tons/year for GHG pollutants) CO	NO_x	VOC	$PM_{2.5}$[3]	PM_{10}[3]	SO_x	CO_2	N_2O	CH_4
Concrete/Indust. Saw	200	2.90E-02	3.86E-02	4.66E-03	4.66E-03	4.81E-03	2.99E-03	3.91E+00	3.19E-05	7.00E-05
Cranes	200	2.52E-02	1.01E-01	6.99E-03	5.15E-03	5.33E-03	6.80E-03	8.89E+00	8.06E-05	1.77E-04
TOTAL Alt. A - 1 tower	**-**	**5.42E-02**	**1.39E-01**	**1.17E-02**	**9.81E-03**	**1.01E-02**	**9.79E-03**	**1.28E+01**	**1.12E-04**	**2.47E-04**
TOTAL Alt. B - 1 tower	**-**	**5.42E-02**	**1.39E-01**	**1.17E-02**	**9.81E-03**	**1.01E-02**	**9.79E-03**	**1.28E+01**	**1.12E-04**	**2.47E-04**

1.Only concrete/industrial saws and cranes were assumed to be used off shore during the deconstruction of the pilings.
2.Assume that the equipment operates for four weeks, 10 hours per day (i.e., 200 hours) for the tower.
3.Assume PM10 = PM2.5. See EF Construction Equip tab for emission factors.
4.Emissions quantified using the following equation: Emissions (tons) = Engine Power Rating (kW) x Load Factor (%) x Activity (hrs) x Emission Factor (g/kW-hr) ÷ 453.59 ÷ 2000. For GHG pollutants CO_2, N_2O, and CH_4, emissions are in metric tons.

Offshore Activities - Fuel Spill

Spill Volume (gal)[1]	Fuel Type	Density (lb/gal)[2]	Percent Recovered[3] (%)	Amount Not Recovered[3] (gal)	VOC Emissions (lb/yr)	VOC Emissions (tpy)
88	Diesel	7.1	0%	88	624.8	**0.31**

1.Assume a spill of 88 gallons of diesel occurs each year.
2.Liquid fuel density values obtained from *Air Emissions Factor Guide to Air Force Stationary Sources* , December 2009, Table 14-2.
3. To be conservative, assume none of the spill could be recovered, and that 100% of the fuel evaporates.

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Appendix E

Sightings Information for Marine Mammals and Sea Turtles: Data Handling Procedures and Maps of Raw Sightings Data and Sightings per Unit Effort

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Overview of Sightings and Sightings per Unit Effort

Occurrences of marine mammals and sea turtles in the vicinity of the Wind Energy Area (WEA) were mapped using data from the North Atlantic Right Whale Consortium (NARWC) sightings database and several other sources. Maps were prepared using two data types: 1) raw sightings and 2) Sightings per Unit Effort (SPUE). Raw sightings data were only mapped for three species of endangered whales (fin, humpback, and North Atlantic right whales; Figures E-1 to E-3); SPUE data were mapped for species of marine mammals and turtles with the highest frequency of occurrence within the study area (Figures E-4 to E-15; EA Section 4.4.2.5 Figures 4-9 and 4-10; EA Section 4.4.2.6 Figure 4-11).

Sightings Data Sources for SPUE

A substantial proportion of the existing marine mammal and sea turtle data for the southern New England and New York Bight region have been aggregated and archived by the North Atlantic Right Whale Consortium (NARWC; Right Whale Consortium, 2015). The NARWC database is managed and continually updated at the University of Rhode Island Graduate School of Oceanography (Kenney, 2001), with funding support from the National Marine Fisheries Service (NMFS). The database contains several different types of data, which can differ significantly in their usefulness for description and analysis of the distribution, abundance, seasonality, and habitat use of any particular species.

The most rigorous category of data comes from line-transect aerial surveys. These surveys are designed to estimate density and abundance of encountered populations. Survey methods include measuring the right-angle distance from the survey track to each sighting, and using the distances to construct the probability functions used in the density estimation process. Survey designs are systematic and randomized so that any location should have an equal likelihood of being sampled. Within the WEA study area, the only line-transect aerial survey data in the database are those generated in 1978–1982 by the Cetacean and Turtle Assessment Program (CETAP) (CETAP, 1982).

There is a second, less rigorous category of survey data contained in the NARWC database. The CETAP study included a Platforms of Opportunity Program (POP), which involved placing trained observers on board aerial and vessel platforms conducting other operations in the study area. The platforms included National Oceanic and Atmospheric Administration (NOAA) vessels, foreign research vessels, Coast Guard cutters, Coast Guard patrol aircraft, ferries, commercial fishing vessels, whale-watching vessels, and others. The observer was tasked with keeping a detailed record of the platform's track, environmental conditions, and all sightings. A significant source of POP shipboard data was a program conducted by Manomet Bird Observatory (MBO) personnel aboard NOAA fisheries and oceanographic research cruises (so-called "piggy-back" surveys) during most of the 1980s. The MBO observers maintained watches when the vessel was underway and recorded sightings of mammals, turtles, and birds. The National Marine Fisheries Service's Northeast Fisheries Science Center (NMFS-NEFSC) in Woods Hole, MA has also conducted aerial surveys focused on right whales since the late 1990s, some of which have extended into the study area. These are focused surveys using systematically placed tracks, but the objective was not density estimation, therefore sighting distances were not recorded. Aerial surveys for right whales were also conducted in 2005 and 2006 by the Riverhead Foundation for Marine Research and Preservation in Riverhead, NY. A final source of

POP survey data in the database are aerial and shipboard stock assessment surveys by NMFS, including the recent (2010–2013) AMAPPS surveys (Atlantic Marine Assessment Program for Protected Species). These were conducted as line-transect surveys, however the data are publicly provided without the sighting distances, therefore they are formatted and archived in the NARWC database as POP surveys. By definition, in addition to records of all target species (and sometimes non-target species) encountered, line-transect and POP survey data include detailed information on the track of the survey platform and associated environmental conditions, allowing for subsequent reconstruction of the survey and quantification of effort.

Additional Opportunistic Sightings Data Sources

The NARWC database also includes substantial numbers of opportunistic sighting records that have no associated survey data, which were excluded for SPUE maps (Figures E-4 to E-15; EA Section 4.4.2.5 Figures 4-9 and 4-10; EA Section 4.4.2.6 Figure 4-11), but used for sightings maps (Figures ES-1 to ES-3). Many of these represent records collected during CETAP or older historical sighting records that were aggregated and archived as part of the CETAP study. Other sightings have been contributed on an on-going basis by a variety of individuals, including Navy, Coast Guard, other federal agencies, mariners, commercial fishermen, whale-watch operators, and recreational boaters. An important source of older records for the region was a database provided by Dr. James Mead at the Smithsonian's National Museum of Natural History. This included early historical records extracted from published sources going back as far as the colonial era in some cases; some of these records included strandings or intentional captures by whalers or hunters. Additional sources of data for dead or debilitated marine mammals and sea turtles that occasionally wash up on shore, or strand, are also included in the NARWC database. All records of dead or stranded animals were excluded from the WEA maps.

One other source of opportunistic sighting records is unique to right whales. North Atlantic right whales are individually identifiable from photographs (Hamilton et al., 2007), and now from genetic samples. The “catalog” of identified right whales is maintained by New England Aquarium (NEAq; NEAq, 2015). Anyone who takes a photograph anywhere in the North Atlantic of a right whale which might be identifiable is encouraged to submit it to NEAq. Records in the catalog even include videos posted on YouTube by fishermen if the right whale can be identified. Part of the collaborative NARWC project is to periodically cross-reference right whale sightings in the database with identifications in the catalog. At the end of the process each time, there are some number of catalog records that (1) do not match any sightings already included in the database, (2) are not same-day duplicates of individuals included in sightings already in the database, and (3) are not from surveys likely to be submitted to the database. These records are extracted from the catalog and added to the database as opportunistic sightings. During the most recent round of cross-referencing, a new category of identification record added to the catalog—tagging data. Part of the tagging protocol for right whales is to collect enough photographs to be able to identify the tagged whale. For every right whale that had been tagged with a VHF or satellite tag, a single location per day was added to the catalog. These were then extracted into the database in such a way as to be able to uniquely identify each tag track separately if so desired. For example, if a right whale had been satellite-tagged off Florida and passed through the New York Bight on migration to the Gulf of Maine, one location for each day would show up as opportunistic sightings in a map.

SPUE data handling methods for the WEA

The simplest method for depicting marine mammal distributions is to plot all available records. This makes the maximum use of the available data; however, such a map is very likely to be biased by the distribution of sampling effort. One cannot be sure that a concentration of sightings represents a real concentration of animals or simply a concentration of 10 years. Conversely, a blank space on a sighting map can mean a true absence of that species, or that no one ever looked in that area.

One method to overcome this potential bias is to quantify survey effort, and then to correct sighting frequencies for differences in effort, producing an index termed sighting rate or SPUE. The units are numbers of animals sighted per unit length of survey track. (Note: It is possible to quantify effort in time units rather than length, but that is much less effective when combining aerial and shipboard data together because of the very different speeds.) SPUE values are computed for consistent spatial units and can therefore be quantitatively mapped or be statistically compared across areas, seasons, years, etc. Development of this method was begun during CETAP (1982), and it has been used in a variety of analyses (e.g., Kenney and Vigness-Raposa, 2010; Lagueux et al., 2010). Because the method requires regular location and environmental data to reconstruct the survey tracks and to quantify effort, only a subset of the sighting data can be included. Opportunistic sightings and stranding data are entirely excluded because there is no corresponding effort information. SPUE maps show quantitative relative abundance patterns scaled for uneven sampling, however are based on much smaller numbers of sightings than maps of raw sighting data.

To standardize the SPUE data even further, the data can be limited to only a subset of the survey tracklines and sightings that meet pre-defined criteria for "acceptability." The effort criteria can vary between studies or between target species. For this analysis, the criteria included having at least one observer formally on watch, visibility of at least 3.7 km (2 nautical miles), and altitude below 366 meters (1,200 feet, applicable only to aerial surveys). Sightings were excluded from the analysis if they were noted as dead (either floating or stranded on a beach) or if the reliability of the species identification had been recorded as "possible" (the lowest level, below "probable" and "definite"). The final criterion for acceptable effort was sea state, which varied by species category. Large whales are easier to spot in higher sea states, therefore effort was included for sea states up to Beaufort class 4. For minke whales and all of the dolphins, the upper sea state limit was set at Beaufort 3. For harbor porpoises and sea turtles, which are all small and tend to be solitary and therefore are the most difficult to see in rough seas, the upper sea state limit was set at Beaufort 2.

The SPUE method involves partitioning the study area into a regular grid based on latitude and longitude. The grid size selected is a compromise between resolution (smaller cells) and sample sizes (larger cells). Previous studies based on the NAWRC data have used cells ranging from 1 min X 1 min (1.9 X 1.4 km in the WEA) to 10 min X 10 min (18.5 X 14.1 km). For this project we used a 5 min X 5 min grid (9.3 X 7.1 km). All acceptable aerial and shipboard survey tracks were parsed into the grid cells and their lengths computed and summed by season. Seasons were defined as: Winter—December, January, February; Spring—March, April, May; Summer—June, July, August; Fall—September, October, November. The survey data are archived as points along the track, and each successive pair of points defines a line segment. The length of a segment where both ends are within the same grid cell is easily assigned to that cell. Segments that cross more than one cell have to be cut into sub-segments, and those lengths assigned to the appropriate cells. The entire process is accomplished using custom-written programs in SAS for Windows version 9.2 (SAS Institute, Inc., Cary, NC). Sightings were similarly filtered and assigned to cells and the numbers of animals sighted were summed by cell and season. Finally, the number of animals in each cell/season was divided by the corresponding effort value, then multiplied by 1,000 to avoid small decimal values, generating a SPUE index in units of animals sighted per 1,000 km of acceptable survey track.

The defined study area (north of 39°00'N, west of 71°45'W) for the WEA was partitioned into a grid of 5-minute X 5-minute blocks. All acceptable survey effort, both aerial and shipboard surveys, across all available years was assigned to the blocks and summed by season and for all seasons combined. All sightings made during that effort were also assigned to the 5x5-minute blocks. For single species, sightings with the lowest level of identification reliability ("possible") were deleted. The numbers of sightings and individuals included in the SPUE analysis are summarized in Table E-1. For the pooled large whale and turtle categories, they were included (e.g., a possible humpback whale sighting is a more reliable ID than an unidentified large whale sighting). For sightings where the number of animals was not recorded (if any), the number was assumed to be 1. SPUE values for the entire area of each 5x5 block where mapped at a point in the center of each block.

Table E-1
Numbers of sightings and individuals included in the SPUE maps

SPECIES CODE	SPECIES NAME	TOTAL INCLUDED SIGHTINGS/ANIMALS
Large Whales[1]:		
FIWH	Fin Whale (*Balaenoptera physalus*)	126/454
HUWH	Humpback Whale (*Megaptera novaeangliae*)	13/17
RIWH	North Atlantic Right Whale (*Eubalaena glacialis*)	3/4
WHAL	All endangered large whales	271/679
	[includes the three preceding species, plus UNBA (Unidentified *Balaenoptera*), UNFS (Unidentified Fin or Sei Whale) UNLW (Unidentified Large Whale), and UNRO (Unidentified Rorqual)	
Medium Whales and Dolphins[2]:		
MIWH	Minke Whale (*Balaenoptera acutorostrata*)	32/78
	[An attempt to combine all beaked whale categories into one pool resulted in a dataset with no sightings. Beaked whale records are either strandings on the beach (excluded) or sightings far offshore (outside of the study area).]	
BODO	Bottlenose Dolphin (*Tursiops truncatus*)	127/2179
GRAM	Risso's Dolphin (*Grampus griseus*)	122/1895
PIWH	Pilot Whale (*Globicephala* sp.)	43/599
	[Sightings, if any, identified as LFPW (Long-finned Pilot Whale, *Globicephala melas*) or SFPW (Short-finned Pilot Whale, *Globicephala macrorhynchus*) were pooled into this category.]	

SADO	Common Dolphin (*Delphinus delphis*)	115/2848
WSDO	Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*)	41/600

Harbor Porpoise and Sea Turtles[3]:

HAPO	Harbor Porpoise (*Phocoena phocoena*)	48/69
LETU	Leatherback Turtle (*Dermochelys coriacea*)	87/97
LOTU	Loggerhead Turtle (*Caretta caretta*)	520/562
RITU	Kemp's Ridley Turtle (*Lepidochelys kempii*)	59/63
TURT	All Sea Turtles Combined	741/800

[This pooled sea turtle category includes the three species above plus GRTU (Green Turtle, *Chelonia mydas*) and UNTU (Unidentified Turtle).]

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[1]The sea state threshold for the large whales was Beaufort 4 (i.e., survey effort and sightings at Beaufort 4 or lower were included, while Beaufort 5 effort and sightings were deleted).

[2]The sea state threshold for medium whales and dolphins was Beaufort 3 (i.e., survey effort and sightings at Beaufort 3 or lower were included, while Beaufort 4 effort and sightings were deleted).

[3]The sea state threshold for harbor porpoise and sea turtles (which are the smallest animals and also all tend to be solitary) was Beaufort 2 (i.e., survey effort and sightings at Beaufort 2 or lower were included, while Beaufort 3 effort and sightings were deleted).

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Kenney, R.D. and K.J. Vigness-Raposa. 2010. *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan*. Rhode Island Coastal Resources Management Council (RICRMC) Ocean Special Area Management Plan (SAMP), Volume 2. Appendix, Chapter 10. 337 pp.

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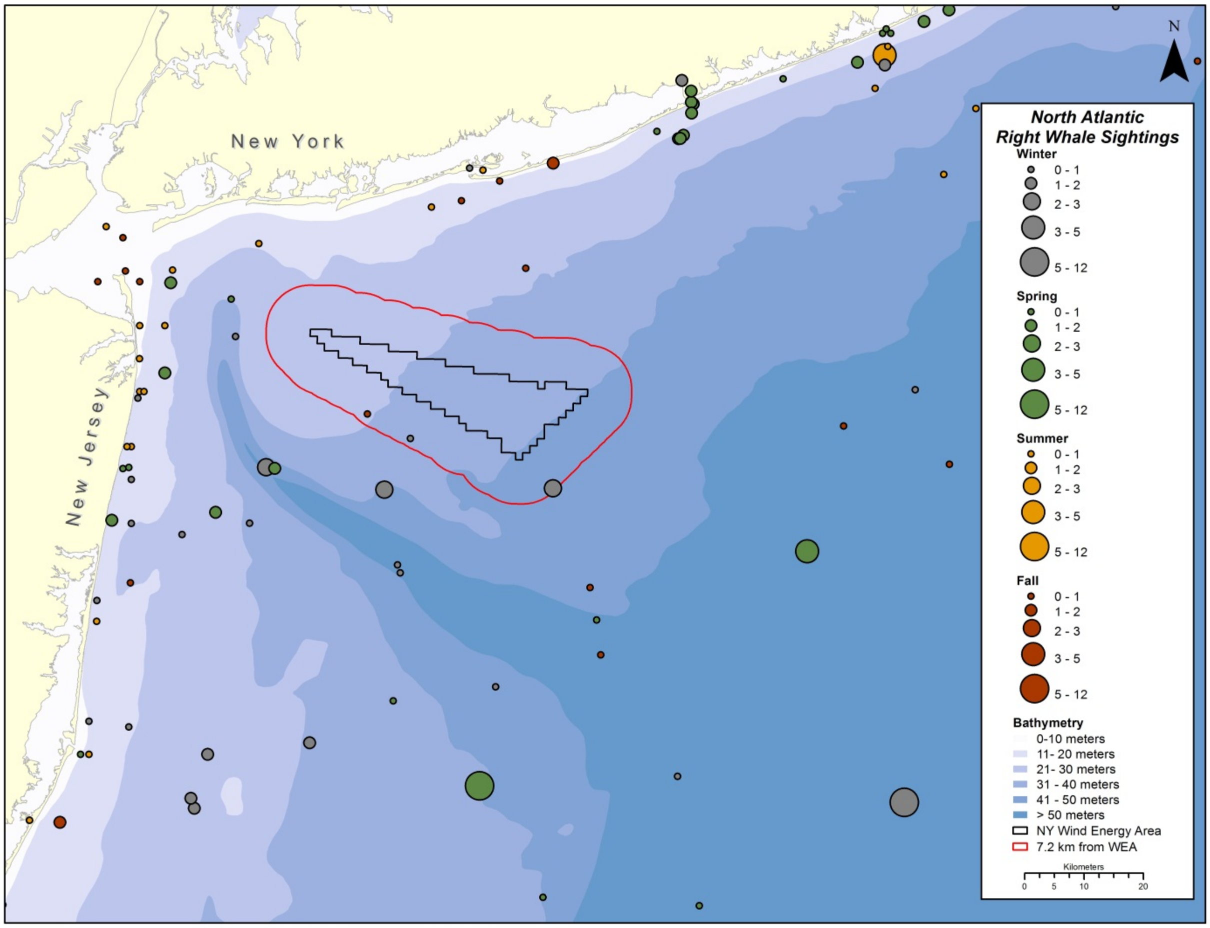

Figure E-1 Sightings for North Atlantic right whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

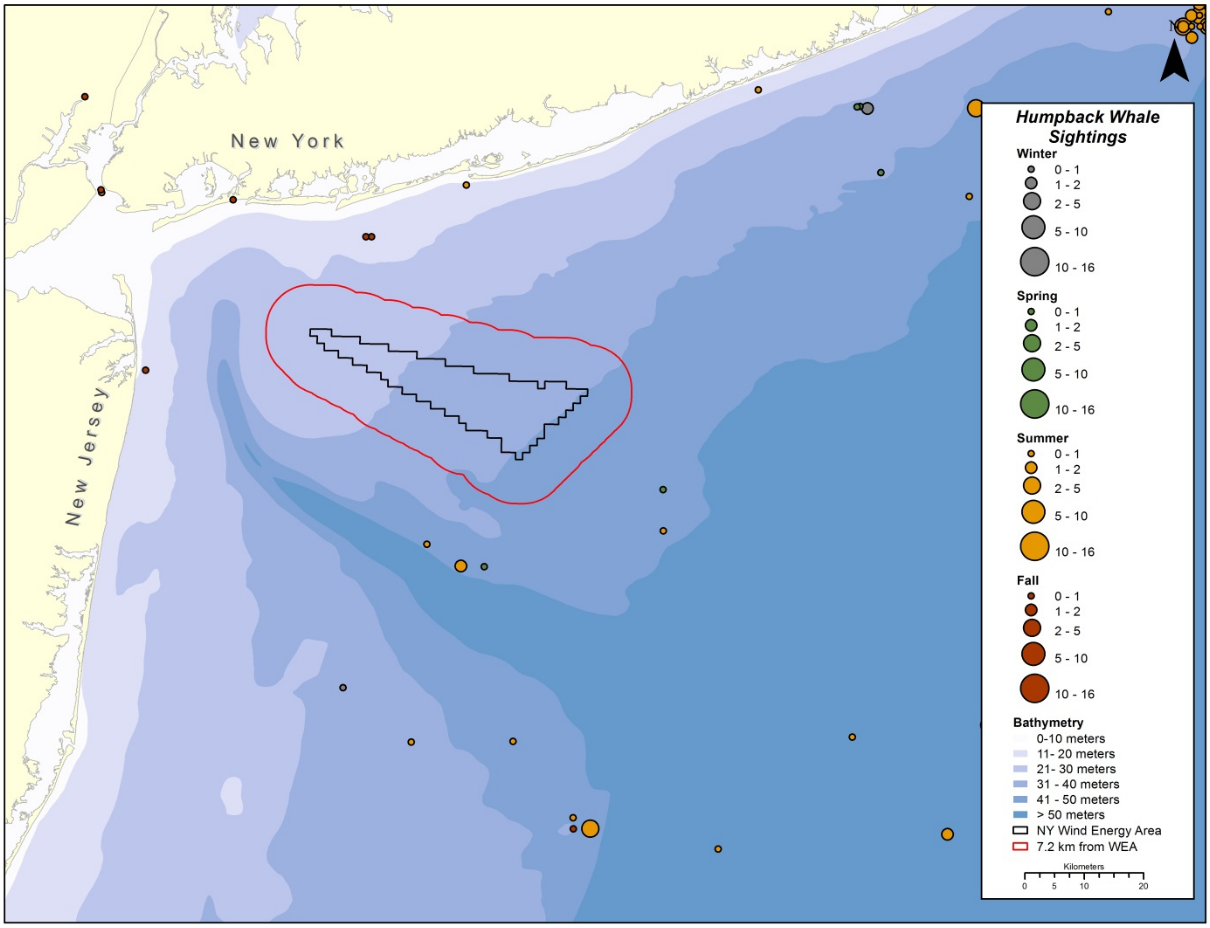

Figure E-2. Sightings for humpback whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

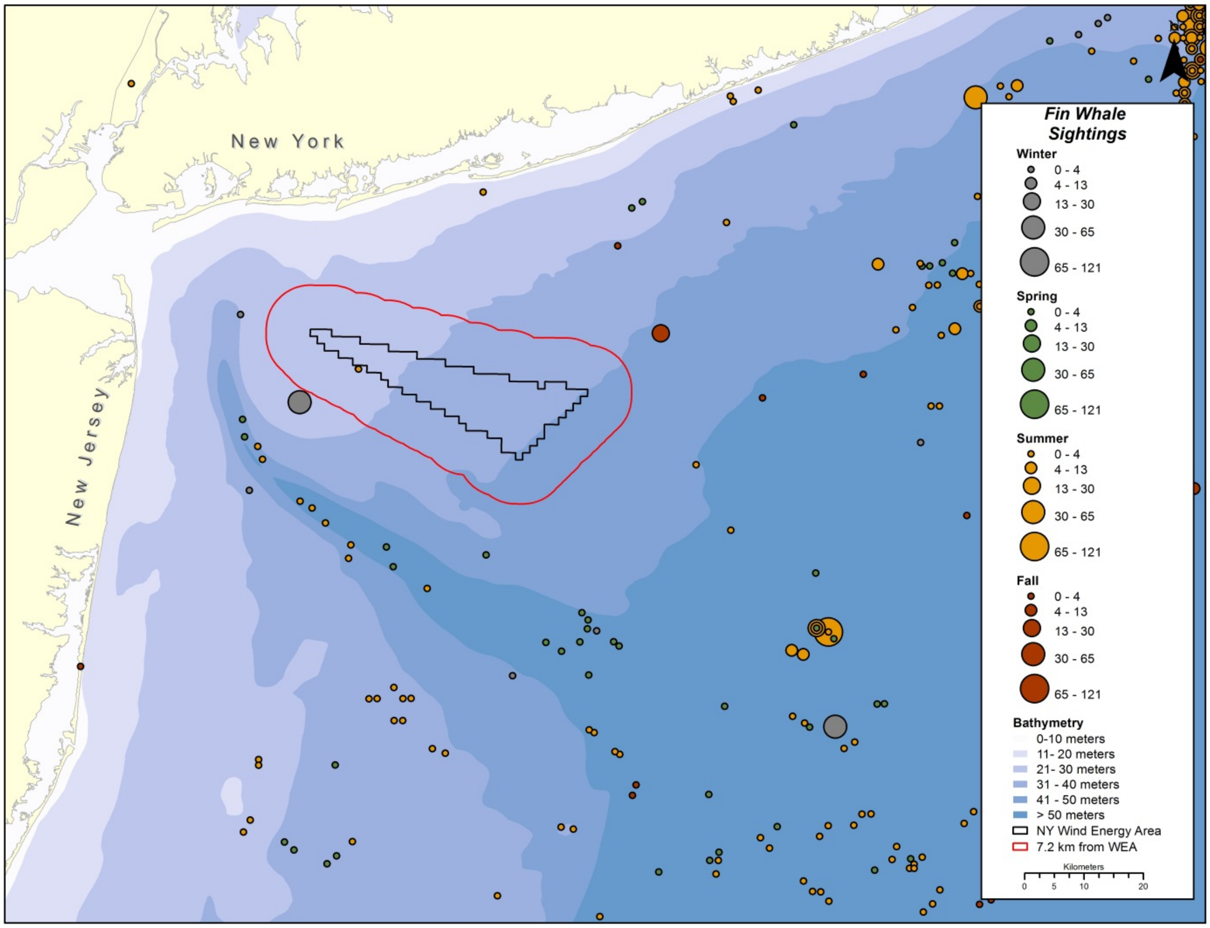

Figure E-3 Sightings for fin whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

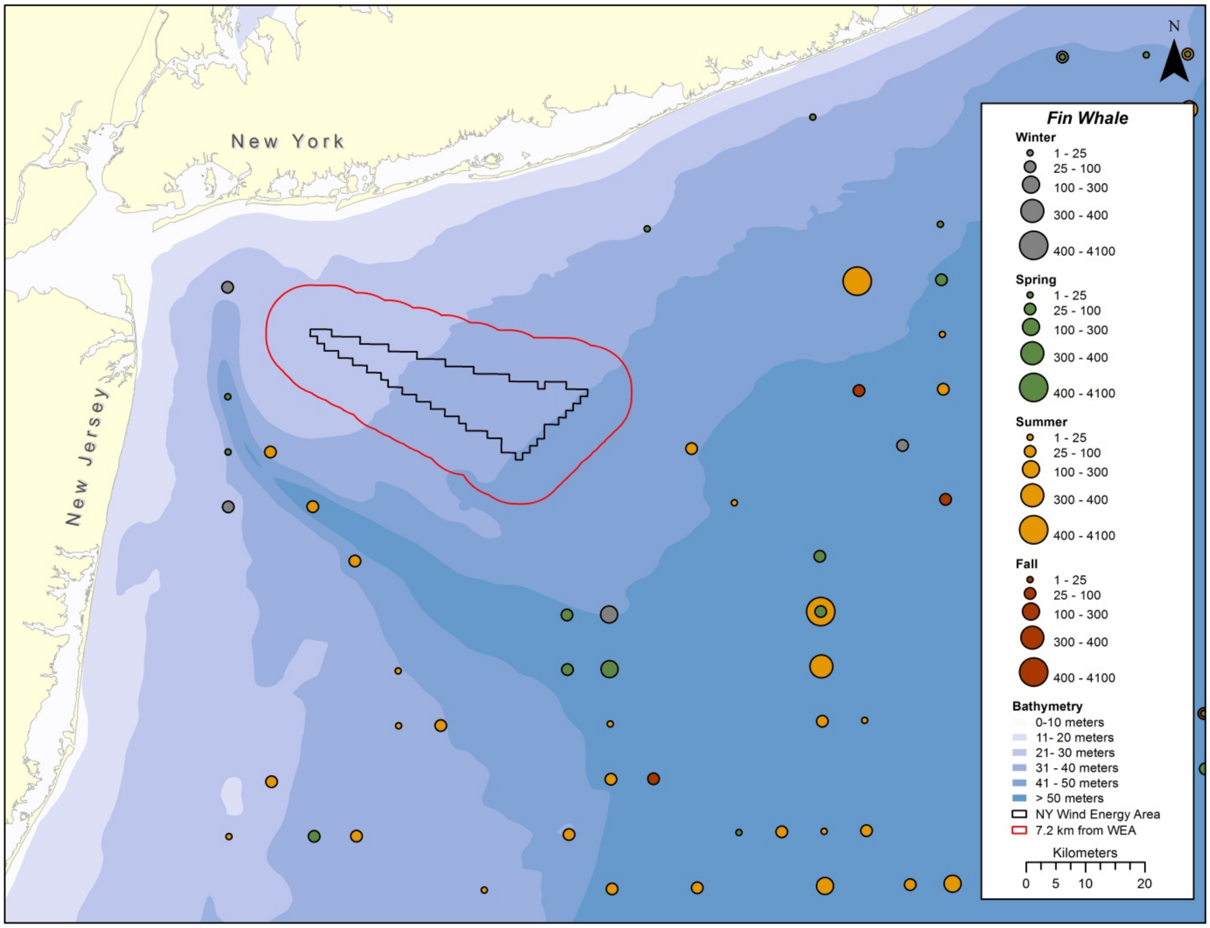

Figure E-4 SPUE for fin whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

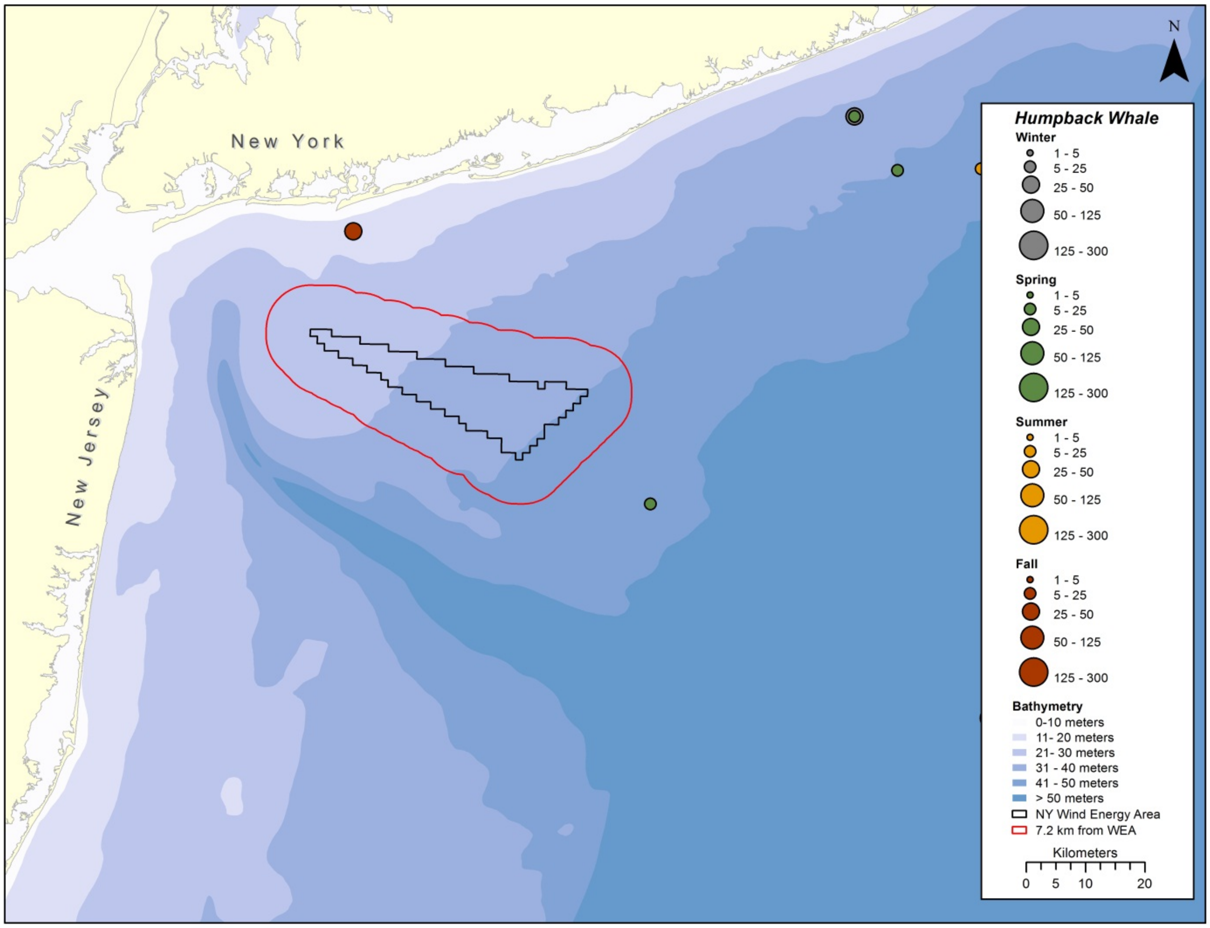

Figure E-5 SPUE for humpback whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

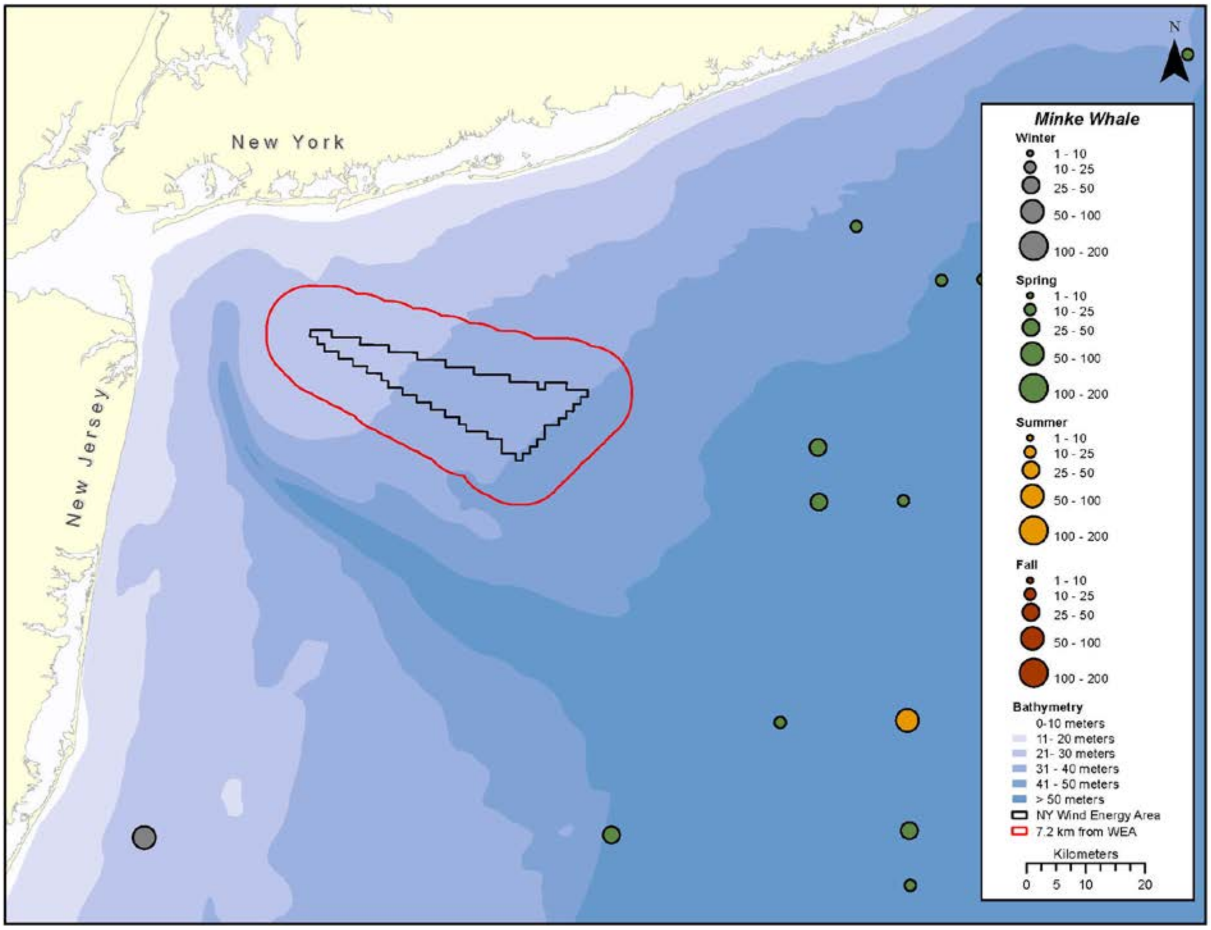

Figure E-6 SPUE for minke whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

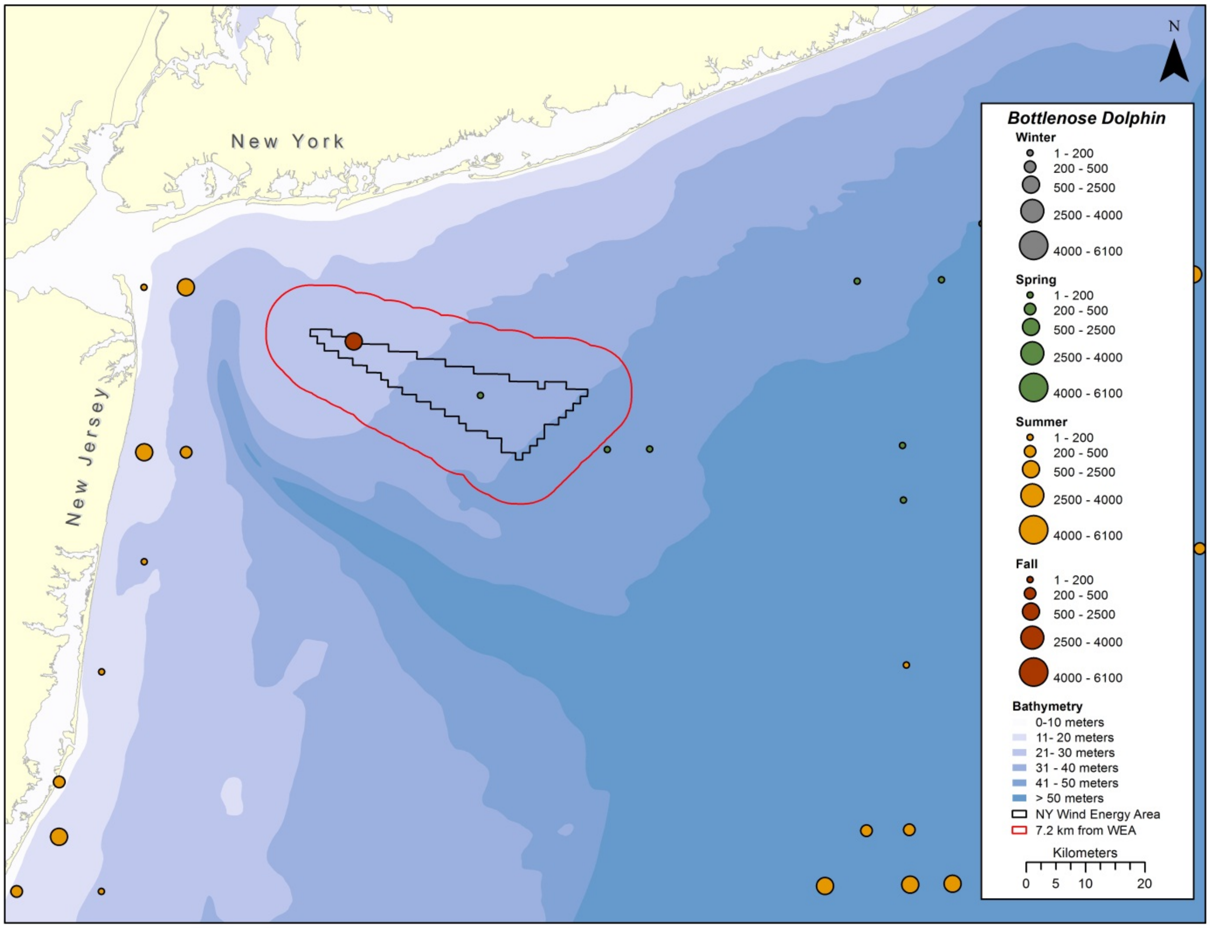

Figure E-7 SPUE for bottlenose dolphins in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

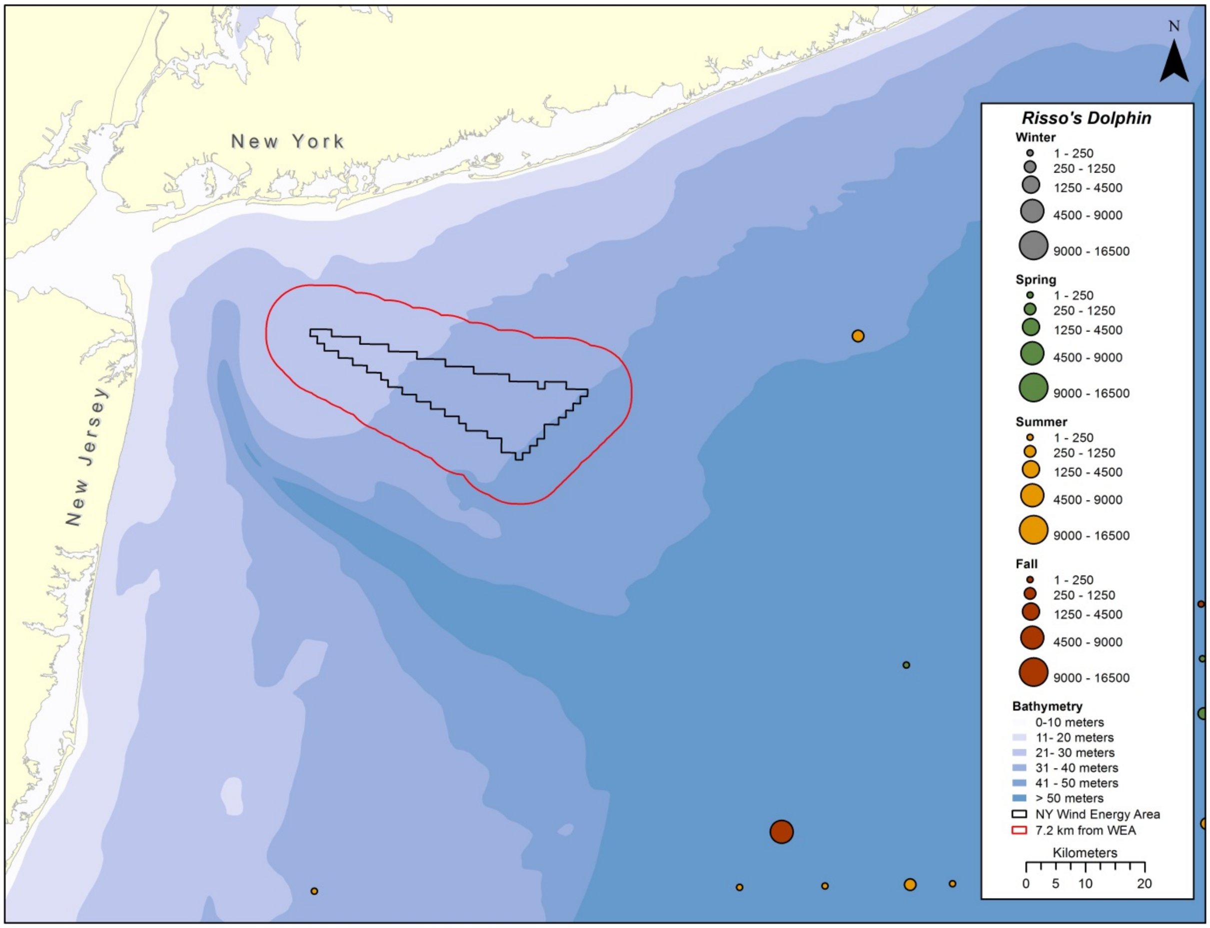

Figure E-8 SPUE for Risso's dolphins in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

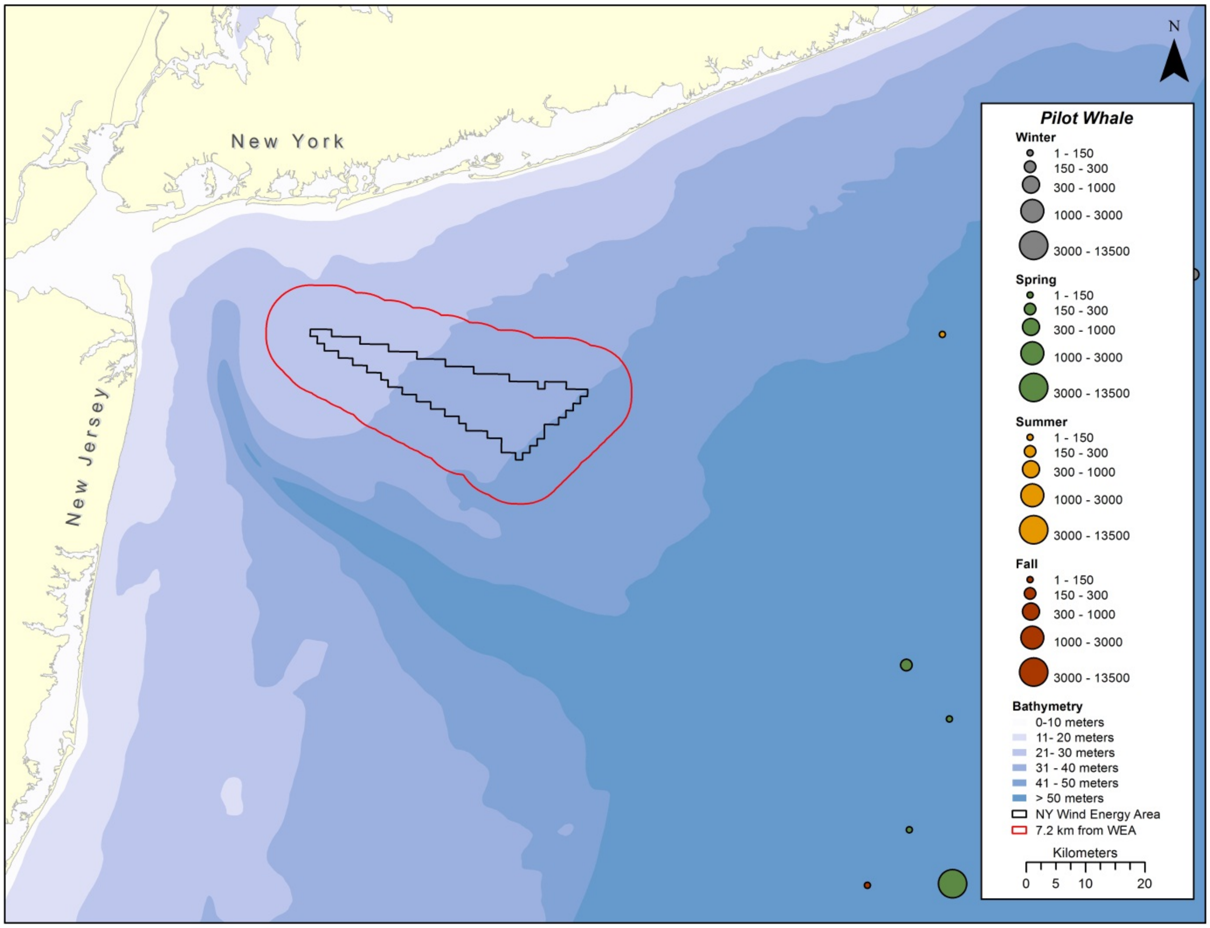

Figure E-9. SPUE for pilot whales in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

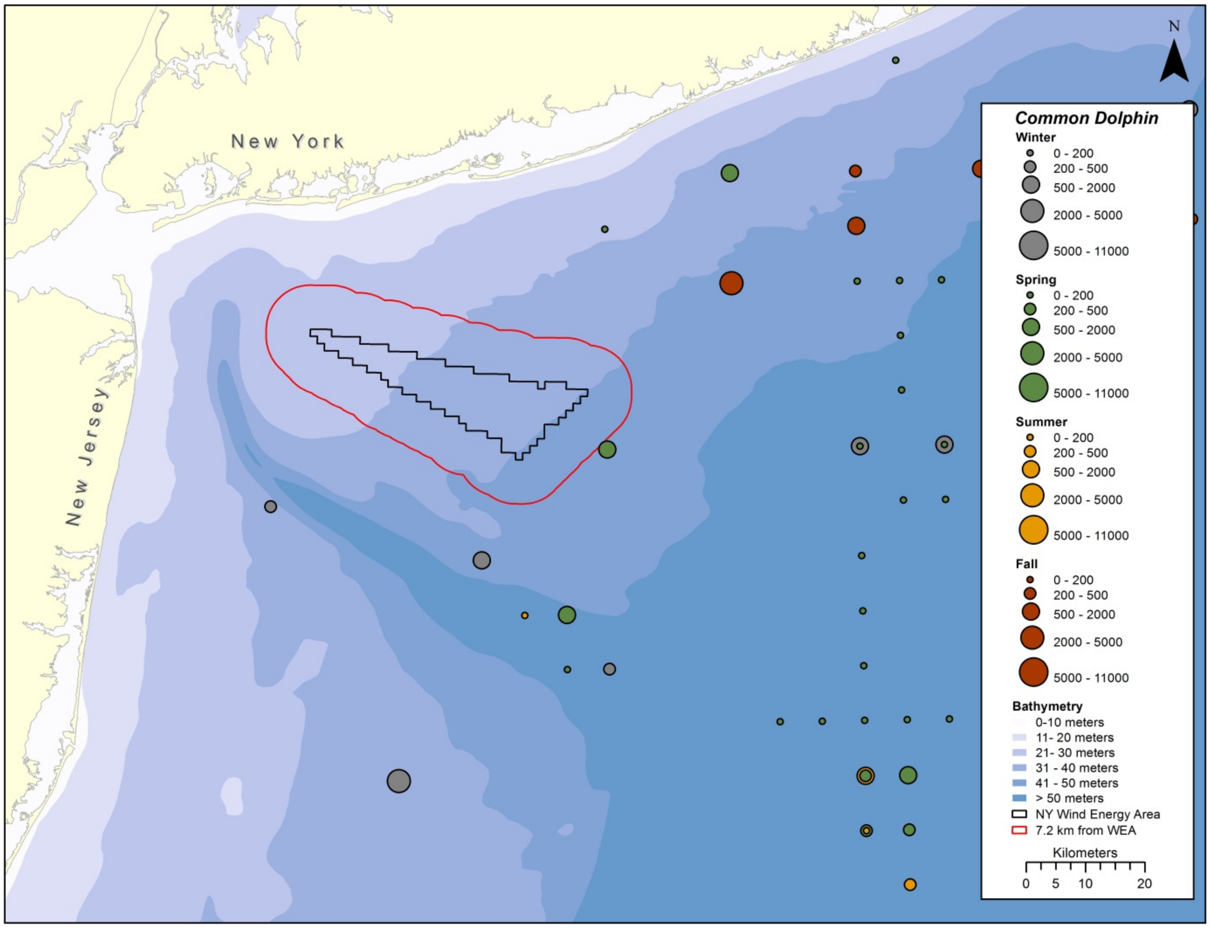

Figure E-10 SPUE for common dolphins in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

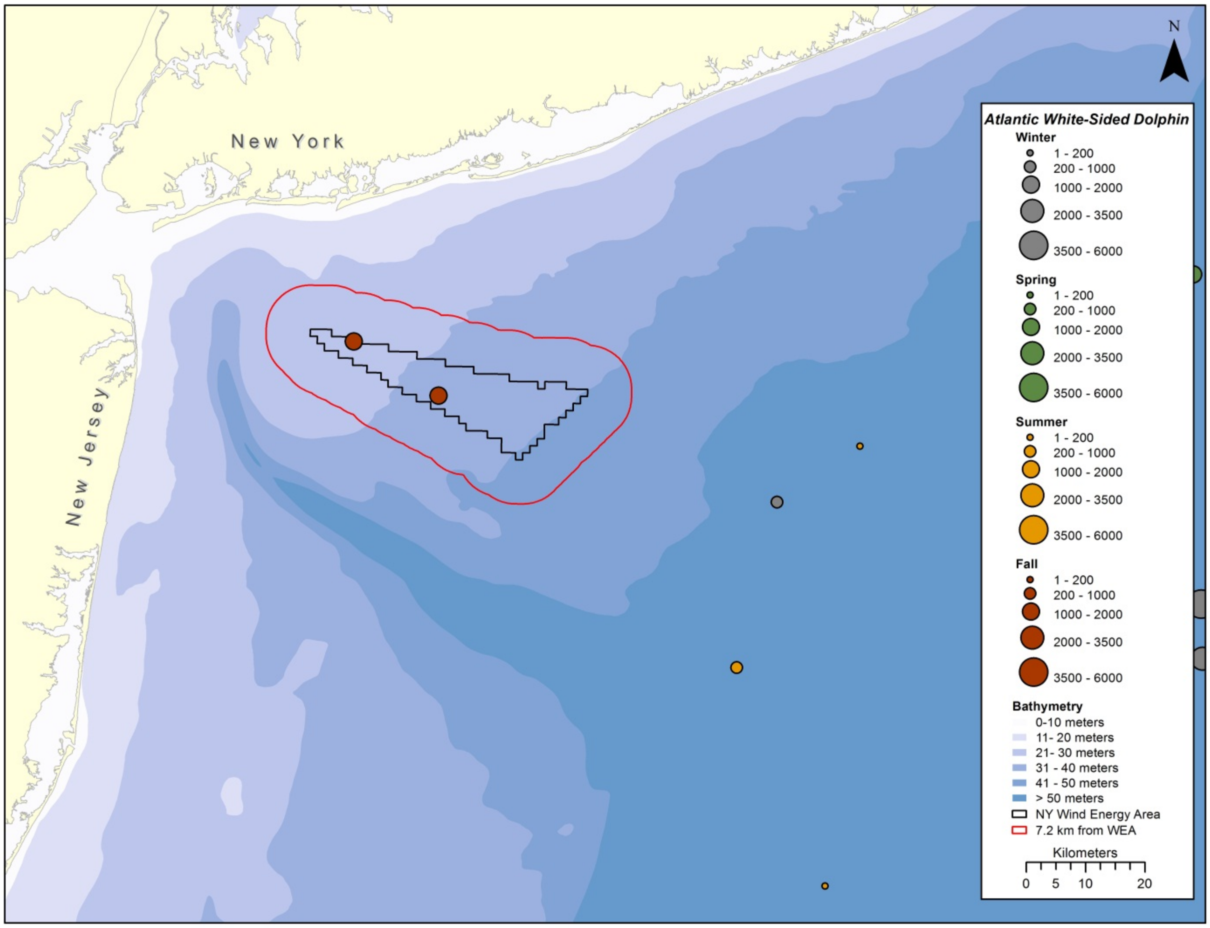

Figure E-11 SPUE for Atlantic white-sided dolphins in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

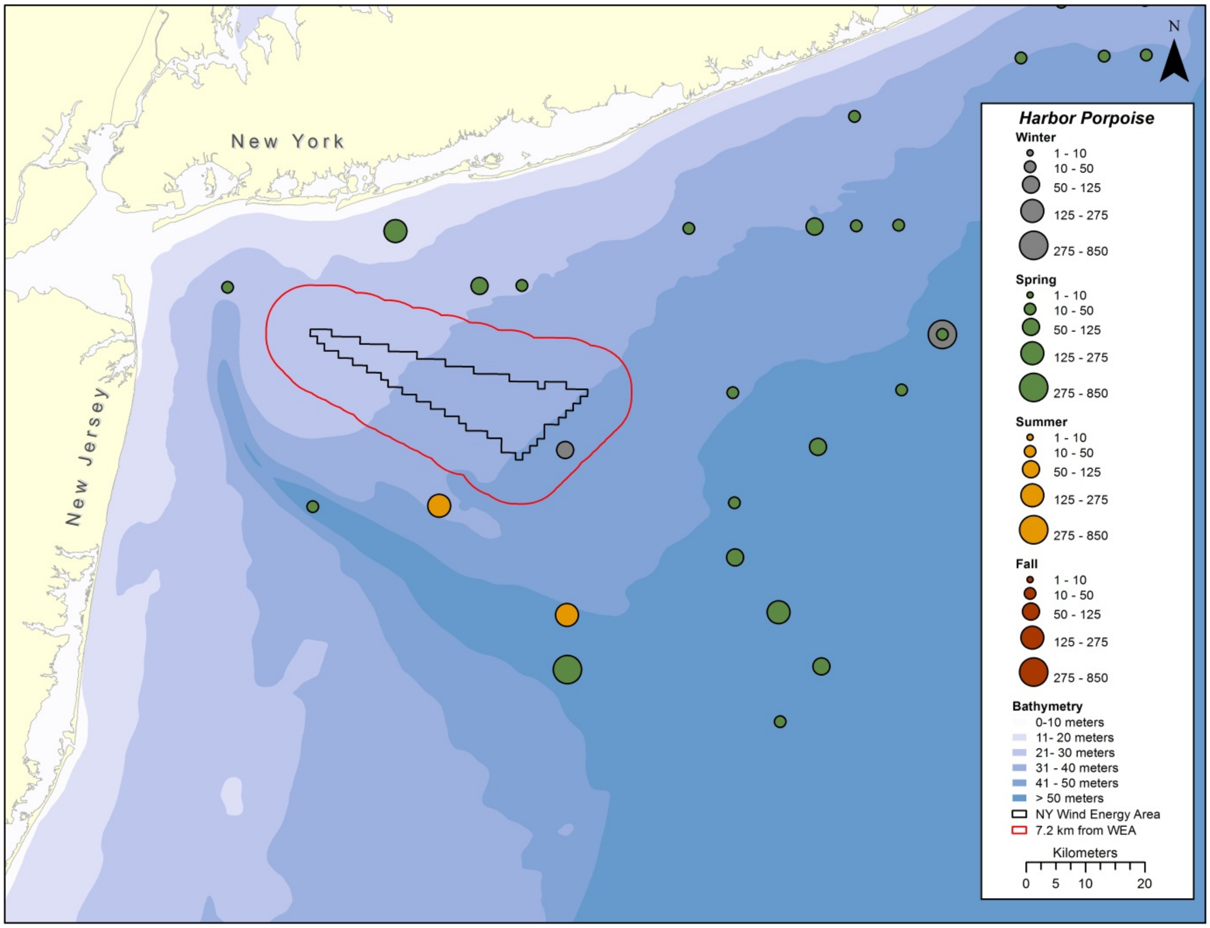

Figure E-12 SPUE for harbor porpoise in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

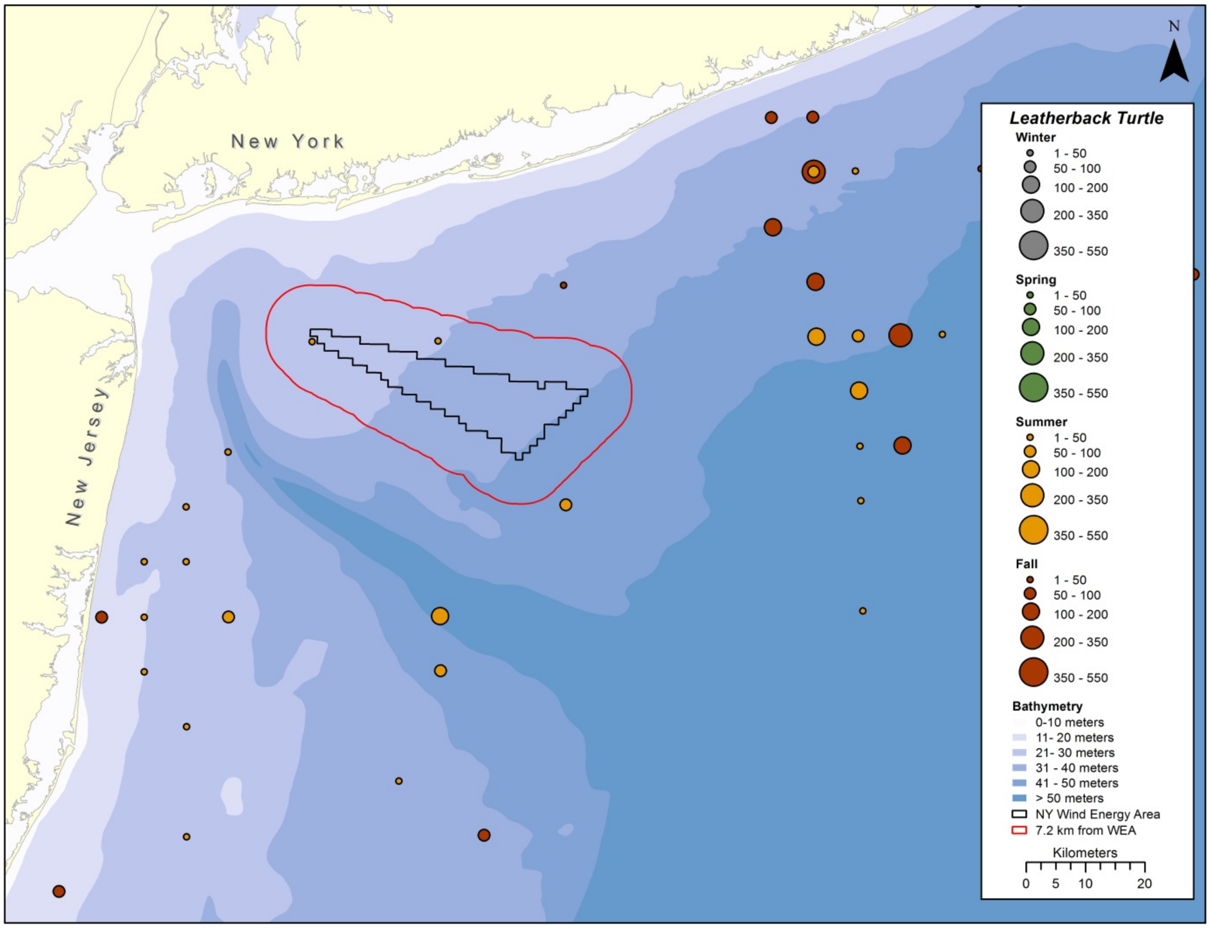

Figure E-13 SPUE for leatherback turtles in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

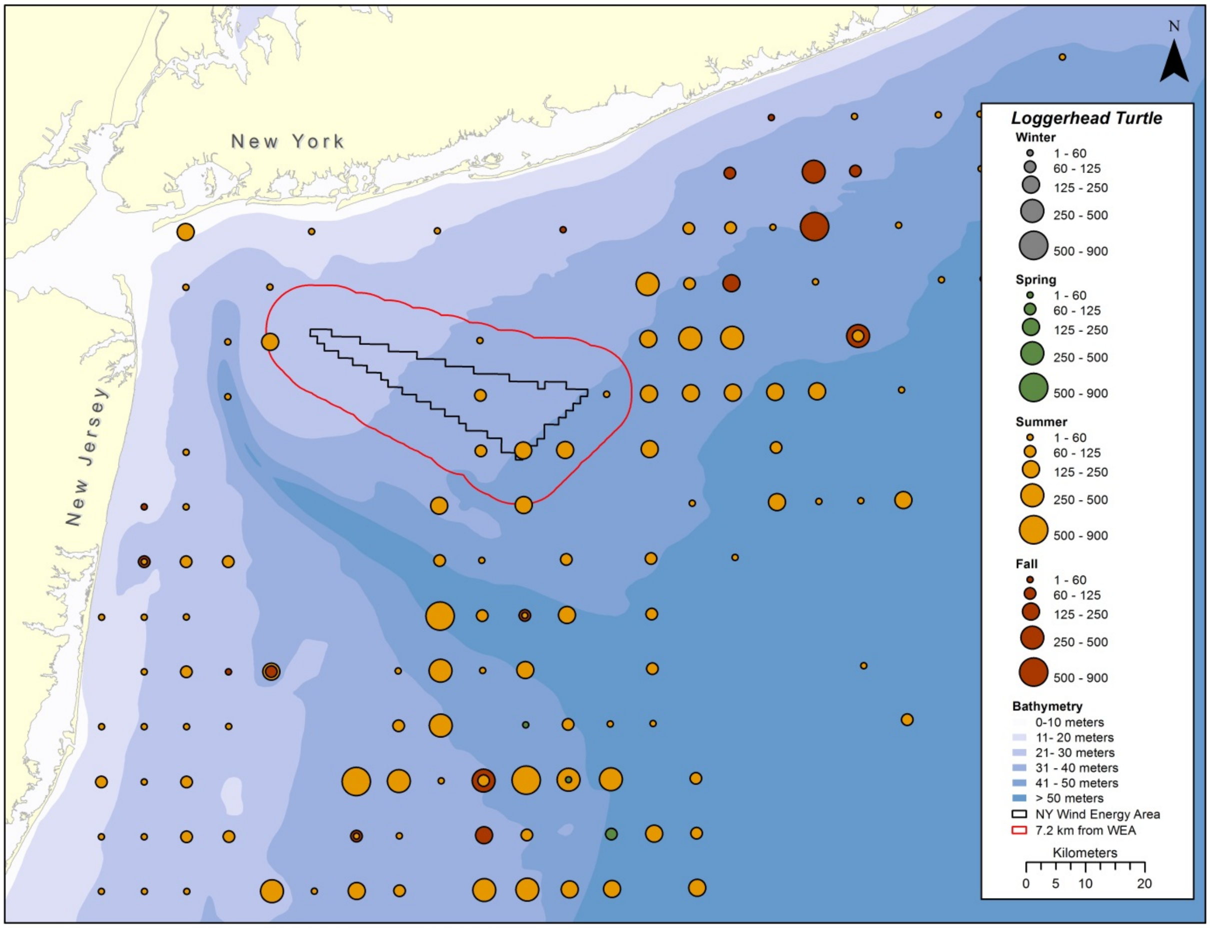

Figure E-14 SPUE for loggerhead turtles in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

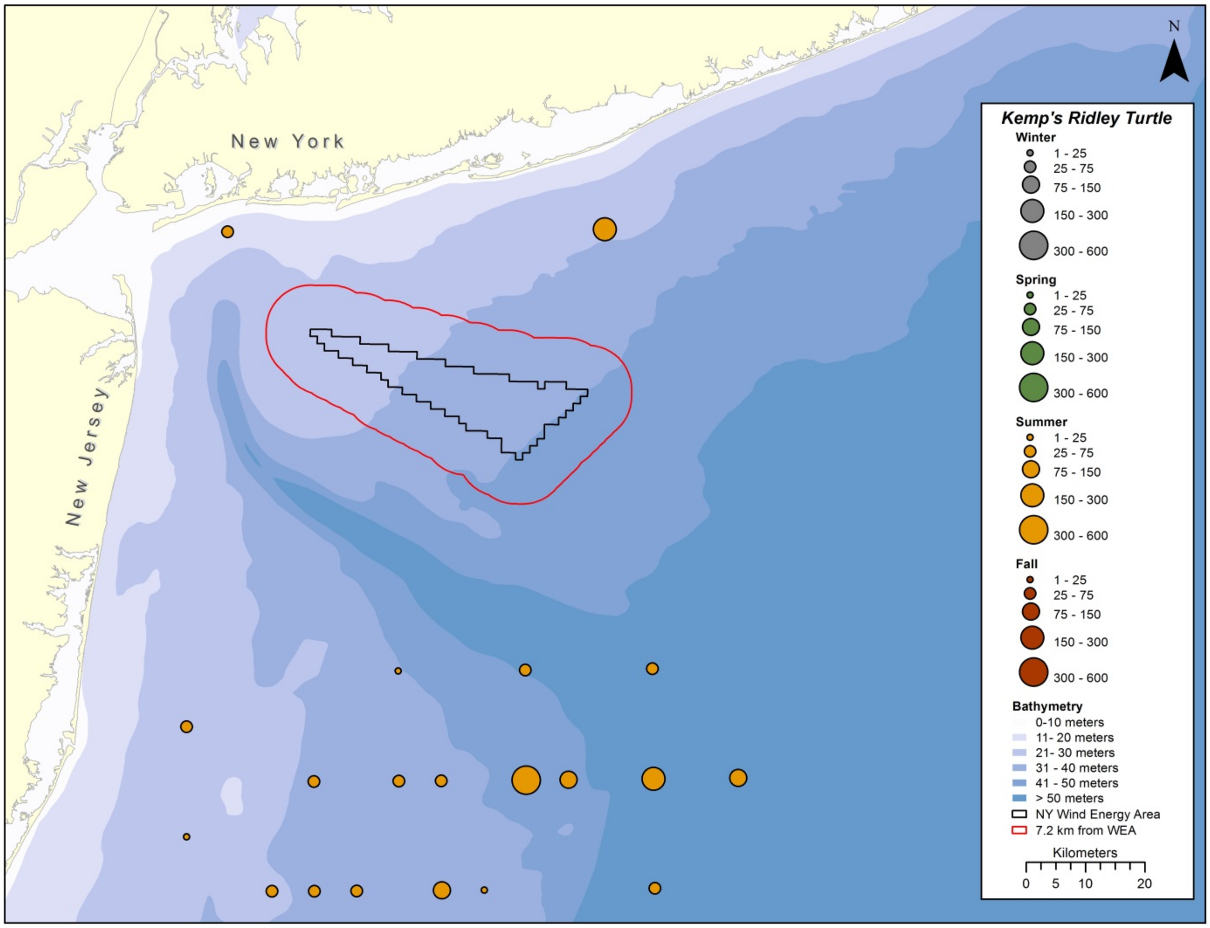

Figure E-15 SPUE for Kemp's ridley turtles in the WEA and surrounding waters (WEA outlined in black and 7.2 km from the WEA outlined in red)

Data Source: Right Whale Consortium, 2015. Map prepared by Normandeau Associates, Inc.

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Appendix F

Key Observation Points in the EA Analysis Area and Photosimulations

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KEY OBSERVATION POINTS

Otis Pike Wilderness

Otis Pike Wilderness is located on the Fire Island National Seashore, on public lands administered by the National Park Service (NPS). The Key Observation Point (KOP) was established at the Fire Island Wilderness Visitor Center, at the end of a boardwalk leading to the beach (Figure 4-21). Observer groups represented by this KOP include recreators, tourists, and educational groups. The boardwalk, located adjacent to the Visitor Center, provides viewing opportunities of upland dunes and seascape. The Visitor Center provides access to designated fishing areas, trails, and wilderness campsites.

The seascape appears large in scale, panoramic, and dominated by the broad horizontal plane of the Atlantic Ocean. Dominant colors in the landscape include the varied blue tones of the ocean and sky, the pale tan of the sandy beach, and the greens of upland vegetation. The horizon appears pale tan/white due to atmospheric haze and sea spray.

Observers experience the seascape from both a stationary and mobile position. Observer geometry relative to the WEA is at grade, with a lateral view of the northern edge of the grid. Seascape views from upland ground-level locations are intermittently blocked by dunes and coastal vegetation. Views to the ocean from the beach are unobstructed, limited only by the curvature of the earth and light refraction.

Fire Island Sunken Forest

Fire Island Sunken Forest is located on the Fire Island National Seashore, on public lands administered by the NPS. The KOP was established on the boardwalk, at a location where natural openings in vegetation allow views extending across the dunes to the Atlantic Ocean (Figure 4-21).

The foreground is dominated by the extensive dunes. Topography of the dunes is gentle, characterized by shallow, undulating hills that create enclosure in the foreground. Seascape views from upland ground-level locations are intermitted blocked by low dunes and coastal vegetation. From high-elevation vantage points, views extend outward over the dunes to include the large-scale panorama and dominant horizontal line of the Atlantic Ocean. The existing night sky appears pristine and is not affected by artificial lighting.

Observer groups represented by this KOP include recreators, tourists, and educational groups. Observers experience the seascape in a stationary position at observation decks or interpretive signs and while walking along the boardwalk.

Fire Island Lighthouse

The Fire Island Lighthouse is located on the Fire Island National Seashore, on public lands administered by the NPS. The lighthouse is listed in the National Register of Historic Places. The KOP established outside the door leading from the lens house (Figure 4-21).

Views from the lighthouse deck encompass 360 degrees surrounding the structure. On days of high visibility, observers may view the Manhattan skyline, approximately 50 miles to the northwest. The seascape appears large in scale, panoramic, and dominated by the broad horizontal plane of the beach in the foreground and the Atlantic Ocean beyond. Under nighttime conditions, artificial lighting from residential and commercial centers on the mainland is apparent to the north, east, and west. The night sky above the Atlantic Ocean appears natural, despite the influence of light scatter from the mainland.

Observer groups represented by this KOP include recreators, tourists, and educational groups. An NPS staff member accompanies visitors on the deck to facilitate discussion of views from the lighthouse. Observer geometry relative to the WEA is superior, oriented with a lateral view of the northern edge of the grid. Views to the ocean from the lighthouse deck are unobstructed, limited only by the curvature of the earth and light refraction.

Jones Beach State Park

Jones Beach State Park is located on the south shore of Long Island and includes 6.5 miles of beachfront and 2,400 acres of maritime environment. Approximately 6 to 8 million people visit this park each year (NYPRHP 2015). Jones Beach State Park is listed in the National Register of Historic Places. The KOP established on a boardwalk overlooking the beach (Figure 4-21).

The seascape from Jones Beach appears large in scale, panoramic, and dominated by the broad horizontal plane of the beach in the foreground and the Atlantic Ocean beyond. During the summer months, high visitor use results in a foreground characterized by a high density of recreators and recreation equipment (e.g. beach umbrellas, chairs) that, collectively, dominate foreground views and interrupt views toward the horizon.

Observer groups represented by this KOP primarily include recreators. Observer geometry relative to the WEA is at grade, oriented southeast across the northern edge of the grid. Views to the ocean from the beach are unobstructed.

Jacob Riis Park

Jacob Riis Park is located on the Rockaway Peninsula, a narrow spit separating Jamaica Bay from the Atlantic Ocean. The park is administered by the NPS as part of the Gateway National Recreation Area (NRA). The park is listed in the National Register of Historic Places. The KOP was established in front of the Riis Bathhouse on the Rockaway Gateway Greenway (Figure 4-21).

The seascape from the Riis Bathhouse appears large in scale and panoramic. When standing on the greenway, foreground views are interrupted by the railing and recreational activity on the beach. To the northeast, large-stature buildings can be seen along the shoreline of Rockaway Beach. Artificial lighting illuminates the boardwalk and beach. The night sky is influenced by light from adjacent urban areas and the shoreline of Long Beach.

Observer groups represented by this KOP primarily include recreators and tourists. Views toward the ocean from the beach are unobstructed, limited only by the curvature of the earth and light refraction.

Breezy Point Tip

Breezy Point Tip is located at the tip of the Rockaway Peninsula. Breezy Point Tip is administered by the NPS as part of the Gateway NRA. The KOP was established at a remote access point at the end of a dirt road leading to the beach from Rockaway Point Boulevard (Figure 4-21).

The seascape from Breezy Point Tip appears large in scale and panoramic, with uninterrupted views extending to the horizon. Buildings are visible to the east at Jacob Riis Park and neighboring areas. The night sky is influenced by artificial lighting emanating from nearby urban areas. At the time of the study, offshore cranes and support vessels were stationed near the shore, to the north of the WEA. The vessels were equipped with bright night lighting and appeared dominant on the horizon.

Observers at this location are primarily recreators. Observer geometry relative to the WEA is at grade, oriented southeast toward the tip of the triangular grid.

Fort Wadsworth

Fort Wadsworth is located on Staten Island, NY, on lands administered by the NPS Gateway NRA. Fort Wadsworth is listed in the National Register of Historic Places. The KOP was established at the shoreline, in front of a day-use picnic area (Figure 4-21).

Observers at this location are primarily recreators. Views of the WEA from this location are obstructed by buildings of Seagate and Coney Island, NY.

Great Kills Park

Great Kills Park is located on Staten Island, NY, on lands administered by the NPS Gateway NRA. The KOP was established in front of the bathhouse, overlooking Lower Bay and the Atlantic Ocean (Figure 4-21). The seascape appears large in scale and panoramic; however, some of the New Jersey coastline to the south and the City of Brooklyn and Brighten Beach to the east encroach the view. Under night conditions, artificial lighting emanates from the City of Brooklyn, Brighten Beach, and New Jersey, dominating the night sky from this location and adding to enclosure of the seascape. Isolated white and red lights occupy the horizon of Lower Bay.

Observers at this location are primarily recreators. Observer geometry relative to the WEA is at grade, oriented southeast toward the tip of the triangular grid.

Sandy Hook Lighthouse

Sandy Hook Lighthouse is located on the northern portion of the Sandy Hook Spit, on public lands administered by the NPS Gateway NRA. The lighthouse is designated as a National Historic Landmark. The KOP for this location was established on the lighthouse deck, with views directed east-southeast (Figure 4-21). Foreground views from the lighthouse are dominated by mature deciduous coastal forest. Historic buildings, local surface streets, and visitor parking are visible.

Observer geometry relative to the WEA is superior, oriented east-southeast toward the tip of the triangular grid. An observer's attention is drawn outward toward the Atlantic Ocean, where a narrow beach separates the upland forest from the water.

Sandy Hook North Beach

Sandy Hook North Beach is located on the eastern shoreline of the Sandy Hook Spit, on public lands administered by the NPS Gateway NRA. The KOP was established on the beach overlooking the Atlantic Ocean, with views generally directed to the southeast (Figure 4-21).

The seascape of Sandy Hook North Beach is dominated by the broad, horizontal lines of the beach and ocean. The landscape is both large in scale and panoramic, with views extending to the horizon. Color is composed primarily of the tan colors of the sand, and—on a clear day—the deep blue of the water and sky. A band of light tan to off-white haze was present on the horizon for many of the days this location was visited. Under night conditions, lighting from the Long

Island shoreline is visible, providing enclosure to the seascape to the north.

Observers at this location are primarily recreators. Observer geometry relative to the WEA is at grade, oriented east-southeast across the tip and the southwestern edge.

Sandy Hook Area D

Sandy Hook Area D is located on the eastern shoreline of the Sandy Hook Spit, on public lands administered by the NPS Gateway NRA. The KOP was established on the beach overlooking the Atlantic Ocean, with views generally directed to the east (Figure 4-21).

The seascape of Sandy Hook Area D is similar to that observed at Sandy Hook North Beach: large in scale and panoramic, with views extending to the horizon and dominated by the broad, horizontal lines of the beach and ocean. Color is composed primarily of the tan colors of the sand, and—on a clear day—the deep blue of the water and sky. Under night conditions, lighting from the Long Island shoreline is visible, providing enclosure to the seascape to the north. Lighting from overflying commercial aircraft is common.

Observers at this location are primarily recreators. Observer geometry relative to the WEA is at grade, oriented east-southeast across the tip and the southwestern edge.

Green-Wood Cemetery

Green-Wood Cemetery is a private cemetery located in Brooklyn, NY. This site is a registered National Historic Landmark. The KOP was established on a prominent hill in the cemetery, overlooking the skyline and Jamaica Bay toward the Atlantic Ocean (Figure 4-21). Observers at this location include individuals attending burial services, tourists, and cemetery managers and maintenance workers.

Twin Lights Lighthouse

Twin Lights Lighthouse is located in Highlands, NJ, in Monmouth County and is registered as a National Historic Landmark. The lighthouse is situated on top of a high bluff overlooking the communities of Highlands, Atlantic Highlands, Navesink, Rumson, Fairhaven, and Seabright, and the open beaches and natural areas of Sandy Hook, the Navesink River, and Sandy Hook Bay. Highway 36 extends across the foreground, crossing the Navesink River and heading south along the New Jersey shoreline. The KOP was placed on the lighthouse deck (Figure 4-21). Views from this location are seen through safety railings on the lighthouse deck. Though visual elements of the foreground are complex, the eye is drawn to the broad, flat panorama of the Atlantic Ocean during daytime conditions.

Under night conditions, foreground views are dominated by artificial lighting illuminating the highway, residential areas, and docks. Light is reflected off the flat water of the Navesink River. To the north, Long Island appears distinct due to contiguous lighting along the shoreline, adding to the enclosure of the seascape. Light sources appear as white to golden tones. Commercial aircraft on approach or ascent from local airports are apparent due to lighting against the night sky.

Observers at this location are primarily recreators and tourists. Observer geometry relative to the WEA is superior, oriented eastward across the tip and the southwestern edge of the WEA.

Town of Rumson, NJ

The Town of Rumson, NJ, is located on the north shoreline, in Monmouth County. The KOP was established on a pathway leading to a public beach (Figure 4-21). Views from this location are oriented eastward. From this location, the seascape of the Atlantic Ocean appears large in scale and panoramic, with views extending to the horizon.

Observer geometry relative to the WEA is at grade, oriented eastward across the tip and southwestern edge.

City of Asbury Park, NJ

The City of Asbury Park, NJ, is located in Monmouth County, along the northern shoreline of New Jersey. The KOP was established on Asbury Park Boardwalk, adjacent to the Convention Hall (Figure 4-21). The view from the KOP is directed northeast and encompasses the boardwalk, beach, and Atlantic Ocean. The seascape appears large in scale and panoramic, with views extending to the horizon.

Observer geometry relative to the WEA is at grade, oriented eastward along the southwestern edge.

Ocean Grove, NJ

The Town of Ocean Grove is located in Neptune Township, Monmouth County, NJ. The town is situated on the New Jersey shoreline and characterized by iconic Victorian architecture, a boardwalk paralleling the beach, and a central beach pavilion. The KOP was established in front of the beach pavilion (Figure 4-21). A narrow corridor of tall shrubs exists between the boardwalk and the beach, blocking views of the shoreline and Atlantic Ocean from much of this walkway. From the beach, views extend to the horizon and appear large in scale and panoramic. The beach is accessible for a fee. Views from the beach pavilion are partially blocked by tall shrubs and dunes. Observers at this location are primarily residents, recreators, and tourists. The pavilion is used for public meetings and religious services.

Observer geometry relative to the WEA is at grade, oriented eastward along the southwestern edge.

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KEY OBSERVATION POINT - JONES BEACH
EXISTING CONDITIONS (SUMMER / AFTERNOON)

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Scale bar to be 4 inches wide (102 mm)

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Viewing distance is 11.2 inches (285 mm)

For On-Screen Display:
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KEY OBSERVATION POINT - JONES BEACH

SIMULATION OF PROJECT UNDER MAXIMUM VISIBILITY (FALL / AFTERNOON)

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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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