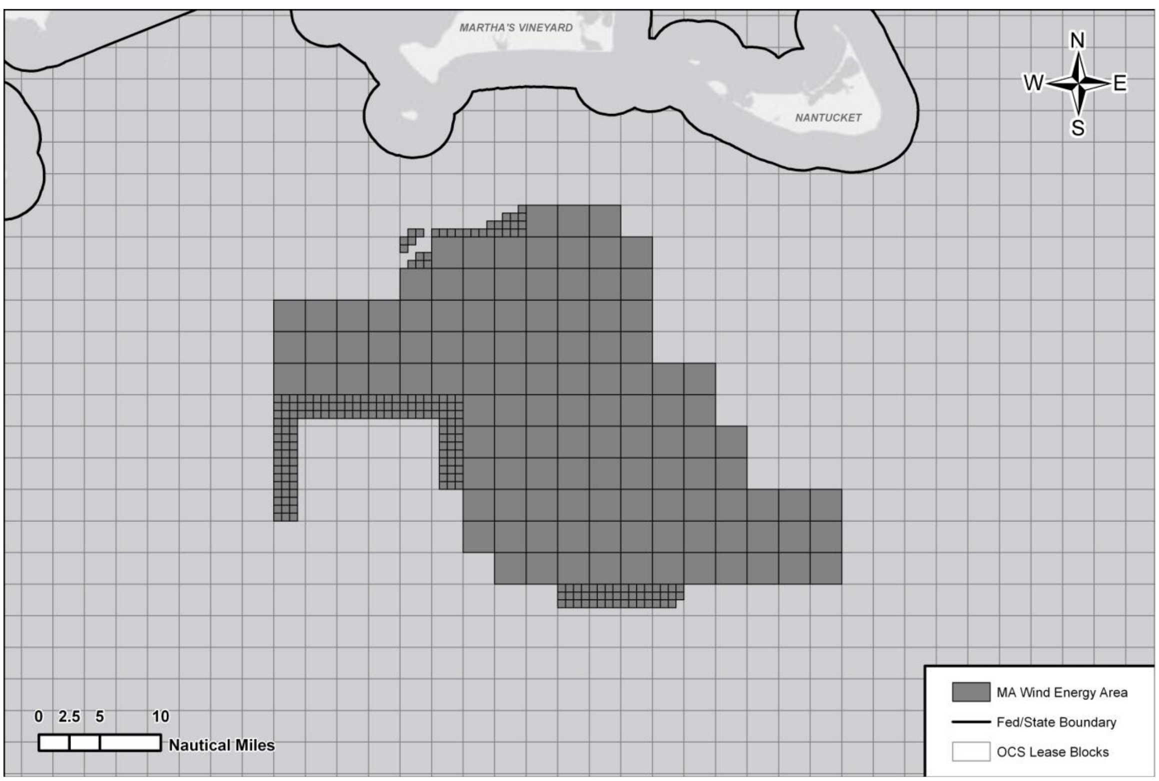
OCS EIS/EA
BOEM 2012-087

# Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts

## Environmental Assessment

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## ACRONYMS, ABBREVIATIONS, AND SYMBOLS

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ACPARS | Atlantic Coast Port Access Route Study |
| ADCP | Acoustic Doppler Current Profilers |
| AIS | Automatic Identification Systems |
| BLS | Bureau of Labor Statistics |
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| BP | before present day |
| CD | Consistency Determination |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| $CH_4$ | methane |
| CHIRP | Compressed High Intensity Radar Pulse |
| cm | centimeters |
| cm/s | centimeters per second |
| CMP | coastal zone management plan |
| CMSP | Coastal and Marine Spatial Planning |
| CO | carbon monoxide |
| CODAR | Coastal Ocean Dynamic Applications Radar |
| COLOS | Coastal Buoy and the Coastal Oceanographic Line-of-Sight |
| COP | construction and operation plan |
| CPT | Cone Penetrometer Test |
| CZMA | Coastal Zone Management Act |
| dB | decibels |
| DMA | dynamic management area |
| DMF | Division of Marine Fisheries |
| DO | dissolved oxygen |
| DOD | U.S. Department of Defense |
| DPS | distinct population segments |
| EA | Environmental Assessment |
| EFH | Essential Fish Habitat |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EOEEA | Massachusetts Executive Office of Energy and Environmental Affairs |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| FAA | Federal Aviation Administration |

| | |
|---|---|
| ft | feet |
| GGARCH | Geological and Geophysical, Hazards, and Archaeological Information |
| GHG | greenhouse gas |
| GIS | Geographical Information System |
| GSOE | Garden State Offshore Energy |
| HAPC | Habitat Areas of Particular Concern |
| HRG | High-resolution Geophysical |
| Hz | hertz |
| IFR | Instrument Flight Rules |
| IUCN | International Union for Conservation of Nature |
| kg | kilograms |
| kHz | kilohertz |
| km | kilometers |
| L | liter |
| LiDAR | Light Detection and Ranging |
| m | meters |
| MA CZM | Massachusetts Office of Coastal Zone Management |
| MADFW | Massachusetts Division of Fisheries and Wildlife |
| MARAD | Maritime Administration |
| MassCEC | Massachusetts Clean Energy Center |
| MBTA | Migratory Bird Treaty Act |
| µg | microgram |
| mg | milligrams |
| MHC | Massachusetts Historical Commission |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| µPa | micro Pascals |
| µs | microseconds |
| ms | milliseconds |
| MSD | marine sanitation device |
| MSR | Mandatory Ship Reporting system |
| MW | megawatt |
| NAAQS | National Ambient Air Quality Standards |
| NABCI | North American Bird Conservation Initiative |
| NCCOS | National Center for Coastal Ocean Science |
| n.d. | no date |
| NEFMC | New England Fishery Management Council |
| NEFSC | Northeast Fisheries Science Center |

| | |
|---|---|
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NJDEP | New Jersey Department of Environmental Protection |
| nm | nautical miles |
| NMFS | National Marine Fisheries Service |
| $N_2O$ | nitrous oxide |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxide |
| NOAA | National Oceanic and Atmospheric Administration |
| NOI | Notice of Intent |
| NPS | National Park Service |
| NSF | National Science Foundation |
| NTL | Notice To Lessees and Operators |
| NTU | Nephelometric Turbidity Unit |
| O3 | ozone |
| OCS | Outer Continental Shelf |
| OCSLA | Outer Continental Shelf Lands Act |
| OPAREA | operating area |
| OSAMP | Ocean Special Area Management Plan |
| OST | Office of Science and Technology |
| Pb | lead |
| PEIS | Programmatic Environmental Impact Statement |
| PM | particulate matter |
| ppm | parts per million |
| PTS | Permanent Threshold Shift |
| RFI | Request for Interest |
| RICRMC | Rhode Island Coastal Resources Management Council |
| RMS | root mean squared |
| ROV | remotely operated underwater vehicle |
| SAP | site assessment plan |
| SEFSC | Southeast Fisheries Science Center |
| SEL | sound exposure level |
| SHPO | State Historic Preservation Office |
| SMA | seasonal management area |
| $SO_2$ | sulfur dioxide |
| SOC | Standard Operating Condition |
| SODAR | Sonic Detection and Ranging |
| SPL | sound pressure level |

| | |
|---|---|
| SPUE | Sightings Per Unit Effort |
| Task Force | Massachusetts Renewable Energy Task Force |
| TEWG | Turtle Expert Working Group |
| TSS | traffic separation schemes |
| TTS | Temporary Threshold Shift |
| UNEP | United Nations Environment Programme |
| 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 |
| USDOT | U.S. Department of Transportation |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VFR | Visual Flight Rules |
| VMS | Vessel Monitoring Systems |
| 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 issuance of leases and approval of site assessment plans (SAPs) within the Wind Energy Area (WEA) offshore Massachusetts would lead to reasonably foreseeable significant impacts on the environment and, thus, whether an environmental impact statement (EIS) should be prepared before leases are issued. An environmental analysis was conducted by BOEM after they identified a WEA. This analysis is limited to the effects of lease issuance, site characterization activities (i.e., surveys of the lease area), and site assessment activities within the WEA (i.e., construction and operation of meteorological towers, buoys, or a combination of towers and buoys on the leases to be granted). This analysis complies with the National Environmental Policy Act (NEPA), Title 42 of U.S. Code (U.S.C.) §§ 4321–4370f and the Council on Environmental Quality (CEQ) regulations at Title 40 of the Code of Federal Regulations (CFR) 1501.3.

## 1.1 PURPOSE AND NEED

The purpose of the proposed action is to issue leases and approve SAPs to provide for the responsible development of wind energy resources in the WEA offshore Massachusetts. The need for BOEM issuance of leases and approval of SAPs is to adequately assess wind and environmental resources of the WEA to determine if areas within the WEA are suitable for, and could support, commercial-scale wind energy production.

## 1.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the issuance of commercial wind energy leases within the WEA offshore Massachusetts and approval of site assessment activities on those leases. Of the alternatives considered in this EA, Alternative A would result in lease issuance over the largest geographic area. Three other action alternatives and a no action alternative are also considered in this EA and discussed in Section 2.

## 1.3 BACKGROUND

### 1.3.1 Bureau of Ocean Energy Management Authority and Regulatory Process

The Energy Policy Act of 2005, Pub. L. No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf  Lands Act (OCSLA), which authorized that 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 delegated this authority to the former Minerals Management Service (MMS), now BOEM. Final regulations implementing this authority at 30 CFR Part 585 were promulgated on April 22, 2009.

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 described below.

(1) **Planning and Analysis.** The first phase is to identify suitable areas to be considered for wind energy project leases through collaborative, consultative, and analytical processes using the Massachusetts Renewable Energy Task Force (Task Force), public information meetings, and input from the States, Native American Tribes, and other stakeholders.

(2) **Lease Issuance.** The second phase, issuance of a commercial wind energy lease, gives the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the right to use the leased 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).** The third stage of the process is the submission of a SAP, which contains the lessee's detailed proposal for the construction of a meteorological tower, installation of meteorological buoys, or a combination of the two on the leasehold. The SAP allows the lessee to install and operate site assessment facilities for a specified term. See 30 CFR 585.605–585.618. The lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold. BOEM may approve, approve with modification, or disapprove a lessee's SAP. See 30 CFR 585.613.

(4) **Approval of a Construction and Operation Plan (COP).** The fourth stage of the process is the submission of a COP, a detailed plan for the construction and operation of a wind energy project on the lease. A COP allows the lessee to construct and operate wind turbine generators and associated facilities for a specified term. See 30 CFR 585.620–585.638. BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS. See 30 CFR 585.628. As with a SAP, BOEM may approve, approve with modification, or disapprove a lessee's COP. See 30 CFR 585.628.

The regulations also require that a lessee provide the results of surveys with its SAP or COP, including shallow hazards surveys (30 CFR 585.610(b)(2) and 30 CFR 585.626(a)(1)), geological surveys (30 CFR 585.610(b)(4) and 30 CFR 585.616(a)(2)), geotechnical surveys (30 CFR 585.610(b)(1) and 30 CFR 585.626(a)(4)), biological surveys (30 CFR 585.610(b)(5) and 30 CFR 585.626(a)(3)), and archaeological resource surveys (30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5)). BOEM refers to these surveys as "site characterization" activities. Although BOEM does not issue permits or approvals for these site characterization activities, it will not consider approving a lessee's COP if the required survey information is not included. See also BOEM's *Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological*

*Information Pursuant to 30 CFR Part 585* (GGARCH) (BOEMRE, 2011a).

In addition to commercial leases, BOEM has the authority to issue leases to other Federal agencies and to States for the purpose of conducting renewable energy research activities that support the future production, transportation, or transmission of renewable energy. See 30 CFR 585.238. The terms of these types of research leases would be negotiated by the Director of BOEM and the head of the Federal agency or the Governor of the relevant State, or their authorized representatives, on a case-by-case basis, subject to the provisions of 30 CFR Part 585, including those pertaining to public involvement.

### 1.3.2 "Smart from the Start" Atlantic Wind Energy Initiative

On November 23, 2010, Secretary of the Interior Ken Salazar announced the "Smart from the Start" Atlantic wind energy initiative to accelerate the responsible development of wind energy on the Atlantic OCS. The initiative calls for the identification of areas on the Atlantic OCS that appear most suitable for commercial wind energy activities, and the opening of these areas for leasing and detailed site assessment activities.

On February 6, 2012, BOEM launched this initiative offshore Massachusetts through the publication of a Notice of Intent (NOI) to prepare an EA (77 FR 5830) and a Call for Information and Nominations (Call) (77 FR 5820) in the *Federal Register*. The NOI and Call identified an area of the OCS offshore Massachusetts that appeared to provide the most suitable opportunity for wind energy development while presenting the fewest apparent user conflicts. The prospective area for wind energy leasing published in the NOI was developed through extensive consultation with other Federal agencies and BOEM's Task Force, public input, and the Area Identification process. See Section 1.5 and Appendix A for further discussion of the development of the prospective OCS area for wind energy offshore Massachusetts into the WEA.

## 1.4 OBJECTIVE OF THE ENVIRONMENTAL ASSESSMENT

Pursuant to NEPA, 42 U.S.C. §§ 4321–4370f, and the CEQ regulations at 40 CFR 1501.3, this EA was prepared to assist the agency in determining which OCS areas offshore Massachusetts should be the focus of BOEM's wind energy leasing efforts. This EA considers a number of reasonable geographic and non-geographic alternatives, and evaluates the environmental and socioeconomic consequences, including potential user conflicts, associated with issuing leases and approving SAPs under each alternative.

### 1.4.1 Information Considered

Information considered in scoping the NEPA document includes:

- Public response to the February 6, 2012, NOI to prepare this EA;
- Research and review of current relevant scientific and socioeconomic literature;
- Comments received in response to the Request for Interest (RFI) and Call associated with wind energy planning offshore Massachusetts;
- Ongoing consultation and coordination with the members of BOEM's Task Force;
- Government-to-Government consultation with federally recognized Tribes: Mashpee Wampanoag Tribe, Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah);
- Ongoing 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);
- Literature Synthesis for the North and Central Atlantic Ocean, OCS Study BOEMRE 2011-012 (BOEMRE, 2011d);
- 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, 2012a);
- 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, 2011);
- Relevant material from the Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf Offshore Delaware and New Jersey (MMS, 2009);
- Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts (BOEM, 2012b);
- Rhode Island Ocean Special Area Management Plan (OSAMP);
- Massachusetts Ocean Management Plan (MA EOEEA, 2009);
- Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas: Draft Programmatic Environmental Impact Statement, March 2012 (BOEM, 2012c); and
- Relevant material from the 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).

### 1.4.2 Scope of Analysis

BOEM intends to use this EA to inform decisions to issue leases in the MA WEA, and to subsequently approve SAPs on those leases. Although BOEM does not issue permits for shallow hazards, geological, geotechnical, or archaeological resource surveys, BOEM regulations require that a lessee include the results of these surveys in its application for SAP or COP approval.

Thus, this EA will analyze two distinct BOEM actions in the WEA—lease issuance and SAP approval—and the reasonably foreseeable consequences associated with these actions, including:

1. Shallow hazards, geological, geotechnical, biological, and archaeological resource surveys (associated with lease issuance); and

2. Installation and operation of a meteorological tower, two meteorological buoys, or a combination of one tower and one buoy (associated with SAP approval).

Additional analysis under NEPA will be required before any future decision is made regarding construction or operation of any wind energy facility on leases that may be issued within the WEA or construction of marine cables and onshore grid transmission connections that are constructed in support of wind energy facilities in the WEA.

The purpose of conducting surveys and installing meteorological measurement devices is to assess the wind resources in the lease area and to characterize the conditions of the water column and seabed so that a lessee can determine whether the site is suitable for commercial development and, if so, submit a COP.

The issuance of a lease does not mean, should a lessee submit a COP in the future, that the COP would be approved, or that the lease will ultimately be developed at all. Rather, the lease only grants the lessee the exclusive right to subsequently seek BOEM approval for the development of the leasehold. The lease does not grant the lessee the right to construct any facilities; rather, the lease grants the lessee the right to use the leased 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. 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 appropriate State Task Force(s), and perform an independent site- and project-specific NEPA analysis before determining whether to approve, approve with modifications, or disapprove a lessee's COP under 30 CFR 585.628.

This EA considers whether issuing leases and approving site assessment activities in certain areas of the OCS offshore Massachusetts would lead to reasonably foreseeable significant impacts on the environment, and thus, whether an EIS should be prepared before leases are issued (see 40 CFR 1508.9). Should a particular area be leased, and should the lessee subsequently submit a SAP, BOEM would then determine whether this EA adequately considers the environmental consequences of the activities proposed in the lessee's SAP. If BOEM determines that the analysis in this EA adequately considers these consequences, then no further NEPA analysis would be required before the SAP is approved. If, on the other hand, BOEM determines that the analysis in the EA is inadequate for that purpose, BOEM would prepare an additional NEPA analysis before approving the SAP.

If and when a lessee is prepared to propose wind energy generation on its lease, it will submit a COP. If a COP is submitted, BOEM would prepare a separate site- and project-specific NEPA analysis from the analysis in this EA. This would likely 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 will use the EIS document to evaluate the reasonably foreseeable environmental consequences associated with the proposed COP activities. BOEM will use the EIS to decide whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR 585.628.

## 1.5 DEVELOPMENT OF WIND ENERGY AREA

### 1.5.1 Planning Process

The RFI and Call processes are planning notices designed to assist BOEM in acquiring environmental and socioeconomic information and determining whether interest exists in acquiring a wind energy lease on the OCS. See 43 U.S.C. § 1337(p)(3). Anyone interested in acquiring a lease in the area identified in the RFI or Call must submit a valid expression or nomination of interest, which includes the identification of the specific block or blocks the applicant is interested in acquiring, and a general description of the applicant's objectives and the facilities that it contemplates using to achieve them. See 30 CFR 585.213. These submissions have assisted BOEM in developing some of the reasonably foreseeable scenarios on which the alternatives in this EA are based:

1. The reasonably foreseeable leasing scenario, which was used to determine how many leases the WEA could reasonably support; and

2. The reasonably foreseeable site assessment scenario that was used to determine how many meteorological towers or buoys would likely be installed in the WEA.

### 1.5.2 Stakeholder and Public Consultation

BOEM developed the WEA through extensive collaboration and consultation with the Task Force, Federal agencies, Native American Tribes, the general public, and other stakeholders between November 2009 and May 2012. Figure 1-1 illustrates the extent of consultation with stakeholders and the public over time.

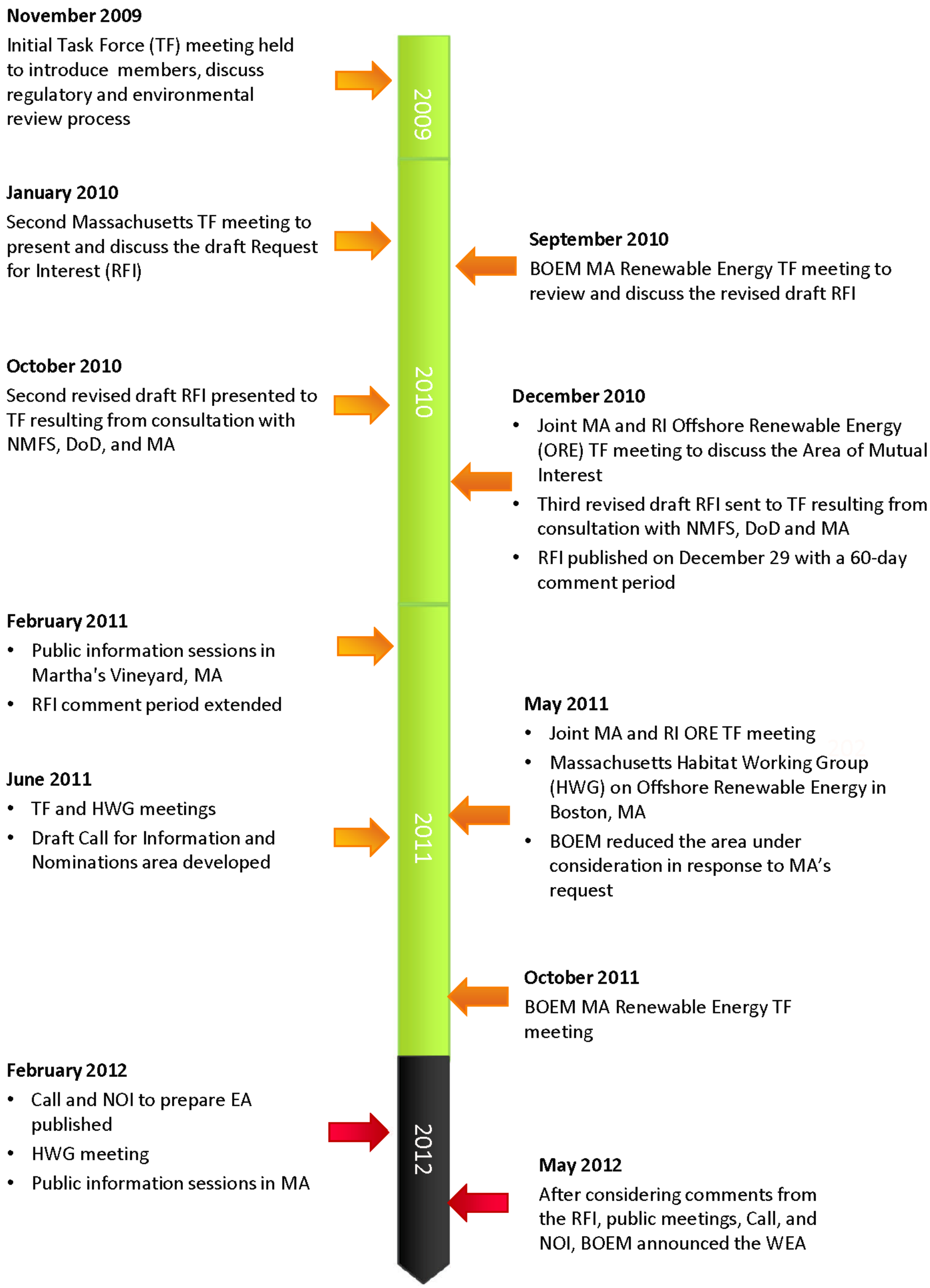



**Figure 1-1. Planning Process Overview**

Following several task force meetings and consultations with NMFS, DOD, and Massachusetts, the RFI was published in the *Federal Register* on December 29, 2010 (75 FR 82055). BOEM reopened the RFI comment period for an additional 30 days starting on March 17, 2011, with a notice in the *Federal Register* (76 FR 14681). BOEM received approximately 260 public comments and 11 individual expressions of interest in response to the RFI. Figure 1-2 illustrates the RFI area.

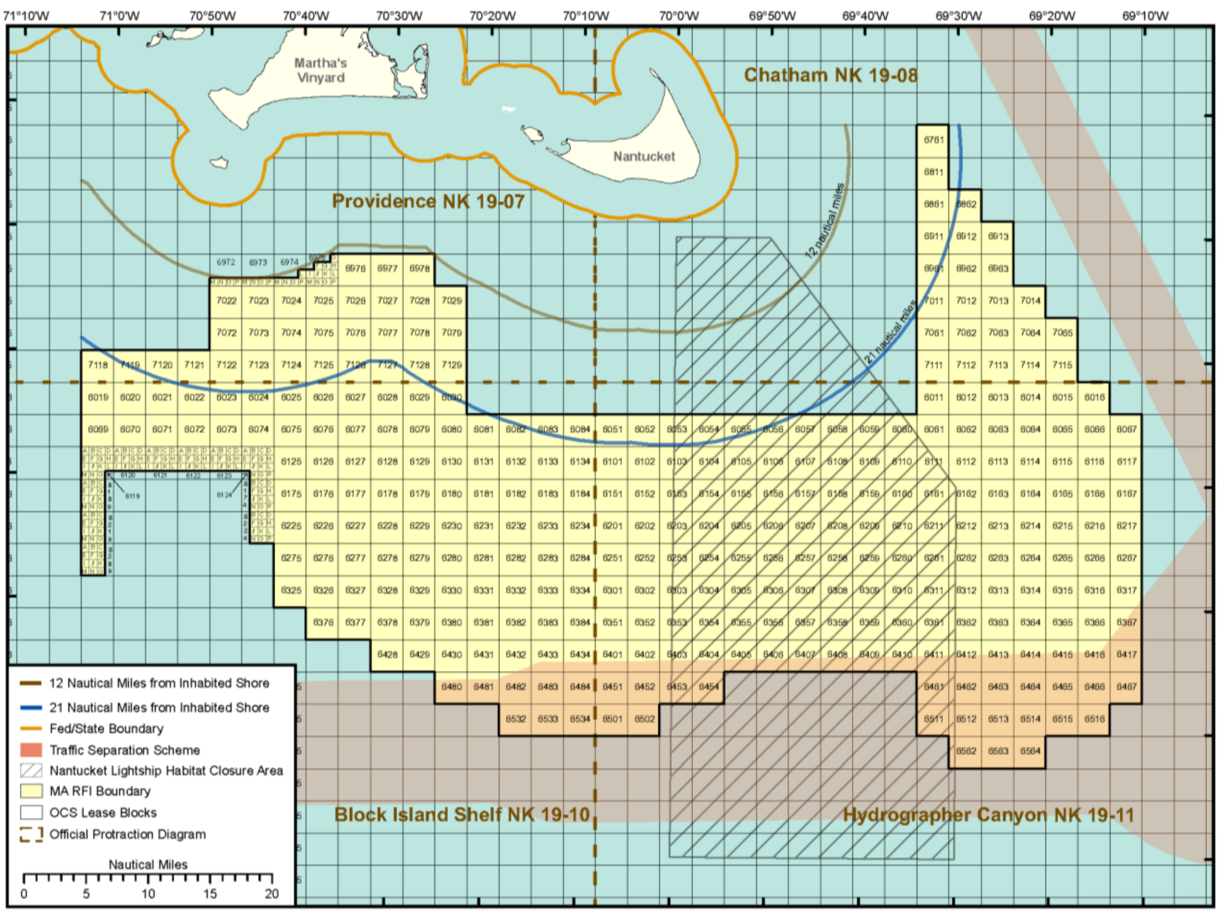



**Figure 1-2. Offshore Massachusetts RFI Area**

Following the release of the RFI (77 FR 5820), BOEM hosted several public meetings throughout 2011 about the leasing process for the potential wind energy development area offshore Massachusetts. Public information sessions hosted by the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) were held on February 16 and 17, 2011. In response to public input at the February information sessions, the Commonwealth of Massachusetts EOEEA established two working groups to facilitate non-governmental consultation: the Fisheries Working Group on Offshore Renewable Energy and the Massachusetts Habitat Working Group on Offshore Renewable Energy. Meetings of these two groups were held on May 2, 2011, and May 4, 2011, respectively.

After considering public input on the RFI and based on further consultation with the Task Force, the potential WEA was developed to avoid the following areas:

1. Shipping lanes, traffic separation schemes (TSS);

2. Nantucket Lightship Habitat Closure Area; and

3. Commercial fishing areas of interest (this resulted in removal of the eastern half of the RFI area from further consideration).

In total, 189 whole OCS blocks (an OCS block is 3 statute miles by 3 statute miles) and 144 partial OCS blocks were removed.

Additionally, public informational meetings hosted by the Commonwealth of Massachusetts EOEEA were held in New Bedford, MA, on June 7, 2011; with the Massachusetts Habitat Working Group on Offshore Renewable Energy and the public in Boston, MA, on June 8, 2011; and in Martha's Vineyard, MA, on June 9, 2011.

As a result of these meetings and consultations, the area considered for lease issuance was reduced to approximately half the size of the RFI area. On February 6, 2012, BOEM published the Call for Commercial Leasing for Wind Power on the OCS Offshore Massachusetts in the *Federal Register* (77 FR 5820). BOEM received 32 public comments and 10 expressions of interest in response to the Call. On February 6, 2012, BOEM also published an NOI that solicited public input regarding the environmental and socioeconomic issues associated with wind energy leasing in the proposed development area (77 FR 5830). Figure 1-3 below illustrates the Call Area.

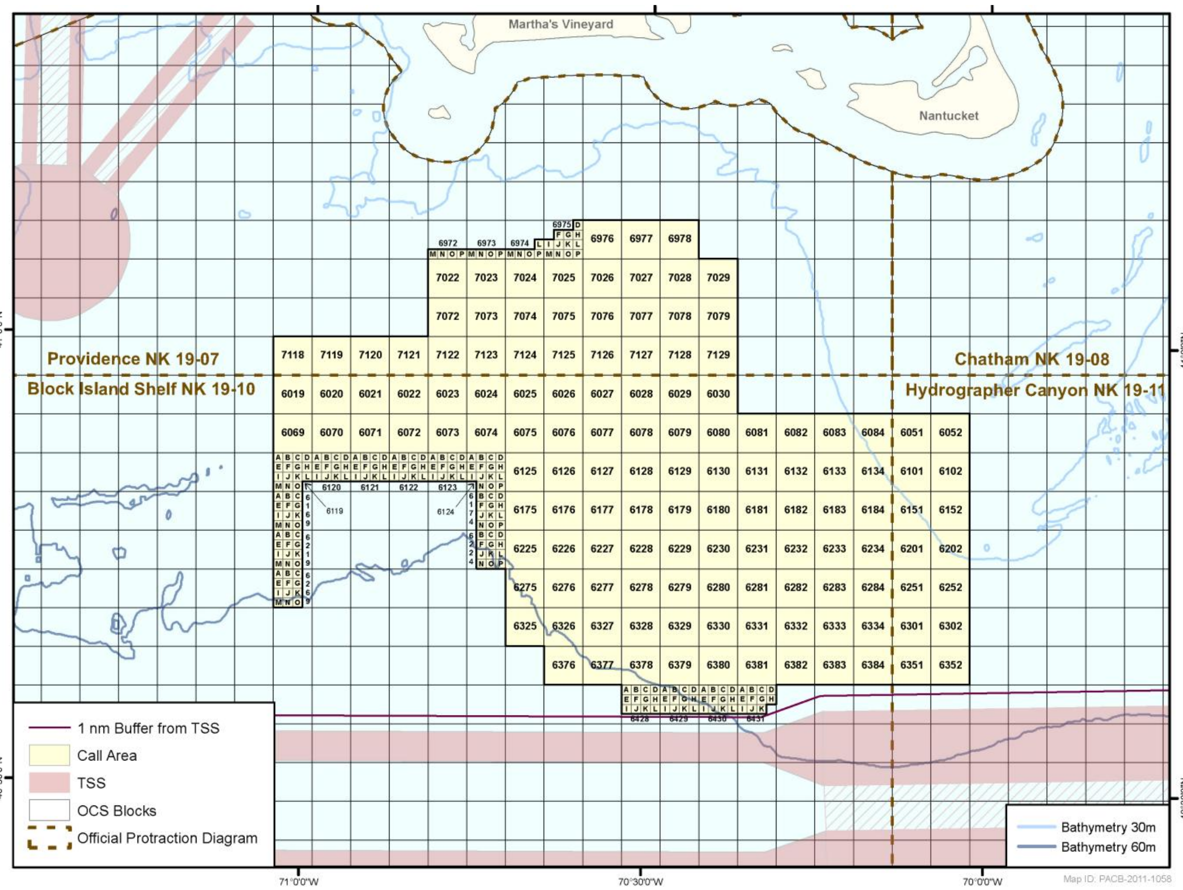



**Figure 1-3. Offshore Massachusetts Call Area**

Following the publication of the Call Area, BOEM convened public information sessions to explain the commercial leasing process and provide additional opportunities for public input on the scope of the EA in Massachusetts on February 13 and 14, 2012. BOEM also met with the Massachusetts Fisheries Working Group on February 13, 2012, and the Massachusetts Habitat Working Group on February 14, 2012.

During the Area Identification process (March through May 2012), BOEM excluded some of the OCS blocks that overlapped with high value sea duck habitat and areas that, if ultimately developed with commercial wind energy facilities, would likely cause substantial conflict with commercial and recreational fishing activities. The remainder of the Call Area, consisting of 117 whole and 20 partial OCS lease blocks, was announced as the final WEA on May 30, 2012, by BOEM. This final WEA is the area that will be considered for leasing and approval of SAPs in this EA. Figure 1-4 illustrates the Massachusetts WEA.

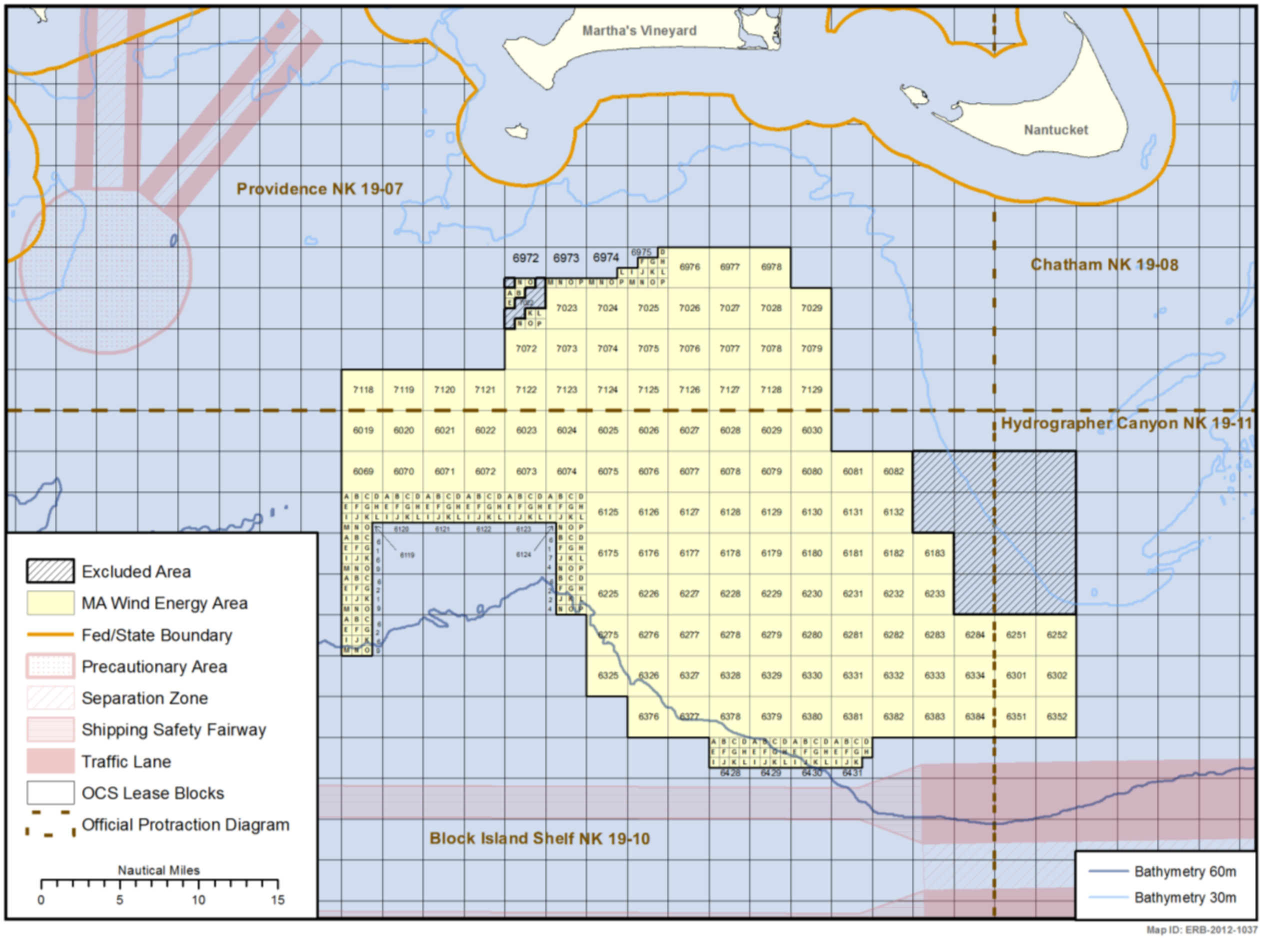



**Figure 1-4. Offshore Massachusetts WEA**

### 1.5.3 Coastal and Marine Spatial Planning

On July 19, 2010, the President signed Executive Order (EO) 13547: *Stewardship of the Ocean, Our Coasts, and the Great Lakes* establishing a National Ocean Policy and the National Ocean Council (75 FR 43023). The Order establishes a comprehensive, integrated national policy for the stewardship of the ocean, our coasts, and the Great Lakes. Where BOEM actions affect the ocean, the Order requires BOEM to take such action as necessary to implement this policy, the stewardship principles, and national priority objectives adopted by the Order and guidance from the National Ocean Council. Following the principles of Coastal and Marine Spatial Planning (CMSP) along with other tools, BOEM developed the WEA through coordination with the Task Force as described in Section 1.5.1.

### 1.5.4 Massachusetts Ocean Management Plan

The Commonwealth of Massachusetts established a comprehensive ocean management plan that provides a framework for managing, reviewing, and permitting proposed uses of State waters.

The plan provides a roadmap for both environmental protection and sustainable use of ocean resources. Although the plan is limited to State waters, the EOEEA identified potentially suitable locations adjacent to these areas in Federal waters for commercial-scale wind energy development because it recognized "that the three-nautical mile (5.6 km) limit of State jurisdiction (and the limit of jurisdiction of the ocean management plan) is an artificial constraint to considerations of technology, economics, and environmental and social benefits and impacts" (MA EOEEA, 2009). Massachusetts requested that BOEM form an intergovernmental task force in 2009 to assist BOEM in the planning and regulatory review associated with leasing areas of Federal waters for large-scale wind energy development.

# 2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes a number of geographic alternatives for lease issuance and the approval of site assessment activities within the WEA offshore Massachusetts. See Table 2-1.

**Table 2-1**

**Alternatives Considered**

| Alternative | Description |
|---|---|
| Alternative A (Preferred Alternative) – Full Leasing of WEA | Under Alternative A, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts (Figure 2-1). High-value fishing grounds and important sea duck habitat areas were excluded from the WEA (depicted as "Excluded Area" on Figure 2-1). |
| Alternative B – Removal of Areas for North Atlantic Right Whales | Activities could occur in all areas of the WEA offshore of Massachusetts, except where right whales occur and/or—based upon historical and current records, whale watch boat records, and NMFS aerial and shipboard protected species abundance surveys—are predicted to occur (Figure 2-2). |
| Alternative C – Removal of Areas within 15 nm[1] of Inhabited Coastline | Under Alternative C, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts except areas within 15 nm of the inhabited Massachusetts coastline because of possible impacts on cultural resources (Figure 2-3). |
| Alternative D – Removal of Areas within 21 nm of Inhabited Coastline | Under Alternative D, lease issuance and approval of site assessment activities could occur in all areas of the WEA offshore Massachusetts except areas within 21 nm of the inhabited Massachusetts coastline because of possible impacts on cultural resources (Figure 2-4) |

[1] nm = nautical miles

These alternatives are the result of extensive meetings with the Task Force, relevant consultations with Federal, State, and local agencies, and potentially affected Native American Tribes, and extensive input from the public and potentially affected stakeholders. BOEM also received useful environmental, economic, use conflict, and safety-related information in response to the Call and NOI. The alternatives were identified and defined by excluding certain areas of the WEA because of the potential for affecting the following resources and uses:

- Sea duck habitat;
- Fishing and fishery resources;
- North Atlantic right whales; and
- Visual /cultural resources.

This EA uses a "reasonably foreseeable scenario," evaluating the maximum amount of site characterization surveys (i.e., shallow hazards, geological, geotechnical, archaeological, and biological surveys) and site assessment activities (i.e., installation of data collection devices under approved SAPs) that could be conducted as a result of the proposed action. BOEM assumes that for each lease, zero to one meteorological tower, one to two buoy(s), or a combination, would be constructed or deployed.

## 2.1 ALTERNATIVE A (PROPOSED ACTION) – LEASING OF THE WHOLE WIND ENERGY AREA

As a result of comments received on the RFI and NOI, BOEM has identified the WEA offshore Massachusetts as the area considered for wind energy development under the proposed action (see Section 1.5 and Figure 1-1). The northern boundary of the WEA offshore Massachusetts begins approximately 12 nautical miles (nm) south of Martha's Vineyard and 13 nm southwest of Nantucket. From its northern boundary, the WEA extends roughly 33 nm south. The WEA has an east/west extent of approximately 47 nm. The northern boundary of the WEA is at an approximately 98-foot (ft) (30-meter [m]) ocean depth and extends to approximately the 197 ft (60 m) bathymetric contour along the southern boundary. The entire area is 877 square nm (742,974 acres; 300,670 hectares) and contains 117 whole OCS blocks and 20 partial OCS blocks. Figure 2-1 illustrates the lease area (the whole WEA) under Alternative A.

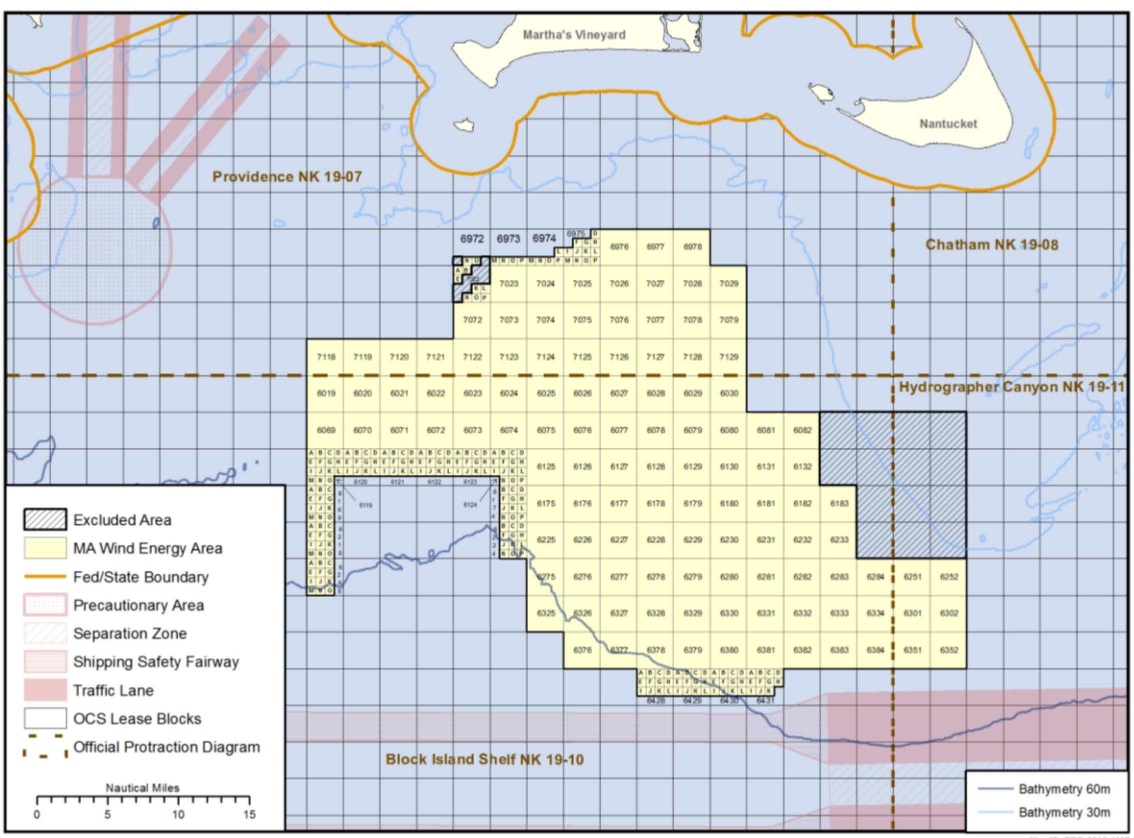



**Figure 2-1. Alternative A lease area (whole WEA)**

Alternative A (the preferred alternative) is the issuance of commercial and research wind energy leases within the whole WEA offshore Massachusetts, and approval of site assessment activities on those leaseholds. Based on the expressions of commercial wind energy interest received by BOEM, this alternative assumes that the entire WEA area would be leased, resulting in five total leaseholds. See Chapter 3, Reasonably Foreseeable Scenarios, for further discussion. Therefore, up to five meteorological towers (should all lessees choose to propose meteorological towers on their leases), 10 meteorological buoys (should all lessees choose to propose meteorological buoys on their leases), or a combination of towers and buoys are projected for the WEA under Alternative A.

The site characterization and assessment activities combined are projected to result in between 2,808 and 6,500 vessel round trips as a maximum worst-case scenario over a 5-year period (see Section 3.1.3.4). Vessel traffic would be divided between 10 major and 21 smaller ports in Massachusetts, Rhode Island, Connecticut, and New York (see Section 3.1.2). These leasing, site characterization, and site assessment scenarios are described in detail in Chapter 3 of this EA. The impacts of Alternative A (the preferred alternative) on environmental resources and socioeconomic conditions are described in detail in Section 4.2 of this EA.

## 2.2 ALTERNATIVE B – NORTH ATLANTIC RIGHT WHALE AREA EXCLUSION

To reduce the likelihood of impacts on right whales, Alternative B would exclude areas of the WEA (Alternative A) where the North Atlantic right whale is most likely to occur. Vessel traffic associated with high-resolution geological and geophysical surveys (e.g., vessel-based and aerial avian, bat, marine mammal, sea turtle, fish surveys) and periodic maintenance trips to install meteorological towers and buoys would not be prohibited access to these areas under this alternative for the entire area of potential effect to be surveyed.

Current estimates of the North Atlantic right whale population are between 350 and 400 individuals (Waring et al., 2011). Two primary human-induced threats have been identified—collisions with vessels (ship strikes) and entanglement with fishing gear. Collisions between ships and whales are the leading cause of right whale deaths (Kraus et al., 2005). Sound produced by vessels, seismic surveys, and pile driving during construction of meteorological towers is another potential source of adverse effects on right whales during site characterization and site assessment activities (Southall et al., 2007). Recent sightings data confirm that the endangered North Atlantic right whale is present in the Call Area during the species' regular migration. Although the number of right whales appears to be variable between years, in the last few years approximately one-quarter of the population has been observed in the Call Area (Khan et al., 2011). The North Atlantic right whale, which is protected under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), has been observed exhibiting feeding behavior in the Call Area. According to the NMFS, North Atlantic right whales are found seasonally in the waters off Massachusetts and have been documented in the waters of the Call Area (see Section 4.2.2.6.1).

Comments received during the Call and NOI comment periods expressed concerns about impacts on right whales during site assessment activities. Because the NOI focused on input relating to lease issuance and site characterization and site assessment activities, most of the issues expressed focused on the impacts that vessel traffic associated with site assessment activities would have on right whales. The concern most often identified was that the Call Area is an important migratory corridor and potential feeding habitat for the North Atlantic right whale.

The lease area under Alternative B is 644 square nm (545,845 acres; 220,895 hectares) and contains 83 whole OCS blocks and 18 partial OCS blocks. Up to three meteorological towers and six meteorological buoys are assumed for the lease area under this alternative. The impacts of Alternative B on environmental and socioeconomic resources are described in detail in Section 4.2 of this EA. Figure 2-2 below illustrates the lease area under Alternative B. The shaded area illustrates the blocks excluded because of their potential importance to North Atlantic right whales. This area was delineated based upon modeled occurrence using effort-corrected sightings data through 2008. Some areas were already removed through the Area Identification process.

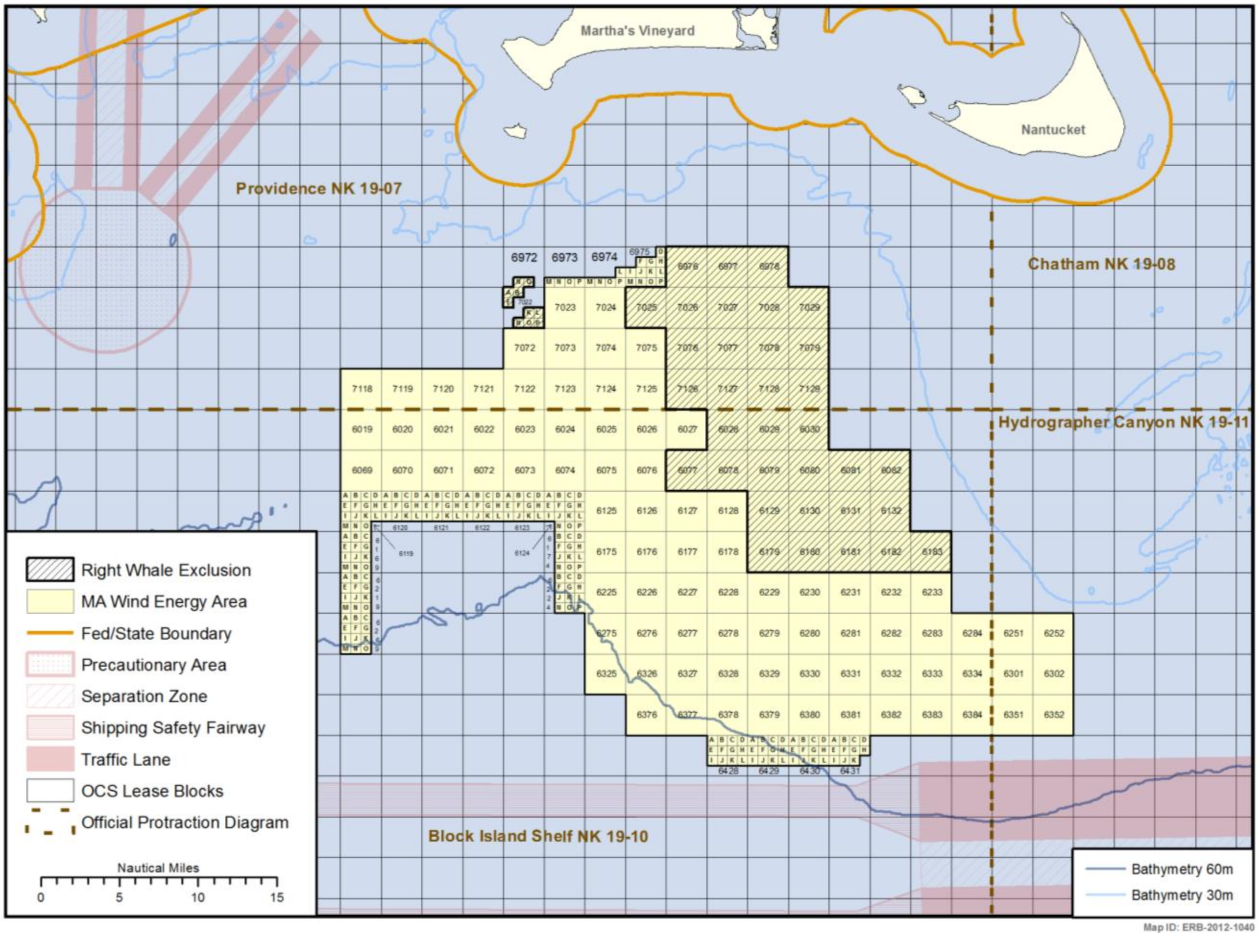



**Figure 2-2. Alternative B lease area**

## 2.3 ALTERNATIVE C – AREAS WITHIN 15 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

Under Alternative C, any OCS blocks within 15 nm of the inhabited coastline are excluded from leasing to reduce possible visual impacts on cultural resources. Historic properties of religious and cultural significance to Native Americans are found in the vicinity of the coast, likely because of the important role maritime resources played in the lives of native peoples. European colonists were also attracted to and found plentiful natural resources in coastal areas. The ocean coastline in this area has gone through several periods of change, yet it retains a variety of significant cultural resources from different periods in history, including districts, sites, buildings, and traditional cultural properties. For most of these historical properties along the shore, the coastal waters are a fundamental aspect of their historical significance and an integral feature in their historical setting. In the offshore waters, increasing levels of ship traffic over the past three centuries combined with strong currents, storms, and frequent periods of heavy fog created an environment in which shipwrecks on shore and collisions at sea were relatively common (RICRMC, 2010).

During the development of the Call Area, several members of the Task Force requested that Federal waters within 15 nm of the coast not be considered for leasing because visible structures in offshore areas could adversely impact the viewshed from onshore historical and cultural resources. In consideration of this request, Alternative C would exclude all areas within 15 nm of the inhabited Massachusetts coastline from leasing consideration. The lease area under Alternative C is 865 square nm (733,013 acres; 296,640 hectares) and contains 108 whole OCS blocks and 20 partial OCS blocks. Up to five meteorological towers and 10 meteorological buoys are projected for the lease area under this alternative. The impacts of Alternative C on environmental and socioeconomic resources are described in detail in Section 4.2 of this EA. Figure 2-3 below illustrates the lease area under Alternative C.

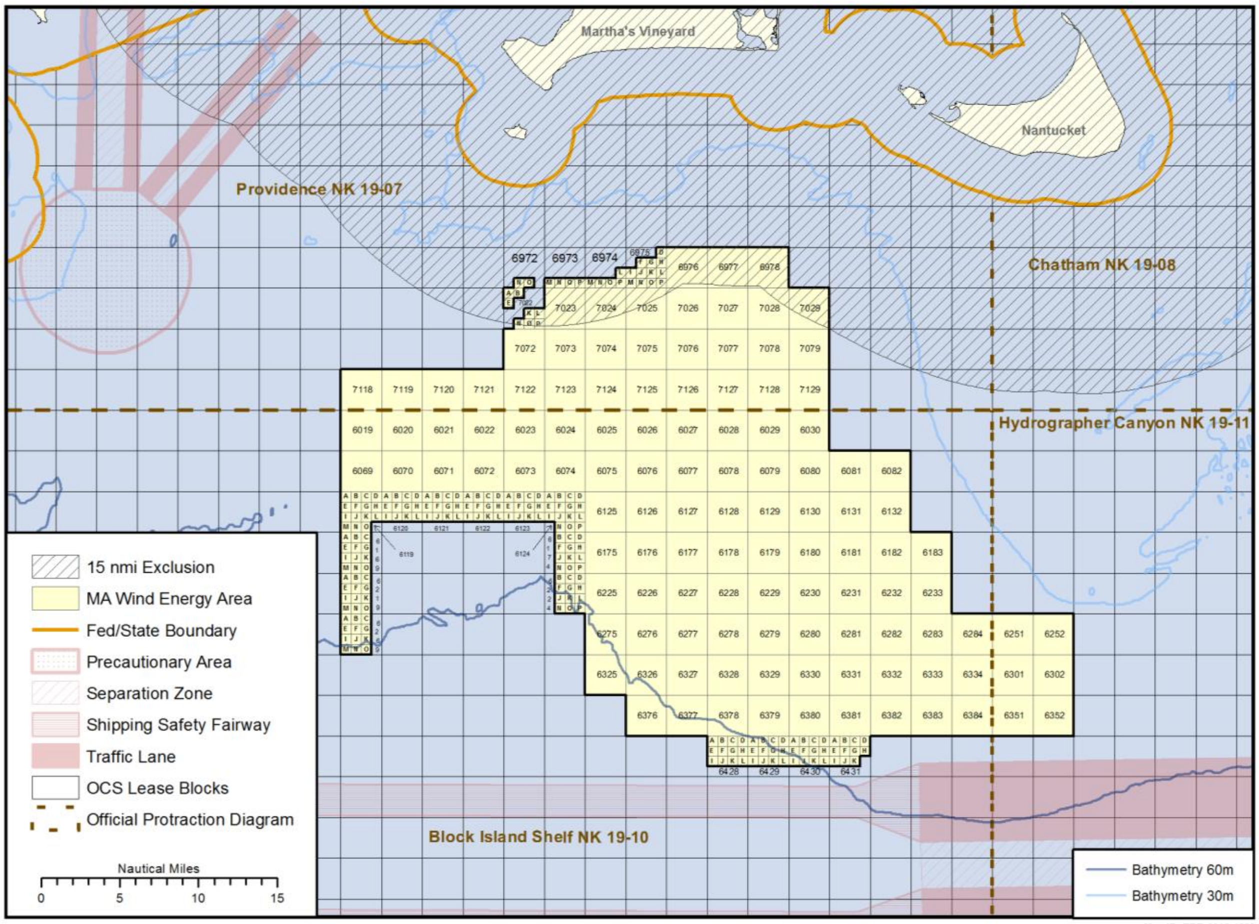



**Figure 2-3. Alternative C lease area**

## 2.4 ALTERNATIVE D – AREAS WITHIN 21 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

Under Alternative D, any OCS blocks within 21 nm of the inhabited coastline are excluded from leasing to reduce possible visual impacts to cultural resources. The Tribal Historic Preservation Officer of the Wampanoag Tribe of Gay Head (Aquinnah) requested a minimum distance of 21 nm from the Massachusetts coastline. The Wampanoag Tribe of Gay Head (Aquinnah) has tribal lands on the west side of Martha's Vineyard that include Gay Head Cliffs, which are designated as a National Natural Landmark by the National Park Service (NPS). An unencumbered view from the cliffs is considered by the Aquinnah to be essential to the sacred nature of the site. The lease area under Alternative D is 709 square nm (600,999 acres; 243,216 hectares) and contains 81 whole OCS blocks and 28 partial OCS blocks. Up to four meteorological towers and eight meteorological buoys are projected for the lease area under this alternative. The impacts of Alternative D on environmental and socioeconomic resources are described in detail in Section 4.2 of this EA. Figure 2-4 below illustrates the lease area under Alternative D.

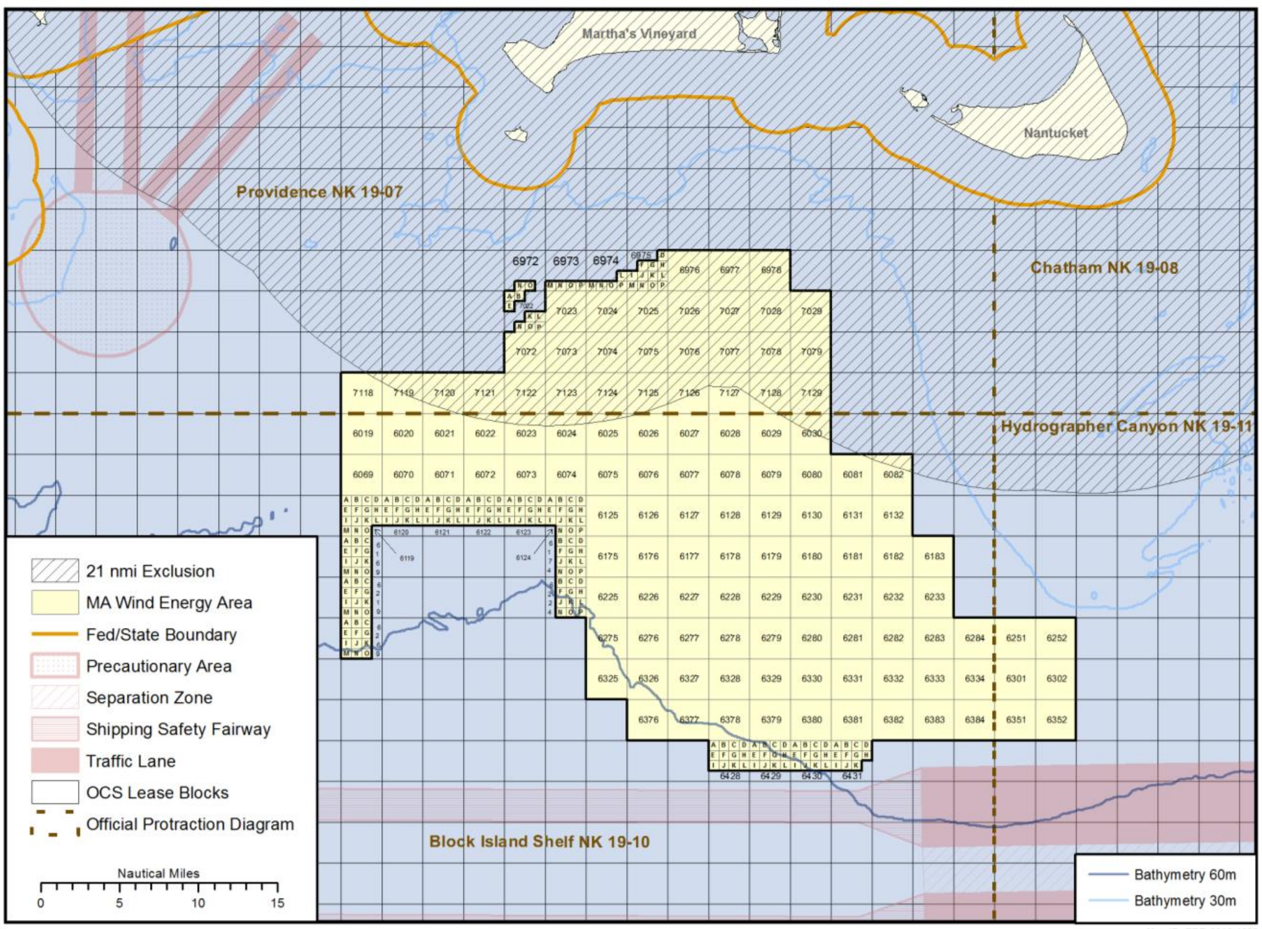



**Figure 2-4. Alternative D lease area**

## 2.5 ALTERNATIVE E – NO ACTION

NEPA requires the analysis of a No Action Alternative. Under the No Action Alternative, no wind energy leases would be issued and no site assessment activities would be approved within the WEA offshore Massachusetts. Although site characterization surveys are not under BOEM's jurisdiction and could still be conducted, these activities would not likely occur without the possibility of a commercial energy lease. The impacts of Alterative E (No Action) on environmental and socioeconomic resources are described in detail in Section 4.5 of this EA.

## 2.6 STANDARD OPERATING CONDITIONS

Under the renewable energy regulations, after the lease is issued, the lessee may not begin construction of meteorological or other site assessment facilities until a SAP and the site characterization survey reports are submitted to and reviewed by BOEM (see 30 CFR 585.605–585.618). The lessee's SAP must contain a description of environmental protection features or measures that the lessee would implement. For offshore cultural resources and biologically sensitive habitats, BOEM's primary mitigation strategy is and will continue to be avoidance. For example, the exact location of meteorological towers and buoys would be adjusted to avoid adverse effects to offshore cultural resources or biologically sensitive habitats, if present.

BOEM has developed several measures called Standard Operating Conditions (SOCs) as part of the proposed action to minimize or eliminate impacts on protected species, including ESA-listed species of whales, sea turtles, fish, and birds (Appendix B). These SOCs were developed through the analyses presented in Section 4.2 and through consultation with other Federal and State agencies.

Additionally, BOEM will continue to analyze and develop SOCs in subsequent NEPA documentation based upon staff recommendations and consultations with the NMFS and the USFWS pursuant to obligations under the ESA, the Magnuson-Stevens Fishery Conservation and Management Act, and public comments. At this time, no fishery or fishery-related SOCs are proposed for the lease issuance and site characterization activity. Development of any additional measures addressing these resources and impacts related to construction and operation of a wind farm will be considered at a future time as part of the COP and not as part of this EA. Additional SOCs will be developed and analyzed after the collection and submittal of site characterization and assessment information. BOEM may add SOCs designed to mitigate the impacts of lease-specific site characterization activities and site assessment activities in the form of lease stipulations and/or conditions of approval of a SAP.

# 3 SCENARIO OF REASONABLY FORESEEABLE ACTIVITY AND IMPACT-PRODUCING FACTORS

To describe the level of activity that could reasonably result from the proposed action and alternatives, BOEM developed the following scenarios for routine activities (Section 3.1 below) and non-routine events (Section 3.2). These scenarios provide the framework for the analyses of potential environmental and socioeconomic impacts of the proposed action (Section 4.2) and alternatives (Sections 4.3–4.6).

## 3.1 ROUTINE ACTIVITIES

This section discusses the reasonably foreseeable leasing scenario, including infrastructure that could be built and the activities that could occur on those leases over the site assessment period. This would include site characterization surveys as well as the construction, operation, and decommissioning of meteorological and oceanographic data collection facilities for site assessment. The routine scenario is intended to be broad enough to cover the range of reasonably foreseeable activities that would take place on a commercial or research wind lease, and structure types and activities that would be authorized under a SAP.

BOEM developed the following scenario based on previous lease applications submitted to BOEM and public comments and expressions of interest received in response to the RFI, Call, and NOI associated with the wind energy development area offshore Massachusetts (Section 1.4.3). Unless otherwise noted, assumptions in this section are based on those previous proposals and expressions of interest.

### 3.1.1 Leasing Scenario

A leasing scenario is necessary to develop a scenario for site characterization and assessment activities. Because there is no historical record to use to develop a leasing scenario for OCS wind energy, BOEM based its leasing scenario assumptions on the offshore wind industry's unsolicited applications for commercial leases, and responses to BOEM's renewable energy planning notices (e.g., RFIs, Call).

In response to BOEM's renewable energy planning notice (the Call) issued for the wind energy development area offshore Massachusetts, the offshore wind industry submitted 10 expressions of commercial wind energy interest. The requested leaseholds ranged from 10 OCS blocks to the entire WEA; therefore, this EA assumes that the whole WEA would be leased. After reviewing the configuration of the OCS blocks within the WEA along with the size and areas that were identified in the expressions of interest, BOEM determined that the average size leasehold would encompass 27 OCS blocks. Therefore, to develop a conservative leasing scenario for the purposes of this EA, the average size of a proposed wind energy lease within the WEA is anticipated to be 27 OCS blocks. Using a lease size equivalent to 27 OCS blocks and a total lease area of 137 OCS blocks (117 whole plus 20 partial blocks), BOEM determined that a maximum of five leases are anticipated under Alternative A.

The timing of lease issuance, weather, and sea conditions would be the primary factors influencing timing of site characterization and site assessment activities. Under the reasonably foreseeable scenario, BOEM would issue all leases in March 2014. The most suitable sea states and weather conditions in the WEA occur from April to August; therefore, meteorological towers and buoys would likely be installed and decommissioned during these months.

Although lessees have 5 years for site characterization activities before a lessee must submit a COP (30 CFR 585.235(a)(2)) the lessee must submit a SAP within 6 months of lease issuance (30 CFR 585.235 (a)(1)). Therefore, site characterization activities required for preparation of the SAP are anticipated to take place in the first 6 months after lease issuance (30 CFR 585.610), between March and September 2014. Remaining site characterization is projected to occur over the 5-year period, from April 2014 through March 2019. Because site assessment activities would need to be approved in the SAP, but completed with enough time to prepare the COP, the majority of site assessment is assumed to take place in years 1 through 3 (2015 through 2018). The COP must be submitted 6 months prior to the expiration of the 5-year term.

### 3.1.2 Port Facilities

Specific ports that would be used by lessees 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 lessees. Existing ports or industrial areas that are likely to be used by lessees in support of the proposed action occur in Massachusetts, Rhode Island, Connecticut, and New York. Because these port facilities are adequate to support proposed action activities, expansion of port facilities to meet lessee needs is not anticipated, and, therefore, only existing facilities that can currently accommodate proposed site characterization and site assessment activities are considered. For this EA, “major” ports include existing sites that have deepwater access (greater than a 15 ft [4.6 m] channel depth) and fabrication yards for the staging, assembly (or partial assembly), and decommissioning of meteorological towers and buoys. Deepwater access at ports is required to accommodate vessels carrying meteorological tower components from port to the WEA. Because vessels used for site characterization work are generally smaller in scale than what is needed for site assessment, and infrastructure requirements for surveying/research equipment are also likely to be smaller than what is needed for site assessment, a list of “minor” ports was also developed for this EA. “Minor” ports are characterized as those that would serve as staging areas and crew/cargo launch sites for the survey vessels, which are anticipated to be approximately 65 to 100 ft (20 to 30 m) in length.

Ten major ports and 21 minor ports are identified (Tables 3-1 and 3-2); however, there is overlap of four ports (Providence, Quonset Point, New London, and Groton) between the lists because these ports could be used by the larger vessels for site assessment and by the smaller research/survey vessels for site characterization. Some of the major ports are not typically used by smaller research-sized vessels and therefore are not included in the minor ports list. There are several marinas and facilities that could be used at most of the minor port locations.

**Table 3-1**

**Major Port Facilities**

| Location | Nearest Lease Block | Approximate Distance[1] to Nearest Lease Block under Alternative A (nautical miles) | Approximate Distance[1] to Mid-Point[2] of Wind Energy Area (OCS Block 6179) (nautical miles) |
|---|---|---|---|
| Boston, MA | 6352 | 215 | 238 |
| Chelsea, MA | 6352 | 215 | 238 |
| Gloucester, MA | 6352 | 215 | 238 |
| New Bedford, MA | 6972M (partial) | 40 | 68 |
| Providence, RI | 7118 | 55 | 85 |
| Quonset Point, RI (Port of Davisville) | 7118 | 45 | 75 |
| New London, CT | 7118 | 60 | 90 |
| Groton, CT | 7118 | 60 | 90 |
| Brooklyn, NY | 6269M (partial) | 170 | 195 |
| Staten Island, NY | 6269M (partial) | 165 | 190 |

[1]Distance was calculated using Traffic Separation Scheme routes and not as the shortest distance between the port facility and the nearest lease block. OCS = Outer Continental Shelf.

[2]To come up with a reasonably foreseeable leasing scenario, it can be assumed that some of the site assessment and characterization would take place in the portion of the WEA closer to shore than the mid-point, and an equally similar amount the activities would take place in the portion of the WEA from the mid-point to the farthest point from shore. Therefore, the mid-point distance was chosen to represent an average of how far vessels would travel to conduct surveys and site assessments within the WEA.

**Table 3-2**

**Minor Port Facilities**

| State | Port Location |
|---|---|
| Massachusetts | Fall River |
| | Falmouth |
| | Fairhaven & New Bedford |
| Rhode Island | Galilee |
| | North Kingstown |
| | Newport |
| | Quonset Point (Port of Davisville) |
| | Providence |
| Connecticut | New Haven |
| | Groton |
| | New London |
| | Westbrook |
| | Clinton |
| | Stonington |
| | Avery Point |
| New York | Montauk |
| | Hampton Bays |
| | Greenport |
| | Islip |
| | Sag Harbor |
| | Orient Point |

### 3.1.3 Site Characterization Surveys

BOEM regulations require that the lessee provide the results of a number of surveys with its SAP and COP, including:

- Shallow hazards (30 CFR 585.610(b)(2) and 30 CFR 585.626(a)(1));
- Geological (30 CFR 585.610(b)(4) and 30 CFR 585.616(a)(2));
- Geotechnical (30 CFR 585.610(b)(1) and 30 CFR 585.626(a)(4));
- Archaeological resource (30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5)); and
- Biological surveys (30 CFR 585.610(b)(5) and 30 CFR 585.626(a)(3)).

BOEM refers to these surveys as "site characterization" activities. It is assumed that the site of a meteorological tower or buoy would be surveyed first to meet the similar data requirements for a lessee's SAP (30 CFR 585.610 and 585.611), and the site of a meteorological tower or buoy would not be resurveyed when the remainder of the leasehold is surveyed to meet the data requirements for a lessee's COP (30 CFR 585.626(a)). Although BOEM does not issue permits or approvals for these site characterization activities, the agency will not consider approving a lessee's SAP or COP if the required survey information is not included. Because an applicant would not likely invest in undertaking these potentially expensive site characterizations prior to acquiring a lease (which would convey the exclusive right to apply for a SAP and a COP), and because the survey information must be submitted to BOEM before any SAP or COP could be approved, this EA treats site characterization activities as actions connected to the issuance of a lease.

As described in the PEIS (MMS, 2007a), high-resolution geophysical (HRG) surveys and sub-bottom sampling would likely be necessary to characterize a site. The HRG surveys would be used to locate shallow hazards, cultural resources, and hard-bottom areas; evaluate installation feasibility; assist in the selection of appropriate foundation system designs; and determine the variability of subsurface sediments. BOEM's GGARCH details the information that would be required to satisfy 30 CFR 585.626(a) (BOEMRE, 2011a). In this guidance, the agency provides descriptions of survey methods that, should lessees follow them, would yield information sufficient to allow the agency to consider approving a COP. For the purposes of this scenario, BOEM assumes that all lessees would employ these methods, or methods substantially similar, to acquire the information required under 30 CFR 585.626(a).

Lessees would only be required to submit survey information for those areas that would be disturbed or otherwise affected by future actions it proposes in a lease area. See GGARCH (BOEMRE, 2011a); see also 30 CFR 585.626. As explained further in this section, different types of site characterization surveys would be necessary to acquire the various types of information required by the regulations. Under BOEM's leasing scenario, surveys with wider line spacing could be conducted for the entire lease area, while surveys for which narrower line spacing is recommended may be limited to the actual area of disturbance. This area of disturbance may or may not be equal to the entire lease area. However, in the absence of any specific proposal for bottom-disturbing activities, this EA assumes that a lessee would survey the entire lease area at the narrower line spacing. This assumption is reasonable because acquiring survey information for the entire lease area would give the lessee the maximum flexibility to propose structures in any area of a lease. For example, if the lessee only surveyed a portion of its lease, then, under 30 CFR 585.610(b), 585.611 (SAP), and 585.626(a) (COP), it could only propose building meteorological towers or buoys or future wind energy facilities in those areas. Should those surveys reveal the presence of cultural resources or critical habitat, development in those areas would be restricted. As a result, the lessee would need to conduct additional surveys on other portions of the lease that were not previously surveyed to find a location suitable for construction. Doing so would incur duplicative mobilization efforts (both financially and in terms of time) associated with the additional surveys and additional reasonably foreseeable environmental effects. Comprehensive lease surveys would be far more efficient, and would allow the lessee the greatest flexibility in determining where on the leasehold to propose renewable-energy-related structures. Comprehensive surveys would also accelerate the timeline for the lessee's proposed activities by eliminating the delay and cost associated with conducting surveys in stages.

Therefore, this EA assumes that the maximum amount of surveys would be conducted over the entire WEA and analyzes the reasonably foreseeable environmental effects associated with maximum surveying. The extent to which lessees survey less than 100 percent of their leasehold area would be the same extent to which the potential environmental effects associated with site characterization activities would be less than the effects analyzed in this EA. Because of the mobilization costs of site characterization surveys, this EA assumes that the site of a meteorological tower or buoy would be surveyed (30 CFR 585.610–585.611) at the same time the leased area is surveyed to meet the similar data requirements for a COP (30 CFR 585.626(a)).

As discussed in Section 3.1.3.1 below, to meet the information requirements of 30 CFR 585.610(b) and 585.626(a), different surveys would need to be conducted at various line spacings. Those survey instruments that would need to be deployed at the wider line spacing would very likely be attached to the same vessel surveying for a different resource at the narrower line spacing. For example, there would be no need to incur the extra time and expense in sending one vessel out to survey the lease area at a 492 ft (150 m) line spacing for one survey, and deploying another vessel to conduct a different survey of the lease area at a 98 ft (30 m) line spacing, when a single vessel could do both simultaneously (BOEMRE, 2011a). As a result, this EA assumes that the lessees would not conduct separate, redundant surveys based on needed line spacing, when the same vessel (or group of vessels) following the smallest line spacing could conduct all of the surveys necessary to acquire all of the relevant data in a single trip.

#### *3.1.3.1 High-resolution Geophysical Surveys*

The lessee must submit the results of site characterization surveys with their SAP (30 CFR 585.610 and 585.611) and COP (30 CFR 585.626(a) and 585.627). Assuming lessees would follow the GGARCH guidelines to meet the geophysical data requirements (30 CFR 585.626(a)), BOEM anticipates that the surveys would entail the following:

- For collecting geophysical data for shallow hazards assessments, magnetometers and side-scan sonar/sub-bottom profilers would be deployed at 492 ft (150 m) line spacing over the lease area;
- For collecting geophysical data for archaeological resources assessments, magnetometers and side-scan sonar/sub-bottom profilers would be flown at 98 ft (30 m) line spacing; and

- For collecting bathymetric charting information, lessees would use a multi-beam echo-sounder. Lessees would also use either a multi-beam technique or side-scan sonar mosaic construction that would adjust for depths encountered and provide both full coverage of the seabed and suitable overlap. Resolution for small discrete targets of 1.5 to 3 ft (0.5 to 1.0 m) in diameter would also be necessary for the identification of potential archaeological resources.

In addition, the geophysical survey grid(s) for proposed transmission cable route(s) to shore would likely include a minimum 984 ft-wide (300 m-wide) corridor centered on the transmission cable location(s) to allow for all anticipated physical disturbances and movement of the proposed location, if necessary. See GGARCH guidelines. Because predicting precisely where a power substation would ultimately be installed on any given lease or the route that any potential future transmission line would take across the seafloor to shore is not yet possible, this EA uses direct lines between the edge of the potential lease areas and the potential interconnection points on shore to approximate the reasonably foreseeable level of surveys that may be conducted to characterize undersea transmission cable routes. BOEM is using five potential grid transmission connection points along the Connecticut, Rhode Island, and Massachusetts shorelines identified by lessees in response to the Call as the reasonably foreseeable locations where undersea cables would connect to the onshore electrical grid. The total length of all five cable routes (from the onshore grid connection point to the edge of the WEA) combined is approximately 150 nm.

The vessel traffic associated with surveying transmission cable routes outside of the WEA has been accounted for in the vessel traffic scenarios associated with the proposed action and alternatives in this EA. Surveying of cable routes within the WEA would be captured during other surveying efforts. Line spacing for surveys associated with transmission cable route surveys would follow the scenario described above.

The possible types of equipment to be used during a HRG survey are summarized below.

*Bathymetry/Depth Sounder:* 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 depths expected in the survey area. This EA assumes the use of multi-beam and/or single-beam bathymetry systems. The use of a multi-beam bathymetry system may be more appropriate for characterizing those lease areas containing complex bathymetric features or sensitive benthic habitats such as hard-bottom areas.

*Magnetometer:* Magnetometer surveys would be used to detect and aid in the identification of ferrous, ferric, or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor, which is anticipated to be no more than approximately 20 ft (6 m) above the seafloor.

*Seafloor Imagery/Side-Scan Sonar:* 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. To meet regulatory requirements as explained in the GGARCH guidelines, BOEM assumes that lessees would use a digital dual-frequency side-scan sonar system with frequencies of 100 and 400 kilohertz (kHz) to record continuous planimetric images of the seafloor.

*Shallow and Medium (Seismic) Penetration Sub-bottom Profilers:* Typically, a high-resolution Compressed High Intensity Radar Pulse (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 is a boomer 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.

Table 3-3 gives a list of typical equipment used in high-resolution site 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 with the assumptions used in the *Final EA for Commercial Wind Lease Issuance and Site Characterization Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia* (BOEM, 2012a). Actual equipment used could have frequencies and/or sound pressure levels (SPL) somewhat below or above those indicated in Table 3-3. This scenario does not assume the use of any air guns that are used for deeply penetrating two-dimensional and three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources.

**Table 3-3**

**Typical High-Resolution Geophysical Survey Equipment**

| Source | Pulse Length | Broadband Source Level (dB re 1 µPa at 1 m) | Operating Frequencies |
|---|---|---|---|
| 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, 2012c

CHIRP = Compressed High Intensity Radar Pulse, µs = microsecond, ms = millisecond, Hz = hertz, kHz = kilohertz, dB re 1 µPa at 1 m = source level, received level measured or estimated 3 ft (1 m) from the source

### *Proposed Action Scenario for HRG Surveys*

This EA assumes that the WEA would be surveyed in its entirety, and geophysical surveys for shallow hazards (142 ft [150 m] line spacing) and archaeological resources (98 ft [30 m] line spacing) would be conducted at the same time on the same vessels conducting sweeps at the narrower line spacing. This results in about 500 nm of HRG surveys per OCS block, not including turns. Therefore, approximately 63,500 nm of HRG surveys would be conducted over the WEA (an average of 250 nm of surveys was used for each of the 20 partial blocks). Assuming a vessel speed of 4.5 knots (Continental Shelf Associates, Inc., 2004), completing 63,500 nm of surveying would take approximately 14,100 hours of vessel time. Assuming a 10-hour work day (not including transit time to/from the WEA), surveying one OCS block would take about 11 days and surveying an average-size lease of 27 OCS blocks would take about 297 days. Assuming one round trip per day, approximately 1,485 round trips (five leases multiplied by 297 days per average-size lease) would be conducted for HRG surveying of the entire WEA.

Because one cable route could be constructed for each individual lease, up to five cable routes are anticipated. Surveying a 984 ft-wide (300 m-wide) corridor along each potential cable route located outside the WEA would result in about 5 nm or 1 hour of surveys per mile of cable. Based on the estimated length of all five cable routes at approximately 150 nm, 750 nm of HRG surveys taking approximately 150 hours would occur to survey the cable routes. Assuming a 10-hour work day and assuming one round trip per day for surveying of the cable routes, 150 hours of surveying would take approximately 15 days (and thus 15 round trips).

To survey the entire WEA and five potential cable routes, HRG surveys would have to be conducted by multiple vessels and/or over multiple years. Using the assumptions described in this section and including surveying of OCS blocks and cable routes, the proposed action would result in a total of approximately 64,250 nm (63,500 nm for within the WEA plus 750 nm outside of the WEA for cable routes) equaling approximately 14,250 hours (594 days) of HRG surveys and 1,500 round trips for survey vessels.

#### *3.1.3.2 Geotechnical Sampling*

A series of site-specific geotechnical sampling methods would be used by lessees to characterize the sub-bottom environment of the WEA. Geotechnical sampling would be used to assess the suitability of shallow sediments to support a structure foundation or transmission cable under any operational and environmental conditions that could potentially be encountered (including extreme events), as well as to document the sediment characteristics necessary for design and installation of all structures and cables. Physical and chemical data on surface sediments is obtained through sub-bottom sampling and, therefore, BOEM is provided with a detailed geotechnical evaluation of the location of potential structure foundation(s) based on the analysis of site-specific samples. The results of the evaluation allow for a thorough investigation of the stratigraphic and geotechnical properties of the sediments that may affect the foundations or anchoring systems of an offshore wind energy project (MMS, 2007a).

The surveying approach most often taken is to simultaneously conduct a series of bottom sampling methods and shallow-bottom coring from a small marine drilling vessel. For sampling sub-bottom sediment, BOEM assumes that one sample would be taken at each meteorological buoy and tower location, each turbine location, and at every nautical mile along cable routes. The following sediment sampling methods may be used to obtain physical and chemical properties of surface sediments.

*Bottom-sampling devices:* Bottom-sampling devices have the ability to penetrate depths ranging from a few centimeters to several meters below the seafloor. 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 corers 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 helps to avoid disturbance of the sediment sample and allows for the best possible sediment sample (MMS, 2007a). Shallow-bottom coring is a method that employs a rotary drill that penetrates through several feet of consolidated rock. None of the above sampling methods uses high-energy sound sources (Continental Shelf Associates, 2004; MMS, 2007a).

*Vibracores:* Vibracores are often used for obtaining samples of unconsolidated sediment or when there are known or suspected archeological and/or cultural resources present that may have been identified through the HRG survey (BOEMRE, 2011a). Vibracores are commonly used because they can retrieve deep samples in most types of undisturbed sediment and can be used to assess bulk physical and chemical properties at and above proposed construction depths. Vibracore samplers typically consist of a core barrel and an oscillating driving mechanism that propels the core 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), with 3-inch (8 centimeter [cm]) diameters are obtained, although some devices have been modified to allow for samples up to 40 ft (12 m) long (MMS, 2007a; USACE, 1987).

*Deep borings:* Deep borings may be used to sample and characterize the geological properties of the sediments at the maximum expected depths of the structure foundations (MMS, 2007a). Deep borings take place on a drill rig on a jack-up barge that is supported by four "spuds" that are lowered to the sea-floor. 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 for marine mammals.

*Cone Penetration Test (CPT)*: CPTs could supplement or be used in place of deep borings (BOEMRE, 2011a). 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 inches (8 cm) in diameter, with connecting rods less than 6 inches (15 cm) in diameter.

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, 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 surface. The WEA is characterized by unconsolidated silt, clay, and sand deposits, so all three sampling methods may be used over the entire area. The bedrock surface in the WEA is hundreds of meters below the seabed (Oldale, 1992).

#### *Proposed Action Scenario for Geotechnical Surveying/Sub-bottom Sampling*

The renewable energy regulations at 30 CFR 585.610(b) (for SAP) and 30 CFR 585.626(a) (for COP) require sediment testing at the proposed site of any proposed bottom-founded structure. The scenario in this EA assumes that one sub-bottom sample may be taken at the proposed location for a meteorological tower or anchoring location for an instrumented buoy. See Section 3.1.4 below for a description of the reasonably foreseeable scenario for the installation of meteorological towers/buoys associated with the proposed action. With regard to potential future

COPs, the number of sub-bottom samples would depend on the number of turbines a lessee ultimately proposes (see 30 CFR 585.626(a)(4). As discussed in the PEIS (MMS, 2007a), spacing between turbines is typically determined on a case-by-case basis to minimize wake effect and is based on the rotor diameter associated with turbine size. In Denmark's offshore applications, for example, a spacing of seven rotor diameters between units has been used (MMS, 2007a). Spacing of six by nine rotor diameters, or six rotor diameters between turbines in a row and nine rotor diameters between rows was approved for the Cape Wind project (MMS, 2009a). Based on this range in spacing for a 3.6 megawatt (MW) (360 ft [110 m] rotor diameter) turbine and a 5 MW (426 ft [130 m] rotor diameter) turbine, placing anywhere from 4 to 20 turbines in one OCS block (3 statute miles by 3 statute miles) would be possible.

The following assumptions result in a total of between 668 and 2,700 geotechnical (seafloor-penetrating) samples taken as a result of the proposed action.

- BOEM assumes a "maximum" scenario of wind development on every OCS block (which is extremely unlikely, but the lower amount of samples associated with less development would result in lower environmental impacts), resulting in a potential of between 508 to 2,540 wind turbines (117 whole OCS blocks in the WEA multiplied by a potential maximum of 20 wind turbines per OCS block plus 20 partial OCS blocks multiplied by an estimated maximum of 10 wind turbines per partial OCS block). Because BOEM assumes that one sub-bottom sample (Vibracore, CPT, and/or deep boring) would be collected at every potential wind turbine location throughout the WEA, a total of up to 2,540 sub-bottom samples may be taken for the wind turbine locations.
- BOEM assumes that a sub-bottom sample would be collected every nautical mile along each of the five projected transmission corridors to shore (see GGARCH guidelines). BOEM estimates approximately 150 total nm of potential cable route would be surveyed, resulting in 150 sub-bottom samples for the cable routes.
- BOEM assumes that a sub-bottom sample would be collected at the foundation of each meteorological tower and/or buoy, resulting in a maximum of 10 sub-bottom samples over the entire WEA (assuming two buoys per leasehold as the maximum scenario).

The amount of effort and vessel trips required to collect the geotechnical samples vary greatly by the type of technology used to retrieve the sample. Vibracore samples would 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 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 boring 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. For all types of sampling, BOEM assumes one sample could be taken per day and that each work day would be associated within one round trip.

#### *3.1.3.3 Biological Surveys*

Under BOEM's regulations, plans (SAP, COP, and General Activities Plans) must describe biological survey information that could be affected by the activities proposed in the plan, or that could affect the activities proposed in the plan. See 30 CFR 585.611(a)(3); 30 CFR 585.626(a)(3); and 30 CFR 585.645(a)(5). Three primary categories of biological resources would need to be characterized using vessel and/or aerial surveys of the lease area: (1) benthic habitats; (2) avian resources; and (3) marine fauna. This EA assumes all vessels and aircraft associated with the proposed action would be required to abide by the standard operating conditions detailed in Appendix B. NMFS may require additional measures from the lessee to comply with the MMPA.

### *Benthic Habitats*

The HRG and geotechnical surveys would help identify sensitive benthic habitat on the leasehold. These surveys would acquire information suggesting the presence or absence of exposed hard bottoms of high, moderate, or low relief; hard bottoms covered by thin, ephemeral sand layers; and algal beds, all of which are key characteristics of sensitive benthic habitat (see Sections 4.2.2.3 and 4.2.2.4). BOEM does not anticipate that lessees would need to conduct separate HRG surveys to delineate benthic habitats that could be affected by potential future leasehold activities. If the HRG survey, or other information, identifies the presence of sensitive benthic habitats on the leasehold, then further investigations would likely be necessary.

### *Avian Resources*

A variety of surveys have provided information on the avian resources in the WEA (Allison et al., 2006; Allison et al., 2009; Menza, et al. 2012; Normandeau Associates Inc., 2011; USFWS, 2012a; Zipkin et al., 2010). To supplement data collected from these studies, the Massachusetts Clean Energy Center (MassCEC) is currently conducting an extensive aerial and boat-based survey effort to provide comprehensive coverage of the entire Massachusetts area under consideration for this EA for all avian resources. The information resulting from the MassCEC survey would be similar to information provided by the New Jersey Department of Environmental Protection's (NJDEP's) *Field Surveys and Marine Resource Characterization for Offshore Wind Energy Planning* study of the area for the New Jersey offshore WEA (NJDEP, 2010a). The NJDEP report produced data on avian distribution and abundance, flight height, and flight direction. Data and a summary report for the MassCEC avian resources study are expected to be available in 2013 (Bolgen, 2012). BOEM may choose not to require additional surveys given the combination of information from the Menza et al. (2012) study and other similar efforts by MassCEC.

If additional 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 area. This survey timeframe is based on the renewable energy regulations at 30 CFR 585.626, which indicate that lessees must document the spatial distribution of avian resources in the areas proposed for development, incorporating both seasonal and interannual variation. Historically, avian data has 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 leasehold, which is standard practice (Thaxter and Burton, 2009). Therefore, the average size leasehold of 27 OCS blocks that BOEM anticipates for this WEA would result in 3 days of boat surveying per lease. 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 result in a maximum of 72 to 108 days of surveys for a single leasehold of 27 OCS blocks.

The Massachusetts WEA was originally defined as comprising all or most of approximately 330 OCS lease blocks and has been subsequently reduced. Because of the speed with which aerial surveys can cover large areas, the entire WEA could potentially be covered in 2 days of aerial surveys (assuming 10 percent subsampling). If aerial surveys occurred on a monthly basis for 2 to 3 years, 48 to 72 aerial survey days would occur. MassCEC is currently using this single effort approach to conduct avian surveys of the entire WEA. If leaseholds are surveyed separately, assuming that five leaseholds represents an upper limit for what could potentially be proposed within the WEA, as many as 120 to 180 days of aerial survey and 360 to 540 days of boat survey could be conducted in the WEA, assuming monthly surveys of each leasehold for 2 to 3 years. The number of boat survey days is not likely to be strongly affected by whether surveys are conducted separately for individual leaseholds or jointly under a single, WEA-wide effort, as boats would generally not be capable of covering much more than 10 to 15 OCS blocks in a single day due to speed constraints. 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, 2010a; 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). These types of surveys would be the best approach for the Massachusetts WEA.

### *Bat Resources*

Bats have been emerging as a potential impact issue for offshore wind energy projects. Migratory behavior is not well understood. Very few surveys have been conducted to investigate bat activity over the ocean, and little information is available on the presence of bats off the coast of Massachusetts. Bats are difficult to survey because of their elusive nocturnal nature. Fortunately, bats use echolocation when orienting through space, and ultrasonic detectors are a cost-effective method for monitoring multiple bat species on a large spatial scale because bat species emit echolocation calls with species-specific characteristics. 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 at least monthly throughout the warm season (approximately March through November) to capture temporal variation in bat activity within the project area. Additionally, to ensure adequate coverage of the project area ship transects, evenly distributed monitoring points should be designated to allow for an examination of spatial variation in bat activity within the WEA.

### *Marine Fauna*

Lessees are required to characterize the marine fauna (i.e., marine mammals, sea turtles, and fish species) occurring within their lease area and include this information in their plan submissions (see 30 CFR Part 585 Subpart F). Lessees may use existing information, if the information meets plan requirements. If biological information is not available, or does not meet plan requirements for specific lease areas, data gaps may need to be filled by survey work. The NMFS North Atlantic Right Whale Sightings Survey Reports provide an important source of information for right whales within the WEA. These annual reports have been produced since 2002 and summarize right whale aerial sightings surveys (NMFS NEFSC, 2012a). Another source of information is the Technical Report Number 10 of the Rhode Island OSAMP titled "Marine Mammals and Sea Turtles in 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" (RICRMC, 2010). The OSAMP report, while mostly targeting Rhode Island waters, also includes information for the "Rhode Island Study Area," which includes the coastal and continental shelf and slope waters from Long Island to Nantucket and outer Cape Cod.

BOEM, the U.S. Department of Energy, and State governments are in the process of collecting biological information in several of the Atlantic WEAs. One source of information on the presence/absence and distribution of many marine mammal and sea turtle species that occur in the Massachusetts WEA is the ongoing study by MassCEC (discussed in this section for avian resources). The MassCEC effort, which BOEM is supporting in Year 2 of the study, will provide data for North Atlantic right whales and other large whale species. The goal of the MassCEC whale surveys is to better understand the spatial and temporal distributions of right whales (and other large whale species, to the extent possible) as well as migratory patterns in the MassCEC study area, which includes the entire WEA. Survey efforts include a combination of passive acoustic monitoring and aerial surveys. Data for sea turtles are also being gathered through this study. Because little is known about basic spatial patterns of sea turtle usage of the WEA, the goal is to provide basic information about when and where sea turtles are within the study area, the relative abundance of various sea turtle species, and how long they may stay in the area (indicators of foraging behavior). The data and a summary report covering North Atlantic right whales, other large whales, and sea turtles are expected to be available in 2013 (Bolgen, 2012). Regional-scale efforts, including the National Oceanic and Atmospheric Administration (NOAA)/BOEM Atlantic Marine Assessment Program for Protected Species, will also aid in site characterization.

With the results of these studies, BOEM anticipates that lessees may not be required to complete additional surveys to document marine mammal or sea turtle resources in the WEA prior to submitting a plan. Independent marine fauna surveys could be undertaken in special circumstances or to address important data gaps. Nonetheless, BOEM anticipates that very little, if any, additional vessel or aerial traffic would be associated with marine fauna surveys within the WEA.

#### *3.1.3.4 Vessel Traffic Associated with Site Characterization*

This EA assumes that vessels associated with site assessment would strongly trend to larger ports, while vessels associated with site characterization activities would use whatever port is convenient. As a result, this EA assumes generally that the total vessel traffic associated with the proposed action would be more or less evenly distributed among several ports in Massachusetts, Rhode Island, Connecticut, and New York. Section 3.1.2 of this EA identifies 21 existing ports that could be used to support site characterization activities. Vessel trips associated with site characterization surveys would add traffic to already heavily used waterways (Section 4.2.3.8 of this EA). Additionally, because vessels would be limited to working only during specific times of the year because of weather conditions, the traffic associated with the proposed action would be concentrated during months with favorable sea state conditions.

Based on the assumptions for all site characterization surveying under the proposed action, BOEM anticipates between 2,588 to 4,800 vessel trips (round trips) to occur over 5 years from April 2014 through March 2019 (Table 3-4). Appendix C contains vessel trip assumptions and calculations associated with site characterization.

**Table 3-4**

**Total Number of Maximum Vessel Trips for Site Characterization Activities**

| Survey Task | Total Round Trips[1] |
|---|---|
| HRG surveys of all OCS blocks within WEA under Alternative A | 1,485 |
| HRG surveys of five cable routes | 15 |
| Geotechnical Sampling | 668–2,700 |
| Avian surveys | 360–540 |
| Fish surveys | 60 |
| Total | 2,588–4,800 |

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

#### *3.1.3.5 Operational Waste*

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. With the exception of ballast water discharges, non-recreational vessels less than 79 ft (24 m) in length and all commercial fishing vessels, regardless of length, are not subject to this permit. Additionally, the Commonwealth of Massachusetts added a provision to the EPA Vessel General Permit that prohibits the discharge of tetrachloroethylene from all maritime operations.

Operational waste generated from all vessels associated with the proposed action includes bilge and ballast waters, trash and debris, and sanitary and domestic wastes. Bilge water is water that collects in the lower part of a ship. The bilge water is often contaminated by oil that leaks from the machinery within the vessel. The discharge of any oil or oily mixtures of greater than 15 parts per million (ppm) into the territorial sea is prohibited under 33 CFR 151.10. However, discharge is not prohibited in waters farther than 12 nm from shore if the oil concentration is less than 100 ppm. As a result, to the extent that bilge water is expelled at sea, BOEM anticipates that the discharge would be more likely to occur beyond 12 nm from shore. Ballast water is used to maintain the 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 to ballast water as to bilge water (33 CFR 151.10). Ballast water may be subject to the USCG Ballast Water Management Program to prevent the spread of aquatic nuisance species (33 CFR Subpart D).

The discharge of trash and debris is prohibited (33 CFR 151.51–77) unless it is passed through a comminutor (a machine that breaks up solids) and can pass through a 25 millimeter mesh screen. All other trash and debris must be returned to shore for proper disposal with municipal and solid waste. BOEM assumes vessel operators would discharge trash and debris only after it has passed through a comminutor and that all other trash and debris would be returned to shore. Vessel operators are expected to abide by the USCG Ballast Water Management Program.

All vessels with toilet facilities must have a Type II or Type III marine sanitation device (MSD) that complies with 40 CFR 140 and 33 CFR 159. A Type II MSD macerates waste solids so that the discharge contains no suspended particles and has a bacteria count below 200 per 100 milliliters. Type III MSDs are holding tanks and are the most common type of MSD found on boats. These systems are designed to retain or treat the waste until it can be disposed of at the proper shoreside facilities. State and local governments regulate domestic or gray water discharges. However, a State may prohibit the discharge of all sewage within any or all of its waters. Massachusetts has several no discharge areas where the discharge of all boat sewage, whether treated or not, is prohibited. See Figure 3-1. Domestic waste consists of all types of wastes generated in the living spaces on board a ship, including gray water that is generated from dishwasher, shower, laundry, bath, and washbasin drains. Graywater from vessels is not regulated outside the State's territory and may be disposed of outside State waters. Graywater should not be processed through the MSD, which is specifically designed to handle sewage. Graywater discharges are not allowed in some State waters; in these restricted areas, graywater would be stored onboard a ship until vessel operators are able to dispose of it at a shoreside facility.


*Source: MA CZM, 2012*

**Figure 3-1. Massachusetts No Discharge Areas**

### 3.1.4 Site Assessment Activities and Data Collection Structures

A SAP describes the activities (e.g., installation of meteorological towers and buoys) a lessee plans to perform for the assessment of the wind resources and ocean conditions of its commercial lease (30 CFR 585.605). No site assessment activities could take place on a lease until BOEM has approved a lessee's SAP (30 CFR 585.600(a)). Once approved, site assessment activities would take place during the site assessment term of a commercial lease period, which is up to 5 years from the date of lease issuance (30 CFR 585.235(a)(2)). This EA assumes that each 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. This information will allow the lessee to determine whether the lease area is suitable for wind energy development, where on the lease area it will propose development, and what form of development to propose in a COP.

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).

#### *3.1.4.1 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 (see Figure 3-2) or a lattice type (similar to a radio tower—see Figure 3-3). 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). Based on the activities described in the Interim Policy EA Offshore Delaware and New Jersey (MMS, 2009b), and other applications received by BOEM for potential offshore leases, the following meteorological tower scenario is anticipated.

Source: Cape Wind Associates, LLC, 2011a

**Figure 3-2. Example of monopole mast meteorological tower**

Source: GL Garrad Hassan, 2012

**Figure 3-3. Photograph of a lattice mast meteorological tower with a monopile foundation**

As of this date, no proposals have been submitted for data collection devices or meteorological towers mounted on a floating platform (spar, semisubmersible, or tension-leg). Because no proposals for these types of floating platforms have been submitted, this EA assumes the use of data collection devices mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases). BOEM anticipates that fixed or pile-supported platforms compared to semi-submersible or tension-leg floating platforms would result in fewer impacts from bottom disturbance and noise because of a smaller footprint. Should BOEM receive an application for a semi-submersible or tension-leg platform, the agency would consider whether such a platform would lead to environmental consequences not considered in this EA.

In the case of fixed platforms, a deck would be supported by a tripod (see Figure 3-2), a single 10 ft (3 m)-diameter monopile (see Figure 3-3), or a steel jacket with three to four 36-inch-diameter (91 cm-diameter) piles (see Figure 3-4). The monopile or piles would be driven anywhere from 25 to 100 ft (8 to 30 m) into the seafloor.

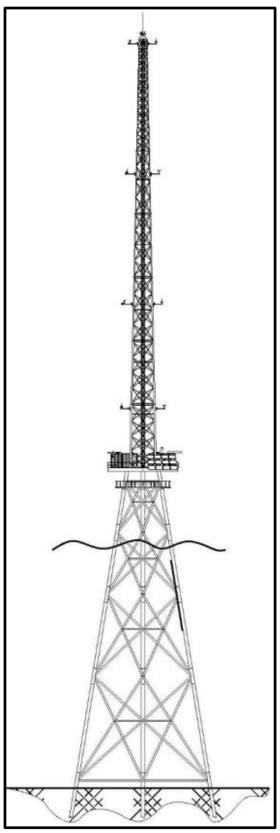


**Figure 3-4(a). Lattic-type mast mounted on a steel jacket foundation**

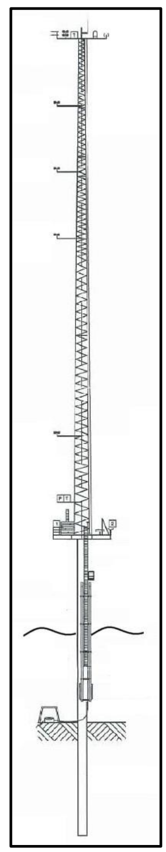


**Figure 3-4(b). Lattice-type mast mounted on a monopile foundation**

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

**Figure 3-4. Example of a lattice-type mast mounted on a steel jacket foundation**

The foundation structure, and a scour control system, if required based on potential seabed scour anticipated at the site, would occupy less than 2 acres. Once installed, the top of a meteorological tower would be 295 to 377 ft (90 to 115 m) above mean sea level. The area of ocean bottom affected by a meteorological tower would range from about 200 square ft (19 square m), if supported by a monopile, to 2,000 square ft (189 square m) if supported by a jacket foundation. 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.

The only meteorological tower currently installed on the OCS is located on Horseshoe Shoal, in Nantucket Sound (shown in Figure 3-2). In 2002, the U.S. Army Corps of Engineers (USACE) prepared an EA for this monopole mast meteorological tower (USACE, 2002). The tower was installed in 2003 and consists of three pilings supporting a single steel pile that supports the deck. The overall height of the structure is 197 ft (60 m) above the mean lower low water datum.

### *Installation*

*Review of the SAP*

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 (30 CFR 585.614(a)). BOEM regulations (30 CFR 585.600–585.618) require that the SAP include the following information:

- A description of the proposed activities, including the technology intended to be used in conducting activities authorized by the lease and all additional surveys the lessee intends to conduct;
- The surface location and water depth for all proposed facilities to be constructed in the leased area;
- General structural and project installation information with proposed schedules;
- A description of the safety, prevention, and environmental protection features or measures that the lessee would use;
- A brief description of how the meteorological tower and other components on the leased area would be removed and the leased area would be restored to original condition;
- Any other information reasonably requested by BOEM to ensure the lessee's activities on the OCS are conducted in a safe and environmentally sound manner; and
- Results of the geophysical and geological surveys, hazards surveys, archaeological surveys, and baseline collection studies (e.g., biological) with supporting data.

The siting of meteorological towers would also be authorized by the USACE, likely under a Nationwide Permit 5 for scientific measurement devices. The USACE is a cooperating agency on this EA (see Section 5.2).

Total installation time for one meteorological tower would take 8 days to 10 weeks depending on the type of structure installed and the weather and sea state conditions (MMS, 2009b). Because of delays caused by weather and sea conditions, acquiring permits, and availability of vessels, workers, and tower components, it is possible that 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, then 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).

*Onshore Activity*

A meteorological tower platform would be constructed or fabricated onshore at an existing fabrication yard. Production operations at fabrication yards would include the cutting, welding, and assembling of steel components. These yards occupy large areas with equipment including lifts and cranes, welding equipment, rolling mills, and sandblasting machinery. The location of these fabrication yards is 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). Thus, platform fabrication yards must be located at deep-draft seaports or along the wider and deeper of the inland channels. Section 3.1.2 identifies 10 major ports in New York, Connecticut, Rhode Island, and Massachusetts that could support the fabrication of meteorological towers.

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).

*Offshore Activity*

During installation, a radius of approximately 1,500 ft (162 acres) 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 (see Table 3-5).

**Table 3-5**

**Projected Vessel Usage and Specifications for the Construction of a Meteorological Tower**

| | Round Trips | Hours on Site | Length in feet (meters) | 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

*Installation of the Foundation Structure and Mast*

A jacket or monopile foundation and deck would be fabricated onshore, then transferred to barge(s) and carried or towed to the offshore site. This equipment would typically be deployed from two barges, one containing the pile-driving equipment and a second containing a small crane, support equipment, and the balance of materials needed to erect the platform deck. These barges would be tended by appropriate tugs and workboats as needed.

The foundation pile(s) for a fixed platform could range from either a single 10 ft-diameter monopile to four 3 ft (1 m)-diameter piles (jacket). These 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. When the pile driving is complete after approximately 3 days, the pile-driver barge would be removed. In its place, 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 approximately 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.

*Scour Control System*

Wave action, tidal circulation, and storm waves interact with sediments on the surface of the OCS, inducing sediment reworking and/or transport. Episodic sediment movement caused by ocean currents and waves can cause erosion or scour around the base of the towers. Erosion caused by scour may undermine meteorological tower structural foundations leading to potential failure, and erosion would also increase turbidity, potentially affecting marine biota. BOEM assumes that scour control systems would be installed, if required based on potential seabed scour anticipated at the site. There are several methods for minimizing scour around piles, such as the placement of rock armoring and mattresses of artificial (polypropylene) seagrass.

A rock armor scour protection system may be used to stabilize a structure's foundation area. Rock armor and filter layer material would be placed on the seabed using a clamshell bucket or a chute. The filter layer helps prevent the loss of underlying sediments and sinking of the rock armor (ESS Group, Inc., 2006a). In water depths greater than 15 ft (5 m), the median stone size would be about 50 pounds with a stone layer thickness of about 3 ft (1 m). The rock armor for a monopole foundation for a wind turbine would occupy an estimated 16,000 square ft (0.37 acres) of the seabed (ESS Group, Inc., 2006a). While the piles of a meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is also estimated to be 16,000 square ft (0.37 acres).

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 water (ESS Group, Inc., 2004). Divers installed artificial seagrass mats around the Cape Wind meteorological tower piles; monitoring of scouring over a 3-year period found that there was a net increase of 12 inches (30 cm) of sand at one pile and at net scour of 7 inches at another pile (Ocean and Coastal Consultants Inc., 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, an estimated four mats each about 16.4 by 8.2 ft (5.0 by 2.5 m) would be placed around each pile. Including the extending sediment bank, a total area of disturbance of about 5,200 to 5,900 square ft (for a three-pile structure and 5,900 to 7,800 square ft (0.13 to 0.18 acres) for a four-pile structure is estimated. For a monopile, an estimated eight mats about 16.4 by 16.4 ft (5.0 m by 5.0 m) would be used, with a total area of disturbance of about 3,700 to 4,000 square ft (0.08 to 0.09 acres).

### *Operation and Maintenance*

Under the proposed action and alternatives, BOEM is considering the operation of a meteorological tower to assess wind resource potential during the site assessment term of a lease. A lessee must submit a COP at least 6 months before the end of the site assessment term of the lease if the lessee intends to continue its commercial lease (30 CFR 585.618(c)). If the COP describes continued use of existing facilities, such as a meteorological tower or buoy approved in the SAP, the lessee may keep such facilities in place on its lease during the time that BOEM reviews the COP for approval (30 CFR 585.618(a)), which may take up to 2 years. If, following the technical and environmental review of the submitted COP, BOEM determines that such facilities may not remain in place throughout the lease, the lessee must initiate the decommissioning process (30 CFR 585.618(c)). Depending on how long it takes to install a meteorological tower, and depending on whether the lessee submits a COP (or the lease expires) and/or how long subsequent COP approval would take, 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 the commercial term of a lease or require that it be decommissioned immediately.

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, lessees with towers powered by solar panels or small wind turbines would conduct monthly or quarterly vessel trips for operation and maintenance activity over the 5-year life of a meteorological tower (MMS, 2009b). However, if a diesel generator is used to power the meteorological tower's lighting and equipment, a maintenance vessel would make a trip at least once every other week, if not weekly, to provide fuel, change oil, and perform maintenance on the generator. Depending on the frequency of the trips, support for all of the meteorological towers in the WEA would result in a maximum of 1,300 round trips (52 weeks per year times 5 towers times 5 years). No additional or expansion of onshore facilities would be required to conduct these tasks. BOEM projects that crew boats 51 to 57 ft (16 to 17 m) in length with 400- to 1,000-horsepower engines and 1,800-gallon fuel capacity 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*

All meteorological towers and buoys, regardless of height, would have lighting and marking for navigational purposes. Meteorological towers and buoys would be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66. A Private Aid to Navigation is a buoy, light, or day beacon owned and maintained by any individual or organization other than the USCG. These aids are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation.

If meteorological towers are taller than 199 ft (61 m) and within 12 nm 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 77.13). 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. Currently, there are no specific FAA regulations or guidance on lighting and marking of ocean-based towers less than 200 ft (61 m) tall (Edgett-Baron, personal communication, 2012).

*Other Uses*

The meteorological tower and platform could also be used to gather other information in addition to meteorological information, such as data regarding birds, bats, and marine mammals in the lease area. Information on other equipment that could be installed on meteorological towers is included in Section 3.1.4.3 of this EA.

### *Decommissioning*

At the latest, within 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 Part 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 of a meteorological tower would take 1 week or less. Decommissioning activities would begin with the removal of all meteorological instrumentation from the tower, typically 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 and loaded on the transport barge. The same number of vessels necessary for installation would likely be required for decommissioning. The sea bottom area 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 at least 16 ft (5 m) below the mudline to ensure that nothing would be exposed that could interfere with future lessees and other activities in the area (30 CFR 585.910(a)). Which severing tool the operators use depends on the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions (MMS, 2005). Because of the type and size, piles of meteorological towers in the WEA would be removed using non-explosive severing methods.

Common non-explosive severing tools that may 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 on to 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).

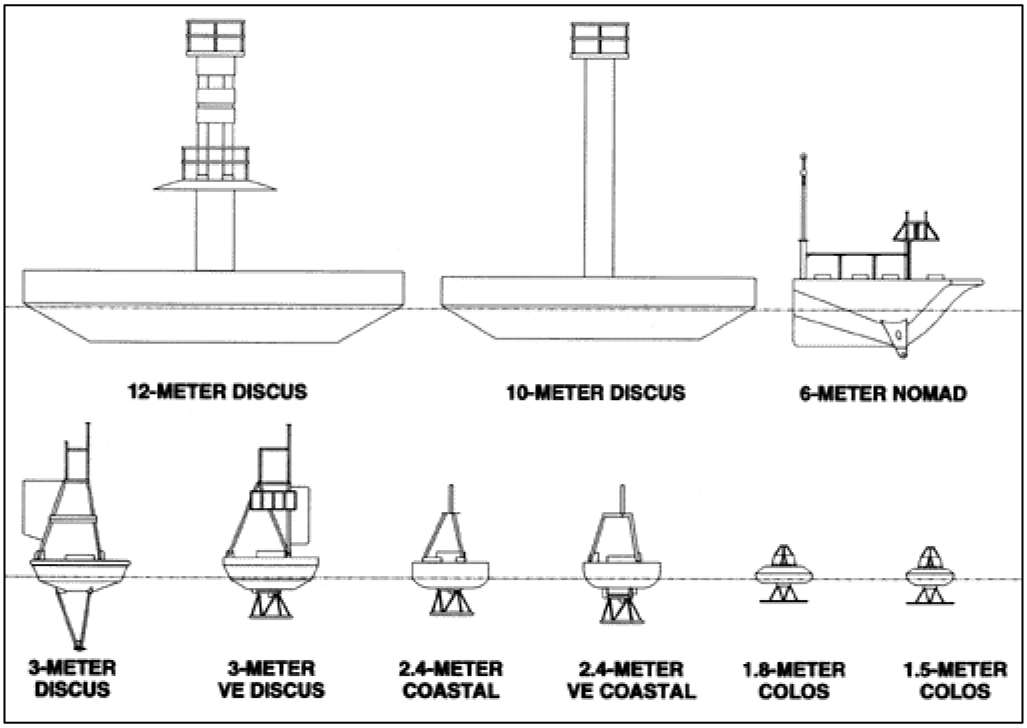
*Disposal*

Unless portions of the meteorological tower would be approved for use as artificial reefs, 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 law. Additionally, 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 hard bottom. 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 Massachusetts Division of Marine Fisheries (DMF) manages Massachusetts' 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.

#### *3.1.4.2 Meteorological Buoy and Anchor System*

Although a meteorological tower has been the traditional device for characterizing wind conditions, lessees could install one to two meteorological buoys per lease instead. Meteorological buoys can be used as an alternative to a meteorological tower in the offshore environment for meteorological resource data collection (i.e., wind, wave, and current). This EA assumes that, should a lessee choose to employ buoys instead of meteorological towers, it would install a maximum of two buoys per lease. These meteorological buoys would be anchored at fixed locations and regularly collect observations from many different atmospheric and oceanographic sensors.

A meteorological buoy can vary in height, hull type, and anchoring method. NOAA has successfully used discus-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 3-5).




*Source: National Data Buoy Center, 2008*

**Figure 3-5. Buoy schematic**

The choice of hull type used usually depends on its intended deployment location and measurement requirements. To assure 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).

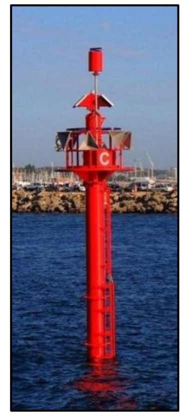
Discus-shaped, boat-shaped and spar buoys (Figure 3-6) are the buoy types that would most likely be adapted for offshore wind data collection. A large discus-shaped hull buoy has a circular hull range between 33 and 40 ft (10 and 12 m) in diameter, and is designed for many years of service (National Data Buoy Center, 2006). The boat-shaped hull buoy is an aluminumhulled, boat-shaped buoy that provides long-term survivability in severe seas (National Data Buoy Center, 2006).

Source: National Data Buoy Center, 2006

**Figure 3-6(a). 10-meter discus-shaped hull buoy**

Source: National Data Buoy Center, 2006

**Figure 3-6(b). 6-meter boat-shaped hull buoy**



Source: Australian Maritime Systems, 2012

**Figure 3-6(c). Spar buoy**

**Figure 3-6. Example of buoy types**

A buoy's specific mooring design is based on hull type, location, and water depth (National Data Buoy Center, 2006). 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 over 10 years (National Data Buoy Center, 2006). 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 has been proposed for one spar-type buoy (TetraTech EC, Inc., 2012).

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 also be installed on or tethered to a meteorological tower to monitor oceanographic parameters and to collect baseline information on the presence of certain marine life.

### *Installation*

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, 2006). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 8,000 pounds with a footprint of about 6 square ft (0.5 square m) and an anchor sweep of about 370,260 square ft (8.5 acres). After installation, the transport vessel would remain in the area for several hours while technicians configure proper operation of all systems. Buoys would typically take 1 day to install. Transport and installation vessel anchoring for 1 day is anticipated for these types of buoys (Fishermen's Energy, 2011).

Based on the Garden State Offshore Energy (GSOE) proposal offshore New Jersey, a spar-type buoy would be towed to the installation location by a transport vessel after assembly at a land-based facility. Deployment would occur in two phases: deployment of a clump anchor to the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately 1 day and would include placement of the clump anchor on a barge and transporting it to the installation site. In this example, a rectangular clump weight anchor is 22 ft x 22 ft x 3 ft (6.7 m x 6.7 m x 1 m) in size and weighs approximately 100 tons, with a bottom footprint area of 484 square ft (45 square m). Phase 2 would include towing the spar buoy to the site, deployment, and connection to the clump anchor (Tetra Tech EC, Inc., 2010). Once at the final location site, the buoy would be positioned vertically in the water column with a height from mean sea level to main deck of 36 ft and a highest mast point of approximately 52 ft. The buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation would take approximately 2 days. The bottom disturbance associated with buoy and vessel anchors would measure 28 ft x 28 ft (8.5 m x 8.5 m), with a total area of 784 square ft (73 square m). The maximum area of disturbance to benthic sediments occurs during anchor deployment and removal (e.g., sediment resettlement, sediment extrusion) for this type of buoy.

*Onshore Activity*

Onshore activity (fabrication, staging, and 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 3.1.2 of this document for information pertaining to existing ports or industrial areas that would be used for meteorological buoys. No expansion of existing facilities would be necessary for the same reasons provided in the onshore activity section for meteorological towers, above.

### *Operation and Maintenance*

Monitoring information that would be 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. Also, all data gathered via sensors would be fed to an on-board radio system that transmits the data string to a receiver on shore (Tetra Tech EC, Inc., 2010). Onsite inspections and preventative maintenance (i.e., marine fouling, wear, and lens cleaning) are expected to occur on a monthly or quarterly basis. Periodic inspections for specialized components (i.e., buoy, hull, anchor chain, and 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 would restrict the equipment that could be placed on a buoy, BOEM anticipates that this equipment would be powered by small solar panels or wind turbines instead of diesel generators. Weekly or bi-weekly vessel trips, which would be necessary for refueling generators on meteorological towers, are not projected for any of the anticipated buoys.

### *Decommissioning*

Decommissioning is basically the reverse of the installation process. Equipment recovery would be performed with support of a vessel(s) equivalent in size and capability to those used for installation (see section on installation 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 the 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 disposed of as scrap iron for recycling (Fishermen's Energy, 2011).

#### *3.1.4.3 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, Light Detection and Ranging (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. 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 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 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 tall (0.3 to 0.6 m) 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 for marine mammals, data logging computers, power supplies, visibility sensors, water measurements (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

#### *3.1.4.4 Vessel Traffic Associated with Site Assessment*

Vessel trips would be associated with all phases of site assessment (installation, decommissioning, and routine maintenance). As explained in Section 3.1.2, there are 10 major ports in the region that are likely to be used to support site assessment activities for the proposed action. The site assessment trips would add vessel traffic in already heavily used waterways (see Section 4.2.3.8).

Based on previous site assessment proposals submitted to BOEM, up to about 40 round trips by various vessels are expected during construction of each meteorological tower (see Table 3-5). Should each potential lessee decide to install a meteorological tower on its leasehold, a total of 200 round trips are estimated for construction (40 trips per tower multiplied by 5 towers [see Table 3-6]). These vessel trips may be spread over multiple construction seasons as a result of the various times at which lessees acquire their leases, 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. 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 200 round trips are estimated for decommissioning of towers.

Meteorological buoys would typically take 1 to 2 days to install by one vessel, and 1 to 2 days to decommission for one vessel.

**Table 3-6**

**Projected Maximum Vessel Trips for Site Assessment Activities**

| Site Assessment Activity | Round Trips | Formula |
|---|---|---|
| **Meteorological Buoys** | | |
| Meteorological Buoy Installation | 10–20 | 1–2 round trip x 10 buoys |
| Meteorological Buoy Quarterly–Monthly Maintenance Trips | 200–600 | 4 quarters x 10 buoys x 5 years – 12 months x 10 buoys x 5 years |
| Meteorological Buoy Decommission | 10–20 | 1–2 round trip x 10 buoys |
| *Total Buoy Trips Over 5-Year Period* | *220–640* | |
| **Meteorological Towers** | | |
| Meteorological Tower Construction | 200 | 40 round trips x 5 towers |
| Meteorological Tower Quarterly–Weekly Maintenance Trips[1] | 100–1,300 | 4 quarters x 5 towers x 5 years – 52 weeks x 5 towers x 5 years |
| Meteorological Tower Decommission | 200 | 40 round trips x 5 towers |
| *Total Tower Trips Over 5-Year Period* | *500–1,700* | |

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

Maintenance trips to each meteorological tower may occur weekly to quarterly, 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 towers and monthly trips for buoys over the entire 5-year period (see Table 3-6).

The total vessel traffic estimated as a result of the installation, decommissioning, and routine maintenance of the meteorological towers/buoys that could be anticipated in connection with the proposed action is anticipated to be between 220 and 1,700 round trips over a 5-year period (Table 3-6).

## 3.2 NON-ROUTINE EVENTS

Chapter 5.2.24 of the PEIS discusses in detail potential non-routine events and hazards that could occur during data collection activities. The primary events and hazards are: (1) severe storms such as hurricanes and extratropical cyclones; (2) collisions between the structure or associated vessels with other marine vessels or marine life; and (3) spills from collisions or during generator refueling. These events and hazards are summarized below.

### 3.2.1 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.

Data collected between 1982 and 2008 from a National Data Buoy Center buoy located southeast of Nantucket, MA, (Buoy 44008) show average wind speeds are typically lowest in June and July at approximately 8 to 9 knots, and highest in December and January at approximately 15 to 16 knots (National Data Buoy Center, 2010a). Peak winds over the period of record (1988–2008) were recorded in the month of December at 82 knots at Buoy 44008 (National Data Buoy Center, 2010b). The highest winds are associated with tropical cyclones (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. The Atlantic basin averages about 11 storms of tropical storm strength or greater per year; about half reach hurricane level and two and a half become major hurricanes (Category 3 or higher) (NOAA, 2012a). Historically, hurricane threats exist in the region of the WEA. From 1851 to 2010, a reported 11 hurricanes struck the Massachusetts coast and 9 hurricanes struck the Rhode Island coastline, 3 and 4 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 of various locations along the U.S. coast. In the region of the WEA, the return period for such an event is listed as 13 years, while the return period for a major (Category 3 or greater) hurricane, in the same location, is 62 years.

### 3.2.2 Allisions and Collisions

A meteorological tower or buoy located 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. When 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 and experience accidental capsizing or result in a diesel spill.

Vessel collisions and allisions are less likely to happen because vessel traffic is controlled by multiple routing measures, such as safety fairways, TSSs, and anchorages. These higher traffic areas were excluded from the WEA. 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 low visibility. Risk of allisions with meteorological towers and buoys for both vessels and aviation would be further reduced by USCG-required marking and lighting.

Historical data supports that the number of potential allisions and collisions resulting in major damage to property and equipment would be small. Major damage is defined as greater than $25,000 worth of damage. Allision and collision incident data were reviewed for the years 1996 through 2010 (BOEMRE, 2011c) for the Gulf of Mexico and Pacific regions, which contain many fixed structures on the OCS like the meteorological facilities that would be installed in the WEA. Operations and maintenance activities on the meteorological facilities in the WEA would be similar to what is needed for fixed structures in the Gulf of Mexico and Pacific regions. Over a 15-year period with over 4,000 structures installed at any one time, 197 allisions and collision were reported in the Gulf of Mexico or Pacific regions; this number includes reports of all major damages and some, but not all minor damages (less than $25,000 in damages). 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.

### 3.2.3 Spills

A diesel spill could occur as a result of collisions, accidents, or natural events. If a vessel collision occurs and if the collision leads to major hull damage, a diesel spill could occur. The amount of diesel fuel that could be released by a marine vessel involved in a collision would depend on the type of vessel and severity of the collision. From 2000 to 2009, the average spill size for vessels other than tank ships and tank barges was 88 gallons (USCG, 2011), and, should the proposed action result in a spill in any given area, BOEM anticipates that the average volume would be the same.

Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills. Most equipment on the meteorological towers and buoys would be powered by batteries charged by small wind turbines and solar panels. However, diesel generators may be used on some of the anticipated meteorological towers. Minor diesel fuel spills may also occur during refueling of generators.

Impacts would depend greatly on the material spilled (diesel fuel in the related vessel and infrastructure types), the size and location of a spill, the meteorological conditions at the time of the spill, and the speed with which cleanup plans and equipment could be employed. Diesel fuel is a refined petroleum product that is lighter than water. It may float on the water's surface or be dispersed into the water column by waves. Diesel is a distillate of crude oil and does not contain the heavier components that contribute to crude oil’s longer persistence in the environment. If a diesel spill were to occur, it would be expected to dissipate very rapidly and would then evaporate and biodegrade within a few days (MMS, 2007b). A lessee would be required to submit an Oil Spill Response Plan with their SAP and COP that describes their emergency response action plan, worst-case discharge scenario, and training and drills for responders under 30 CFR 254.

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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).

### 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 ALTERNATIVE A – THE PROPOSED ACTION

### 4.2.1 Physical Resources

#### *4.2.1.1 Air Quality*

##### *4.2.1.1.1 Description of the Affected Environment*

Since potential impacts on air quality associated with the proposed action could come from vessel traffic from the ports discussed in section 3.1.2, the affected environment includes coastal areas in Massachusetts, Rhode Island, Connecticut, and New York; State and Federal waters between the coastal areas and the MA WEA; and the MA WEA itself (Figure 4-1).

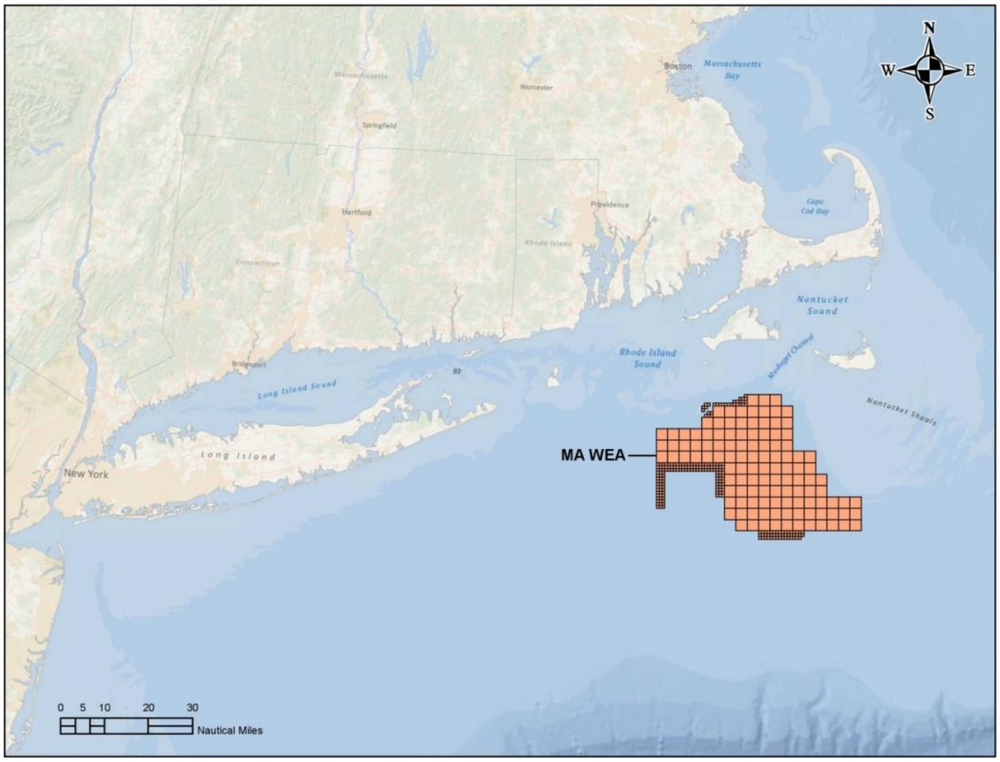



**Figure 4-1. Location of Massachusetts WEA in relation to coastal areas**

There were approximately 27,800 vessel trips into and out of 7[1] of the 10 major ports identified in Section 3.1.2 during 2009 (no data were available for 3 of the 10 ports) (USACE, 2009). The Boston, MA, and New London, CT, ports each had over 10,000 annual trips (11,267 and 10,426 respectively), Chelsea, New Bedford, and Providence each had between 1,200 to 2,600 annual trips, and the remaining two ports, Gloucester and Brooklyn had 85 and 68 trips, respectively. Most of the ports and harbors in these coastal counties are heavily developed metropolitan and industrial areas and have historically been host to large volumes of rail, vessel, and air traffic, all of which emit air pollutants.

Alternative A is projected to result in approximately 1,300 annual round trips under the proposed action leasing scenario. This includes a maximum of 4,800 trips for site characterization plus a maximum of 1,700 trips for site assessment over the 5 lease years. The 1,300 trips could be divided among the 10 major and 21 minor ports listed in Section 3.1.2., but based on the USACE (2009) data and distances to the WEA, would likely be concentrated at New London and Providence.

[1] The seven ports with USACE (2009) vessel trip data include Boston, Chelsea, Gloucester, New Bedford, Providence, New London, and Brooklyn. No data were available for Quonset Point (Ports of Davisville), Groton, and Staten Island.

The Clean Air Act (CAA) of 1970 and its amendments, requires EPA to establish National Ambient Air Quality Standards (NAAQS) for ambient air pollutants considered harmful to public health and the environment (i.e., criteria pollutants). The CAA established two types of NAAQS: primary and secondary standards to protect public health and public welfare, respectively (40 CFR Part 50). NAAQS have been established for the following criteria pollutants: ozone ($O_3$), carbon monoxide (CO), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), lead (Pb), and two types of particulate matter ($PM_{10}$ is coarse particulate matter [10 micrometers or less in diameter] and $PM_{2.5}$ is fine particulate matter [2.5 micrometers or less in diameter]). Ground level $O_3$ results from a chemical reaction of sunlight, volatile organic compounds (VOCs), and nitrogen oxide ($NO_x$), which are ozone precursors, while $SO_2$ is a precursor for $PM_{2.5}$. The standards are expressed as a concentration in air and duration of (often both short and long term) exposure. As with all aspects of environmental regulations, States have the authority to adopt stricter standards.

The EPA air quality standards for ozone are 0.12 ppm (1-hour average) and 0.075 ppm (8-hour average in effect since March 2008), for $PM_{2.5}$ are 15 micrograms per cubic meter ($\mu g/m^3$) (annual average) and 35 $\mu g/m^3$ (24-hour average), and for $PM_{10}$ is 150 $\mu g/m^3$ (24-hours average). All of the counties that may be affected by emissions associated with Alternative A meet the NAAQS for $NO_2$, $SO_2$, CO, and Pb (EPA, 2012). However, based on ambient air monitoring data, other NAAQS are not met for the counties containing Atlantic port cities (Table 4-1) due to indigenous source pollution and intra-State transport of pollutants.

**Table 4-1**

**Total Number of Atlantic Coastal Counties in Nonattainment of Each Criteria Pollutant per State**

| Criteria Pollutant | Massachusetts | Rhode Island | Connecticut | New York |
|---|---|---|---|---|
| 8-hour $O_3$ | 8 | 5 | 4 | 8 |
| $PM_{10}$ | - | - | - | 1 |
| $PM_{2.5}$[1] | - | - | 2 | 8 |

[1]$PM_{2.5}$ (2006 standard)

Source: EPA, 2012

All eight coastal counties in Massachusetts (Essex, Suffolk, Norfolk, Plymouth, Barnstable, Nantucket, Dukes, and Bristol) are classified as moderate nonattainment for 8-hour ozone. Similarly, all five coastal counties in Rhode Island (Providence, Bristol, Kent, Newport, and Washington) and four coastal counties in Connecticut (New London, Middlesex, New Haven, and Fairfield) are moderate nonattainment for 8-hour ozone. The eight Atlantic coastal counties in New York (Westchester, Bronx, Suffolk, Nassau, Queens, Kings, Richmond, and New York) are also moderate nonattainment for 8-hour ozone. While all of the coastal counties in Massachusetts and Rhode Island are in attainment for $PM_{2.5}$, two coastal counties in Connecticut

(New Haven and Fairfield) and all eight Atlantic coastal counties in New York were nonattainment for $PM_{2.5}$. New York County was the only coastal county of the four States in question that was moderate nonattainment for $PM_{10}$.

The General Conformity Rule (40 CFR Parts 51 and 93) requires that Federal actions planned to occur in a nonattainment or maintenance area are reviewed prior to their implementation to ensure that the actions will not interfere with that State's plans to meet the NAAQS, as outlined in the federally approved State Implementation Plan. The Federal agency is required to demonstrate that their action conforms to the approved State Implementation Plan for their geographic area by performing a conformity applicability analysis. The emissions considered must be the total direct and indirect emissions, such as from the transportation of materials, equipment, and personnel, onshore and offshore (within 25 nm of the State's seaward boundary), covering the construction, decommissioning, and operational phase of the action. If, after evaluation and documentation, the total air emissions associated with the action are considered neither exempt nor below the *de minimis* levels (i.e., minimum thresholds for which a conformity determination must be performed for various criteria pollutants in various non-attainment areas) as specified in 40 CFR 93.153, then a conformity determination is required (see Table 4-2).

**Table 4-2**

**Applicable General Conformity *De Minimis* Levels**

| Pollutants of Concern (tons per year) | | | | |
|---|---|---|---|---|
| $NO_x$[1] | VOC[1] | $PM_{10}$[2] | $PM_{2.5}$ | $SO_x$ |
| 100 | 50 | 100 | 100 | 100 |

Source: 40 CFR 93.153(b)(1)

[1]Other ozone NAAQS inside an ozone transport region.
[2]Moderate non-attainment area

In addition, EPA has designated the region extending from Northern Virginia to New England as an ozone transport region, whereby EPA has established more restrictive *de minimis* emissions levels for areas in the ozone transport region. Since vessels supporting site characterization and assessment activities travel through State waters, a conformity determination would be required if total actual emissions for the Federal action exceed 100 tons of $NO_x$ or 50 tons of VOCs.

For the purposes of NEPA evaluation, the Federal action being evaluated is the issuance of leases in the WEA as well as the associated reasonably foreseeable activities, as described in Chapter 2. For the purposes of complying with the General Conformity Rule under the Clean Air Act, however, project specific emissions information is required. This information would not be available until an individual lessee submits a SAP. Therefore, General Conformity Rule evaluations would occur at the SAP stage.

### Regional Haze and Visibility

Regional haze (reduced visibility) occurs when fine particles scatter and absorb light in the atmosphere, which limits how far people can see, and obscures color and clarity of their view. The Mid-Atlantic/Northeast Visibility Union is one of five regional planning organizations made up of numerous States (including Massachusetts), Federal agencies and several Tribes, to coordinate reducing visibility impairment in major national parks and wilderness areas in the Northeast and Mid-Atlantic region. Section 169A of the CAA requires that air quality-related values including visibility be protected in Class I Areas, which are federally owned lands where very little air quality degradation is allowed. There are no Class I areas that could be affected within 62 miles (100 kilometers [km]) of the WEA.

### Regulatory Controls on OCS Activities That Affect Air Quality

Section 328 of the Clean Air Act Amendments of 1990 directs EPA to promulgate regulations for OCS sources that may affect the air quality of any State (42 U.S.C. 7627). The regulations are found in 40 CFR Part 55, which provides EPA with the authority to regulate the air emissions associated with "OCS sources." OCS sources would include meteorological towers, any vessels for the purposes of constructing, servicing, or decommissioning them, and seafloor boring. Under the EPA rules, for all OCS sources located within 25 nm of States' seaward boundaries, the requirements are the same as would be otherwise applicable if the source were located in the corresponding onshore area (40 CFR 55.3). In the States potentially affected by Alternative A, the State seaward boundaries extend three nm from the coastline.

Section 328 also establishes a unique treatment for vessels associated with OCS facilities. 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 facilities as direct emissions from the OCS source when those vessels are at the source, en route to or from the source as long as they are within 25 nm of the source (40 CFR 55.2).

#### 4.2.1.1.2 Impact Analysis of Alternative A

### Routine Activities

Potential emission sources associated with routine activities under Alternative A would be from a variety of different types and sizes of vessels, equipment used in the assembly of the meteorological towers (both onshore and offshore), and diesel generators to power equipment on the towers. The vessel traffic associated site characterization surveys and site assessment activities under Alternative A would occur simultaneously with other navigation/vessel traffic that frequent the same waters and airways.

*Emissions of Criteria Pollutants*

Emissions of criteria air pollutants from the site characterization surveys and site assessment activities were calculated to estimate the reasonably foreseeable scenario for emissions in any given year of the 5-year period. These assumptions are conservative in nature and included construction of all five meteorological towers in the same year, the use of boats instead of aircraft for the avian surveys, and roundtrip mileage of vessels from a representative port to the mid-point of the WEA. Emissions were estimated for site characterization surveys and site assessment activities, using approved emission factors and conservative assumptions. All calculations, along with the assumptions used to complete the calculations, are provided in Appendix D.

*Site Characterization Surveys*

Criteria pollutant emissions would be produced as result of survey vessels traveling to and from the WEA and conducting surveys within the WEA. The average distance that the survey vessels would travel from port to the WEA was calculated using the maximum value from the range of distances of the five most reasonably expected major ports that would be used for surveying, which is estimated to be 75-90 nm. Therefore, a round trip from port to the middle of the WEA would be 180 nm. For the purposes of calculations, it was assumed that vessels travelled an average speed of 12 knots/hour. Because NAAQS are evaluated on an annual basis, total roundtrip travel was divided equally over the 5-year period (Table 4-3).

**Table 4-3**

**Emissions Associated with Site Characterization for Pollutants of Concern (Tons Per Year) in a Single Year**

| **Activity** | **$NO_x$** | **VOCs** | **$PM_{10}$** | **$PM_{2.5}$** | **$SO_x$** |
|---|---|---|---|---|---|
| Site Characterization Survey | 116 | 4 | 6 | 6 | 11 |

*Construction and Decommissioning of Meteorological Towers*

Because BOEM anticipates that lessees would either construct one tower or two buoys on their leasehold, and the number of vessel trips associated with deployment, operation, and decommissioning of buoys is smaller than the vessel trips associated with construction, maintenance, and decommissioning of the meteorological towers (see Section 3.1.4.4), emissions calculations were based solely on construction, maintenance, and decommissioning of the meteorological towers.

BOEM anticipates that meteorological tower platforms would be partially fabricated onshore at an existing fabrication yard and construction would be completed in the WEA. Typical production operations at fabrication yards include cutting, welding, and assembling steel components. These yards occupy extensive areas with equipment that includes lifts and cranes, rolling mills, welding equipment, and sandblasting machinery. The impacts of miscellaneous activities onshore would be considered negligible because of the temporary duration compared to the existing industrial activities/production operations already occurring at the fabrication yards.

Vessels would be used to transport the meteorological towers to their locations within the WEA. Vessel emission calculations were based upon an estimate of 39 roundtrips and the vessel specifications (e.g., engine horsepower) shown in Table 3-5 in Section 3.1.4.1.

*Operation of Meteorological Towers*

BOEM assumes that the meteorological towers in the WEA would be operating concurrently over a 5-year period. The majority of equipment on the meteorological data collection facilities would be powered by batteries charged by small wind turbines or solar panels. However, a diesel generator may be used on some meteorological towers. While turbines and solar panels would not produce any emissions, a diesel generator would emit criteria pollutant emissions. Generator emissions are estimated at approximately 14 tons of $NO_x$ per tower (Appendix D). Assuming three meteorological towers would use generators, total operational emissions would be approximately 42 tons of $NO_x$. Support vessels traveling to and from shore for operation and maintenance of the meteorological towers are anticipated to make a weekly maintenance trip to each tower, resulting in approximately 260 round trips in a year (52 weeks multiplied by 5 towers visited each week). Table 4-4 shows estimated emissions from site assessment in a single year during the 5-year period.

**Table 4-4**

**Emissions Associated with Site Assessment for Pollutants of Concern (Tons Per Year) in a Single Year**

| **Activity** | **$NO_x$** | **VOCs** | **$PM_{10}$** | **$PM_{2.5}$** | **$SO_x$** |
|---|---|---|---|---|---|
| Site Assessment Activities | 72 | 6 | 5 | 5 | 6 |

## *Non-Routine Events*

The most likely impact on air quality within the WEA from non-routine events would be caused by vapors from fuel spills resulting from either vessel collisions or allisions or from servicing or refueling generators that may be located on the meteorological towers. If a vessel spill occurred, the estimated spill size would be approximately 88 gallons (Section 3.2.3). If such a spill were to occur, it would be expected to dissipate rapidly and then evaporate and biodegrade within a few days (USDOI, MMS 2007b *as cited in* BOEM, 2012a). Air emissions from a diesel spill would be minor and temporary. A diesel spill occurring 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.

Although unlikely, a spill could occur in the event of vessel collision or allision while en route to and from the WEA or while a lessee surveys potential cable routes. Spills occurring in these areas, including harbor and coastal areas, are not anticipated to have significant impacts on onshore air quality due to the small estimated size and short duration of the spill.

##### *4.2.1.1.3 Conclusion*

Vessel traffic associated with the site characterization surveys and site assessment activities would have the largest potential to impact local air quality compared to other sources of emissions from the proposed action (i.e., construction, operations, maintenance, and decommissioning of the meteorological towers). During periods of high surveying activity, these emissions could result in moderate impacts on ambient air quality. Surveying activities would not occur year-round because of weather and sea-state limitations, so impacts from site characterization would be temporary in nature throughout the duration of the lease. In addition, compared to the volume of vessel traffic using the major ports listed in Section 3.1.2 (approximately 27,800 annual vessel trips in/out of 7 of the 10 major ports), and the numbers of vessels using nearby TSSs and the area surrounding the WEA for commercial and recreational fishing (see Section 4.2.3.8.1), emissions associated with the 1,300 annual vessel trips under Alternative A are anticipated to be minor.

The prevailing winds in the project area would likely transport offshore emissions away from the shore the majority of the time; however, wind directions may shift and transport emissions towards the shore. When this wind shift occurs, the distance between the WEA and the shore (12 nm at the closest point and 33 nm at the farthest point) and from the 3 nm State waters boundary (9 nm at the closest point and 30 nm at the farthest point) would minimize impacts to onshore air quality and to ambient air quality over State jurisdictional waters. Also, because of the large size of the WEA, emissions from vessels associated with the proposed action operating in the WEA would be dispersed over a large area. Therefore, impacts on air quality both onshore and in State waters are expected to be minor.

A non-routine event, such as a diesel spill, during site characterization or site assessment may have short-term impacts on ambient air quality in a localized area, but these effects would dissipate very quickly.

#### *4.2.1.2 Geology*

##### *4.2.1.2.1 Description of the Affected Environment*

### *Introduction*

This section focuses on surface and subsurface geologic features, geologic processes, and geo-hazards on the continental shelf south of Martha's Vineyard, MA, within the WEA. Although effects from the proposed action on geology may not be substantial, discussing site characteristics adds context by defining the surrounding physical environment.

The WEA covers an area of the shelf that slopes gently seaward (0.03° slope) between 98 and 197 ft (30 and 60 m) water depths. The seafloor within this area is primarily sand with large fractions of silt and clay in the southern portions. The presence of sand waves and other sedimentary features have been documented within the eastern margins of the WEA. Significant physiographic features on the shelf in this region are the result of the advance and retreat of the Laurentide Ice Sheet during the Pleistocene era between 25,000 and 12,000 years before the present. As the ice retreated, sea levels began to rise and the shelf was again inundated.

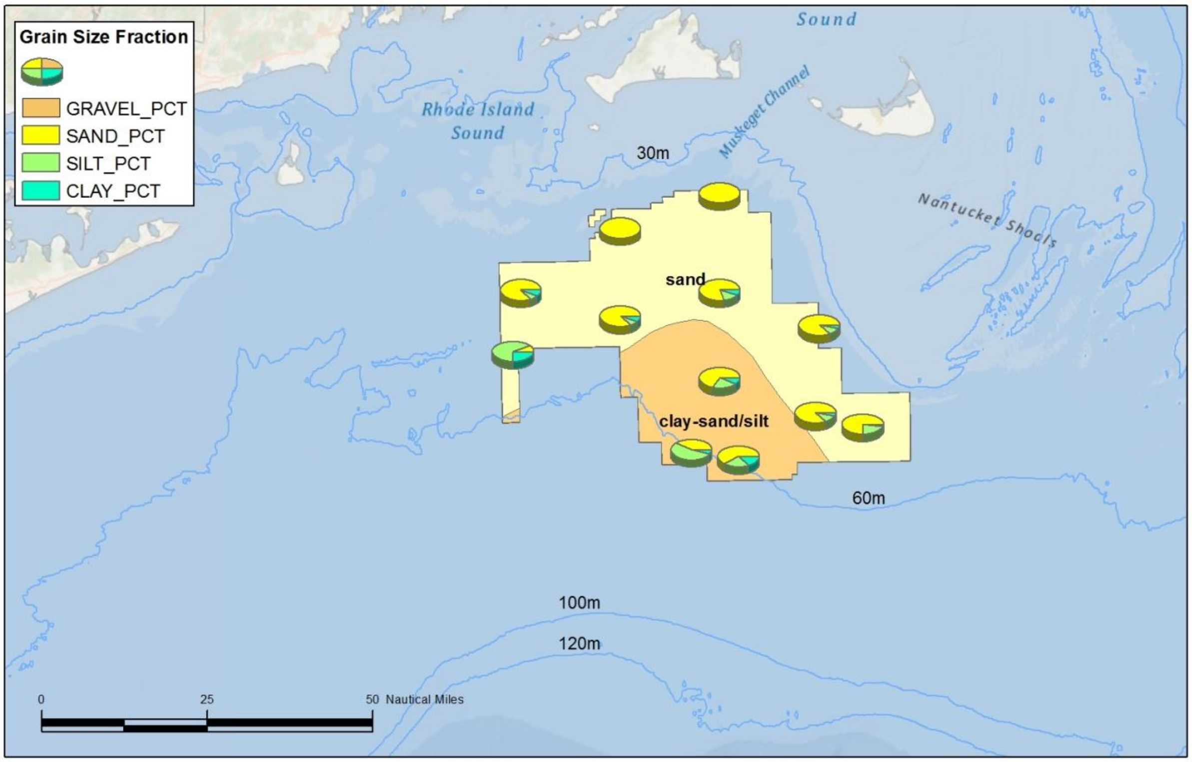
### *Seabed Characteristics*

The WEA includes parts of three distinct bottom types that reflect differences in the underlying geology and sediment transport processes occurring during maximum ice advance and since retreat of the ice sheet and submergence of the shelf. A small portion of the eastern end of the WEA encompasses the sand wave fields of Nantucket shoals to the east. A small portion on the south end of the WEA includes part of a fine-grained sediment area termed the *mud patch*. The majority of the WEA is characterized by sand deposits found over a majority of the continental shelf in this region.

The sand waves that make up Nantucket Shoals and extend into the eastern margins of the WEA are bedforms oriented perpendicular to tidal currents, have wavelengths of tens to hundreds of meters and heights typically 3 to 32 ft (1 to 10 m) (Twichell et al., 1987). Their occurrence is controlled by the availability of sand and tidal currents of sufficient velocity (>40 centimeters per second [cm/s]) to move sand-sized particles. They are actively moving bedforms with highly variable rates of movement.

The mud patch is an area comprising predominantly (up to 95 percent) silt- and clay-sized sediment that began accumulating 8,000 to 9,000 years ago (Bothner et al., 1981) and is still an area of active deposition. The mud patch is unique to the outer eastern continental shelf because it is the only place where surface sediment contains greater than 30 percent silt and clay. Deposits in the mud patch are up to 143 ft (13 m) thick (Emery and Garrison, 1967; Twichell et al., 1981). The remainder and majority of the WEA is characterized by predominantly sandy sediment that was deposited and shaped by coastal processes of the transgressing sea after glacial retreat and by currents and waves during storms on this part of the submerged shelf.

Figure 4-2 is a map of the grain size distribution of surface sediment within the WEA. The data are from the U.S. Geological Survey (USGS) Seafloor Geology and Sediment Type layers obtained from the Multipurpose Marine Cadastre maintained by BOEM and NOAA (BOEM and NOAA, 2012). The grain size data show high sand content (80–100 percent) in the northern two-thirds of the area and predominantly silt and clay content in the southern section.




*Source: BOEM and NOAA, 2012*

**Figure 4-2. Map of sediment grain size within the WEA**

Bedrock underlying the WEA consists of metamorphic and igneous rocks of varying age and origin. The surface of the bedrock generally slopes toward the southeast from roughly sea level on the shore of Buzzards Bay to 1,804 ft (550 m) below sea level approximately 6.2 miles (10 km) south of Nantucket (Oldale, 1992). The bedrock surface is irregular with valleys and basins that are filled with varying thicknesses of sediment.

### *Sediment Transport Processes*

Sediment transport processes currently active on the continental shelf in the area of the WEA are driven by a combination of regional scale residual currents, locally variable tidal currents, wind driven currents, and wave-generated currents. These processes, particularly during storms, drive sediment transport that creates the sediment bedforms seen on the current shelf (Butman, 1987).

The mean east-to-west flow through the area is not strong enough to initiate sediment transport on the seabed, but it is sufficient to transport sediment that is kept in suspension by stronger tidal currents and by storm waves (Twichell et al., 1987). An estimated steady current of 25 to 35 cm/s at a height of 3 ft (1 m) above the seabed is required to move sediment on the bottom. Waves with a 10-second period common during winter storms on the shelf can affect the seabed at up to 262 ft (80 m) water depth (Twichell et al., 1987).

The sandy sediment present on the seabed in this part of the shelf occurs in wave-like features of different scales. The characteristics of these bedform features help understand how sediment is transported through the WEA. The features include:

- *Sand Ridges* – Present in Nantucket Shoals, these large sand features are oriented roughly southwest-northeast and in line with tidal current flow;
- *Sand Waves* – Oriented perpendicular to tidal currents, these bed forms have wavelengths of tens to hundreds of meters with heights typically 3 to 33 ft (1 to 10 m) (Twichell et al., 1987). They are found in the very eastern edge of the WEA; and
- *Mega Ripples* – Smaller bedforms oriented perpendicular to tidal flow, but with wavelengths of 3 to 49 ft (1 to 15 m) and heights less than 0.3 ft (1 m).

Nantucket Shoals and a small portion of the eastern margin of the WEA are characterized by sand ridges and sand waves. Their occurrence is controlled by the availability of sand and sufficient tidal current velocity (> 40 cm/s). As noted above, these bedforms are not present in most of the WEA. The silt and clay deposits of the mud patch are thought to come from Georges Bank and Nantucket Shoals to the east, carried westward by the mean flow (Twichell et al., 1987). Tidal currents in these source areas are sufficient to erode the fine grain sediment and keep it in suspension. Once it reaches the lower currents of the mud patch area, this sediment is able to deposit (Butman, 1987; Twichell, et al., 1987).

### Geo-Hazards

Geologic hazards include scouring from currents during storm events, slope failure, faulting, earthquakes, and tsunamis. Currents and waves generated during storm events may be sufficient to cause erosion of unconsolidated sediment on the continental shelf. Estimated residual surface currents in the WEA are on the order of 5 cm/s (Cowles et al., 2008). Currents were measured in 151 ft (46 m) water depths from March 1979 to July 1979 and from September 1979 to April 1980 at an instrument 46 ft (14 m) above the bottom located within the eastern edge of the WEA (Butman, 1987). The mean flow was towards the west at 29 cm/s. Maximum current velocities measured during these two time periods was 94 cm/s.

#### *4.2.1.2.2 Impact Analysis of Alternative A*

### *Routine Activities*

This section addresses reasonably foreseeable impacts on geologic resources within the WEA from sub-bottom sediment sampling and from construction, deployment, and operation of meteorological towers and buoys. Impacts from direct seabed disturbance and from elevated suspended sediment concentration caused by routine activities are considered. Reasonably foreseeable effects on geologic resources within the WEA come from sediment sampling, construction, and deployment and operation of towers and buoys.

*Sampling Activities*

Sub-bottom sampling would result in small areas of the seafloor being disturbed. This may occur at the bore hole, coring area, vessel anchor locations, or in areas where equipment contacts the seabed. For example, direct disturbance of the seabed from deployment of a tripod-mounted coring device would occur within a 54 to 108 square ft (5 to 10 square m) area. Direct disturbance from vessel anchors varies widely depending on the size and type of the anchor, the length of the anchor chain or cable and the water depth. The area of direct impact from the anchor itself is expected to be on the order of 22 to 108 square ft (2 to 10 square m) depending on the anchor type. The direct impact from the anchor cable or chain depends on the length of cable or chain resting on the seabed and the amount of vessel movement that causes the cable to sweep the bottom and suspend sediment. It is expected that these effects would result in a localized disturbance similar to that caused by commercial fishing activities such as bottom trawls. Numerous studies have been performed to look at the effects of fishing activities on seabed geology. A recent publication by the New England Fishery Management Council (NEFMC, 2011) summarizes many such studies.

Sampling activities disturb seabed sediment and suspend it in the water column where it can be transported away from the sample site and deposited in a new location. The concentration of suspended sediment generated from the sampling methods employed would be similar to sediment concentrations occurring during storm conditions on this part of the shelf.

The amount and duration of increased suspended sediment concentration from anchor deployment would depend on the activity, the grain size of seabed sediment and the current velocity. The direct effect on the seabed occurs from the anchor itself and from the cable sweeping across the bottom. Vessels without dynamic positioning systems would deploy anchors or other methods to maintain position while sampling. Short-term increases in suspended sediment are expected to be confined within the immediate area of the sampling activity.

*Deployment/Construction of Towers and Buoys*

Driving support piles for meteorological towers would result in small areas of the seafloor being directly disturbed where piles are placed and in areas where equipment contacts the seabed. Placing anchors for buoys would also result in direct impacts on a small area of the seabed. Depending on the type of anchor deployed, the direct disturbance area can be a few square meters or up to 107 square ft (10 square m).

Possible methods of scour protection, including rock armoring and protection mattresses, may be deployed at the base of piles supporting meteorological towers. Rock armor would be placed on the seabed using a clamshell bucket or a chute. The rock armor for a monopole foundation for a wind turbine would occupy an estimated 16,000 square ft (0.37 acres) of the seabed (ESS Group, Inc., 2006a). While the piles of meteorological tower would be much smaller than those of a wind turbine, a meteorological tower may be supported by up to four piles. Therefore, the maximum area of the seabed impacted by rock armor for a single meteorological tower is also estimated to be 16,000 square ft (0.37 acres).

If used, the protection mats would be installed by a diver or ROV. For a pile-supported platform, an estimated four mats, each about 16 by 8 ft (4.8 by 2.4 m), would be placed around each pile. Including the extending sediment bank, a total area of disturbance of about 5,200 to 5,900 square ft (1,585 to 1,798 square m) for a three-pile structure and 5,900 to 7,800 square ft (1,798 to 2,377 square m) for a four-pile structure is estimated. For a monopile, an estimated eight mats about 16.4 by 16.4 ft (5.0 m by 5.0 m)would be used, with a total area of disturbance of about 3,700 to 4,000 square ft (0.08 to 0.09 acres).

Meteorological buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site the mooring anchor is dropped and the instruments are configured. 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, 2006). Based on previous proposals, anchors for boat-shaped and discus-shaped buoys would weigh about 6,000 to 10,000 pounds with a footprint of about 6 square ft and an anchor sweep of about 370,260 square ft (8.5 acres). Buoys typically take 1 day to install and vessel anchoring for 1 day is anticipated for these types of buoys (Fishermen's Energy, 2011).

Based on the GSOE proposal offshore New Jersey, a spar-type buoy deployment would occur in two phases: deployment of a clump anchor to the seabed as a pre-set anchor (Phase 1) and deployment of the spar buoy and connection to the clump anchor (Phase 2). Phase 1 would take approximately 1 day and would include placement of the clump anchor on a barge and transporting it to the installation site. In this example, a rectangular clump weight anchor is 22 ft x 22 ft x 3 ft (6.7 m x 6.7 m x 1 m) in size and weighs approximately 100 tons, with a bottom footprint area of 484 square ft (45 square m). Phase 2 would include towing the spar buoy to the site, deployment, and connection to the clump anchor (Tetra Tech EC, Inc., 2010). The buoy would be anchored to the seafloor using a clump weight anchor and mooring chain. Installation would take approximately 2 days. The bottom disturbance associated with buoy and vessel anchors would measure 28 ft x 28 ft (8.5 m x 8.5 m), with a total area of 784 square ft (73 square m).

Deployment and construction of meteorological towers disturbs seabed sediment and suspends sediment in the water column where it can be transported away from the sample site and deposited in a new location. The concentration of suspended sediment generated would be similar to suspended sediment concentrations occurring on a regular basis during storm conditions on this part of the shelf.

A study performed by Churchill in the 1980s (Churchill, et al, 1988; Churchill, 1989) provides data from measurements of suspended sediment near the seabed along a line that crossed through the mud patch, the area of fine-grained sediment at the southwest corner of the WEA. Churchill observed elevated suspended sediment concentrations that correlated with the presence of bottom trawls and developed a model to predict the concentrations that occur during trawling. He used the model to predict suspended sediment concentration in the water column by trawls operating in the mud patch of up to 470 milligrams per liter (mg/L) at 328 ft (100 m) behind the operating trawl. Elevated suspended sediment concentrations were present for up to 1 day after the trawling activity.

*Operation of Towers and Buoys*

The effects on the geologic resources within the WEA occurring during operation of meteorological towers and buoys includes scour of sediment adjacent to tower support piles embedded in the seabed. Scour occurs at the base of piles and other structures embedded in the seafloor because of a disturbance of current flow around the pile that causes an increase in bottom shear stress and localized erosion.

### *Non-Routine Events*

Non-routine events include collisions between the structure or associated vessels with other marine vessels or marine life and spills from collisions or during generator refueling. None of these events would adversely affect the geology of the WEA.

#### *4.2.1.2.3 Conclusion*

Impacts on geological resources as a result of sediment sampling and the construction, deployment, and operation of meteorological towers and buoys associated with Alternative A are expected to be minor. The disturbance of small areas of the seafloor due to sub-bottom sampling and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. Elevated suspended sediment concentrations generated during pre-assessment sampling and meteorological tower and buoy deployment are expected to be confined within the immediate area of the activity.

#### *4.2.1.3 Physical Oceanography*

##### *4.2.1.3.1 Description of the Affected Environment*

This section describes the physical oceanography within the WEA and the areas that may be traversed by ships during construction and maintenance activities for the meteorological towers and buoys. Although effects from the proposed action on physical oceanography may not be substantial, discussing these site characteristics adds context by defining the surrounding physical environment.

### *Currents*

Movement of water expressed as currents are categorized by their scales of forcing, i.e., mean, weather band, and tide currents.

The mean currents in the WEA originate as the Labrador Current off the Canadian coast and continue down the shelf to the Cape Hatteras area where they ultimately join the Gulf Stream. Lentz (2008) analyzed current meter records longer than 200 days from deployed instruments and reported that currents on the New England Shelf are aligned with the isobaths (heading in a west northwesterly direction). The depth averaged mean currents increase with increasing water depth.

Recent data have been collected in the vicinity of the western boundary of the WEA as part of the Rhode Island OSAMP (RICRMC, 2010) to evaluate offshore areas suitable for renewable energy development, among other goals. Ullman and Codiga (2010) documented a significant field program that included deployment of five instrumented moorings from October 2009 to July 2010. The easternmost mooring, in waters 112 ft (34 m) deep at location 41.12°W and 71.03°N, is near the northwestern corner of the WEA. They found monthly mean currents in the range of a few cm/s to 10 to 15 cm/s.

Weather band currents result from meteorological forcing and are the most prominent features in current meter records on the shelf (BOEMRE, 2011d) with timescales from about 1 to 10 days. Strong sustained along-shelf (westerly) winds can drive near surface currents offshore at 20 to 30 cm/s with a corresponding deep shoreward flow on the New England Shelf. Typical onshore-offshore currents are 5 to 10 cm/s.

The recent data (Ullman and Codiga, 2010) taken adjacent to the western boundary of the WEA indicate current magnitudes in the range from 5 to 20 cm/s with predominant directions of motion toward either the west-northwest or east-southeast.

The New England Shelf is located between the Gulf of Maine to the northeast, which has large tides, and the much less energetic Mid Atlantic Bight shelf to the southwest (He and Wilkin, 2006). The most important tidal constituents are semidiurnal (twice daily) in the area with the principal lunar constituent $M_2$, having a period of 12.42 hours, dominating with an amplitude of 13.8 to 15.7 inch (35 to 40 cm). The range of $M_2$ currents averaged over the water column from bottom to surface varies from 5 cm/s in the southwest portion of the WEA to 80 cm/s in the northeast portion with a general increase to the north and east (He and Wilkin, 2006). Total tidal currents observed at a site 230 ft (70 m) deep directly south of the eastern end of Martha's Vineyard were found to be 13 cm/s at the surface, 11 cm/s at 98 ft (30 m) deep, and 10 cm/s at 197 ft (60 m) deep with a vertical average of 11 cm/s (Cowles et al., 2008).

#### *Waves*

Two dominant factors affect the wave climate in the WEA: local meteorological processes generating wind waves (with periods less than approximately 8 s) and distant weather systems generating swell (with periods greater than 8 s) (BOEMRE, 2011d). The most important characteristics of waves are the significant wave height (average of the highest one-third of waves) and the wave direction. Wave data for the WEA was taken from the USACE Wave Information Study (USACE, 2012), which consisted of a 20-year (1980 to 1999) hindcast of wave conditions based on wind forcing. The deep stations to the south of the WEA were located in water depths of approximately 100 m, while the shallow stations at the northern boundary of the WEA were located in water depths of approximately 98 ft (30 m) or less.

Wave data were also acquired during field programs as part of the Rhode Island OSAMP development (Ullman and Codiga, 2010). Five stations provided continuous wave data from October 2009 to July 2010 at locations throughout the Rhode Island area. Two of the stations, one located in waters 112 ft (34 m) deep near the northwestern corner of the WEA, and the other located in waters 158 ft (48 m) deep further south, are most representative of wave conditions in the WEA, although all five stations shared very similar ranges and temporal variations. Typical significant wave height varied from 1 to 8 ft (0.5 to 2.5 m) with peak periods from 5 to 10 s and peak direction from south or southeast.

##### *4.2.1.3.2 Impact Analysis of Alternative A*

#### *Routine Activities*

Site characterization surveys are performed during cruises where specialized instrumentation is typically attached to the survey vessel, either through the hull or in packages towed behind the vessel. Other instrumentation, such as dredges and grab samplers, vibracores, and deep coring devices, are placed on the bottom to acquire data or samples. This instrumentation is relatively compact and too small (on the order of 30–40 square ft [3–4 square m] in the vicinity of the equipment), to affect the physical oceanography in the WEA, including currents (mean, weather band, or tides) or waves.

The construction, operations and decommissioning of the meteorological towers could disturb the seabed via anchoring, pile driving, and placement of scour protection devices. As the equipment is compact, only minor and localized changes in physical oceanography (currents and waves) around the structures would occur. Similarily, bouy anchor installation, operation and decommissioning could disturb the seabed, but it is anticipated that this disturbance will be minor, localized and temporary.

### *Non-Routine Events*

Collisions between structures and vessels or with other marine vessels or marine life and spills from collisions or during generator refueling would not have an impact on physical oceanography.

#### *4.2.1.3.3 Conclusion*

Impacts on physical oceanography as a result of Alternative A are expected to be minor. The instrumentation used for site characterization would be compact and small and impacts as a result of the construction and deployment of buoys and towers would also be minor.

### *4.2.1.4 Water Quality*

#### *4.2.1.4.1 Description of the Affected Environment*

Water quality generally refers to the physical, chemical, and biological attributes of water. For the purposes of this section, water quality refers to the ability of the waters of the New England Shelf to maintain the ecosystem within it. Factors such as pollutant loading from both natural and anthropogenic sources via the atmosphere, freshwater drainage, transport of offsite marine waters, and influx from sediments can contribute to changes, usually detrimental, in water quality. Anthropogenic sources include those from direct discharges, runoff, dumping, and spills.

Water quality can be measured by a large number of parameters, some of which are more important to certain water bodies than to others. For the WEA and adjacent nearshore areas, these parameters include temperature, salinity, dissolved oxygen (DO), nutrients, chlorophyll, acidity as measured by pH, oxidation reduction potential, suspended sediment/turbidity, and trace constituents, usually metals and organic compounds.

### *Hydrography*

The main water mass affecting the New England Shelf is formed by mixing in the Gulf of Maine of cold, fresh Scotian shelf water and warm, saltier slope water that enters the Gulf via the Northeast Channel (BOEMRE, 2011d). This water is modified by estuarine outflows and air-sea interaction as it travels out of the Gulf and moves west across the New England Shelf. The temperature and salinity fields, which define the density field and density stratification change primarily on a seasonal basis with warming in the spring, peaking in August, and cooling in the fall. Although seasonal changes in salinity have been observed, they are much less predictable than temperature and are smaller than the interannual variability in salinity (BOEMRE, 2011d).

Recent data have been collected in the vicinity of the western boundary of the WEA as part of Rhode Island's OSAMP (RICRMC, 2010). Ullman and Codiga (2010) documented a significant field program that included deployment of an instrumented mooring in waters 112 ft (34 m) deep at location 41.12°W and 71.03°N near the northwestern corner of the WEA from October 2009 to July 2010. They found temperature variations between 2 and 24°C and salinity variations between 31.0 and 33.6 practical salinity units at the site.

The density gradient on the New England Shelf is consistent with the larger Mid-Atlantic Shelf pattern of less dense inshore waters and denser offshore water and is governed more by salinity changes than temperature changes (BOEMRE, 2011d). Density stratification is typically strongest inshore as a result of freshwater outflows from land, although temperature contributes more strongly to the seasonal cycle. In areas shallower than 16 to 66 ft (5 to 20 m) deep, the turbulence of the tidal currents can supply sufficient mixing to limit stratification depending on the strength of the tidal currents.

Ullman and Codiga (2010) reported density variations from 23.5 to 26 kilograms per cubic meter ($kg/m^3$) and stratification from 0 to -0.13 $kg/m^3$ from data taken adjacent to the western boundary of the WEA.

### *Nutrients*

Nutrients in the oceanic context commonly refer to nitrogen, phosphorus, and silica (BOEMRE, 2011d). Nitrogen in marine environments is mostly derived from dissolved nitrogen gas followed by the dissolved inorganic nitrogen forms of nitrate, nitrite, and ammonium ion, as well as dissolved and particulate organic nitrogen. Inorganic phosphate is the primary form of phosphorus, known as orthophosphate, with lower levels of organic phosphate in surface waters. Silicate makes up most the silica in marine environments.

Little information is available relative to nutrient concentrations in the WEA. Using Georges Bank as a proxy for the New England Shelf, TRIGOM (1974) reported phosphate concentrations of 0.03 micrograms phosphate per liter (µg P/L) at the surface and 1.2 at 394 ft (120 m). Nitrate concentrations ranged between 0.7 and 9.7 µg N/L, nitrite concentrations were close to zero, and ammonia concentrations were about 1 µg N/L.

Sources of nutrients that enter continental shelf areas such as the New England Shelf (and the WEA) include:

- Recycling or resuspension from sediments
- River discharges
- Transport onto the shelf from offshore waters
- Atmospheric deposition
- Upwelling from deeper waters

### *Chlorophyll*

Chlorophyll *a* is a green pigment found in marine plants, and is critical in photosynthesis, the process whereby plants absorb energy from light. It is a measure of biomass, particularly phytoplankton, and may be indicative of eutrophication and linked to nutrient levels, which are more difficult to determine than chlorophyll *a*.

Ullman and Codiga (2010) documented a significant field program that included a gridded survey plan extending close to the west boundary of the WEA. Stations were located on a line from 41.05°W and 70.88°N in approximately 125 ft (38 m) of water north-northwest to another station in 98 ft (30 m) of water. These stations showed relatively low values of chlorophyll *a*: between 0.5 and 1.5 µg/L at the surface and between 1.5 and 2.5 µg/L at the bottom, with the exception of a pool measured at the shallower station with a level of greater than 10 µg/L during the September cruise.

### *Dissolved Oxygen*

DO mainly enters the ocean via exchange with the atmosphere. Concentrations are also controlled by physical factors (water temperature) and biological factors (respiration, photosynthesis, and bacterial decomposition), which may result in concentration changes through the water column.

Ullman and Codiga (2010) documented a field program that included two stations close to the west boundary of the WEA. These stations showed a seasonal variation of surface DO from 7.5 to 10.5 mg/L and bottom DO from 6.5 to 10.5 mg/L with the highest values recorded in March and the lowest values recorded in September.

### *Turbidity*

Turbidity is a measure of the scattering of light by suspended particulate matter in contrast to total suspended sediment, which is a measure of the concentration of sediment particles in the water column. There is no accurate way to convert from one to the other except by taking simultaneous measurements of both and performing a regression analysis. Historically, turbidity has been measured directly as defined by Nephelometric Turbidity Units (NTUs), while suspended sediment concentrations were determined in the laboratory (newer instruments can now measure total suspended sediment directly) in units of mg/L.

Measurements reported by Ullman and Codiga (2010) showed that there was little difference in turbidity levels between the surface and bottom. The levels ranged from 0.25 to 0.5 NTU for the September, March, and June cruises but rose to between 0.75 and 1.25 NTU in December.

#### *Trace Metals*

An arbitrary concentration of 1 mg/kg (1 ppm) is considered the concentration that separates trace metals from the other metals in seawater (BOEMRE, 2011d). Trace metals enter the marine environment from runoff, direct discharge/deposition, atmospheric deposition, sediment resuspension, paints from hulls, accidental spills, and even cosmic impacts. The highest concentrations are found closest to sources, which on the New England Shelf would be dumpsites receiving sewage sludge, chemical wastes, and dredged sediments. There do not appear to be any dumpsites within the WEA or directly upstream (east); therefore, trace metal concentrations are expected to be low.

##### *4.2.1.4.2 Impact Analysis of Alternative A*

#### *Routine Activities*

The routine activities associated with Alternative A that would impact coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste) and structure installation and removal. A general description of these impacts on coastal and marine water quality is presented in Section 5.2.4 of the PEIS (MMS, 2007a).

*Site Characterization*

Site characterization surveys are described in Section 3.1.3 and include HRG surveys, geotechnical surveys, and biological surveys. These surveys are performed during cruises where specialized instrumentation is typically attached to the survey vessel, either through the hull or in packages towed behind the vessel. Other instrumentation, such as dredges and grab samplers, Vibracores, and deep coring devices, are placed on the bottom to acquire data or samples. All of this instrumentation is self-contained with no discharges to affect the water quality in the WEA, including hydrography, nutrients, chlorophyll, DO, or trace metals. Suspended sediment concentrations as a proxy for turbidity is discussed in Section 4.2.1.2.2.

Survey vessels performing these characterization surveys may affect water quality both during the surveys in the WEA, as well as traveling to and from shore facilities. Vessels generate operational discharges that can include bilge and ballast water, trash and debris, and sanitary waste. Details of these waste discharges and the governing regulations are discussed in Section 3.1.3.5. In the event of failure of the onboard equipment for treating such waste, water quality could be impacted, particularly in near-shore areas. However, in the WEA, coastal and oceanic circulation and the large volume of water available would disperse, dilute, and biodegrade vessel discharges relatively quickly and the water quality impact would be minor.

*Construction, Decommissioning, and Operations*

Meteorological and oceanographic data collection towers and buoys are described in Section 3.1.4. The construction and deployment of such equipment would disturb the seabed via anchoring, pile driving, and placement of scour protection devices. Because the equipment is compact, only small, local changes in water quality (turbidity) in the vicinity of the structures would occur. The small changes would likely only occur approximately to 30 to 40 square ft (3 to 4 square m) in the vicinity of the equipment, assuming the area of influence is approximately 3 ft (1 m) above the equipment with a radius of one to two length scales around the equipment. These small changes would cease to occur during operation of towers and buoys. Additional discussion on increased sediment concentration (as a proxy for turbidity) in the water column is found in Section 4.2.1.2.2.

### *Non-Routine Events*

The water quality effects of non-routine events such as allisions/collisions and spills are described in Sections 3.2.2 and 3.2.3, respectively.

#### *4.2.1.4.3 Conclusion*

Impacts on water quality as a result of Alternative A would be minor. The instrumentation used for site characterization is self-contained, so there would be no discharges to affect the water quality in the WEA. Although there would be operational discharges from vessels during site characterization surveys, the coastal and oceanic circulation and large water volume would disperse, dilute, and biodegrade vessel discharges, so impacts on water quality would be minor. The disturbance to the seabed during construction and deployment of towers and buoys would cause small, localized impacts on the water quality in the vicinity of the structures. However, these small, localized impacts would cease during operation of the towers and buoys.

## 4.2.2 Biological Resources

### *4.2.2.1 Birds*

#### *4.2.2.1.1 Description of the Affected Environment*

A wide variety of bird species occur within the WEA and onshore areas associated with the proposed action. Blodget (2007) compiled a list of over 450 species that could possibly use the onshore and offshore areas of Massachusetts. This list includes many accidental and rare species that are not likely to use the offshore pelagic areas. The most likely taxa to occur within the offshore areas include approximately 17 species of sea ducks, 4 species of loons and grebes, 9 species of shearwaters and petrels, 3 species of gannets and cormorants, and 22 species of gulls and terns (eBird, 2012; Table 4-5). Other taxa and species may occur in the area in lower numbers, either throughout the year or at specific times of the year.

**Table 4-5**

**Temporal Distribution and Relative Abundance of Bird Species Likely to Use the Areas Offshore Massachusetts**

| Bird Type | Genus | Species | Common Name | Occurrence[1] C=common, R=rare | | | |
|---|---|---|---|---|---|---|---|
| | | | | winter | spring | summer | fall |
| Sea Ducks | | | | | | | |
| | *Branta* | *bernicla* | Brant | C | C | R | C |
| | *Anas* | *rubripes* | American Black Duck | C | C | C | C |
| | *Aythya* | *valisineria* | Canvasback | C | C | R | C |
| | *Aythya* | *americana* | Redhead | C | C | R | C |
| | *Aythya* | *marila* | Greater Scaup | C | C | R | C |
| | *Aythya* | *affinis* | Lesser Scaup | C | C | R | C |
| | *Somateria* | *spectabilis* | King Eider | C | C | R | C |
| | *Somateria* | *mollissima* | Common Eider | C | C | C | C |
| | *Histrionicus* | *histrionicus* | Harlequin Duck | C | C | R | C |
| | *Melanitta* | *perspicillata* | Surf Scoter | C | C | C | C |
| | *Melanitta* | *fusca* | White-winged Scoter | C | C | C | C |
| | *Melanitta* | *nigra* | Black Scoter | C | C | C | C |
| | *Clangula* | *hyemalis* | Long-tailed Duck | C | C | R | C |
| | *Bucephala* | *albeola* | Bufflehead | C | C | C | C |
| | *Bucephala* | *clangula* | Common Goldeneye | C | C | R | C |
| | *Bucephala* | *islandica* | Barrow's Goldeneye | C | C | R | R |

| Bird Type | Genus | Species | Common Name | Occurrence[1] C=common, R=rare | | | |
|---|---|---|---|---|---|---|---|
| | *Mergus* | *serrator* | Red-breasted Merganser | C | C | C | C |
| Loons and Grebes | | | | | | | |
| | *Gavia* | *immer* | Common loon[2] | C | C | C | C |
| | *Gavia* | *stellata* | Red-throated loon | C | C | C | C |
| | *Podiceps* | *auritus* | Horned Grebe | C | C | R | C |
| | *Podiceps* | *grisegena* | Red-necked Grebe | C | C | R | C |
| Shearwaters and Petrels | | | | | | | |
| | *Fulmarus* | *glacialis* | Northern Fulmar[2] | C | C | C | C |
| | *Calonectris* | *diomedea* | Cory's Shearwater[2] | R | R | C | C |
| | *Puffinus* | *griseus* | Sooty Shearwater[2] | R | A | C | C |
| | *Puffinus* | *puffinus* | Manx Shearwater | R | C | C | C |
| | *Puffinus* | *lherminieri* | Audubon's Shearwater | R | R | R | C |
| | *Oceanites* | *oceanicus* | Wilson's Storm-Petrel[2] | R | C | C | C |
| | *Pelagodrama* | *marina* | White-faced Storm-Petrel | R | R | R | C |
| | *Oceanodroma* | *leucorhoa* | Leach's Storm-Petrel | R | C | C | C |
| | *Oceanodroma* | *castro* | Band-rumped Storm-Petrel | R | R | C | C |
| Sulids | | | | | | | |
| | *Morus* | *bassanus* | Northern Gannet[2] | C | C | C | C |
| | *Phalacrocorax* | *auritus* | Double-crested Cormorant | C | C | C | C |
| | *Phalacrocorax* | *carbo* | Great Cormorant | C | C | C | C |
| Gulls and Terns | | | | | | | |
| | *Rissa* | *tridactyla* | Black-legged Kittiwake[2] | C | C | C | C |
| | *Xema* | *sabini* | Sabine’s Gull | R | R | R | C |
| | *Larus* | *philadelphia* | Bonaparte's Gull | C | C | C | C |
| | *Chroicocephalus* | *ridibundus* | Black-headed Gull | C | C | R | C |
| | *Hydrocoloeus* | *minutus* | Little Gull | C | C | R | C |
| | *Larus* | *atricilla* | Laughing Gull[2] | R | C | C | C |
| | *Larus* | *delawarensis* | Ring-billed gull | C | C | C | C |
| | *Larus* | *argentatus* | Herring Gull[2] | C | C | C | C |
| | *Larus* | *glaucoides* | Iceland Gull | C | C | R | C |

| Bird Type | Genus | Species | Common Name | Occurrence[1] C=common, R=rare | | | |
|---|---|---|---|---|---|---|---|
| | *Larus* | *fuscus* | Lesser black-backed gull | C | C | R | C |
| | *Larus* | *hyperboreaus* | Glaucous Gull | C | C | R | C |
| | *Onychoprion* | *fuscatus* | Sooty Tern | R | R | R | C |
| | *Onychoprion* | *anaethetus* | Bridled Tern | R | R | C | C |
| | *Sternula* | *antillarum* | Least Tern | R | C | C | C |
| | *Sterna* | *caspia* | Caspian Tern | R | C | C | C |
| | *Chlidonias* | *niger* | Black Tern | R | C | C | C |
| | *Sterna* | *dougalli* | Roseate Tern | R | C | C | C |
| | *Sterna* | *hirundo* | Common Tern[2] | R | C | C | C |
| | *Sterna* | *paradisae* | Arctic Tern | R | C | C | C |
| | *Sterna* | *forsteri* | Forster's Tern | R | R | C | C |
| | *Sterna* | *maxima* | Royal Tern | R | R | C | C |
| | *Sterna* | *sandivicensis* | Sandwich Tern | R | R | C | C |

[1]Occurrence indices are derived from eBird, 2012

[2]Species was mapped as part of the Menza et al. (2012) study.

Birds within this area have historically been, and will continue to be subject to a variety of anthropogenic stressors, including commercial and recreational boating activity, pollution, disturbance of marine and coastal environments, hunting, habitat loss of breeding and wintering grounds, and climate change (NABCI, 2011). The following sections discuss several categories of birds that are particularly sensitive with respect to the proposed action.

### *Migratory Birds*

Although most North American bird species are exclusively, or primarily restricted to terrestrial habitats, a large number of species can occur within the WEA, particularly during spring and fall migratory periods. Most of these species receive Federal protection under the Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. 703–712), which states, “Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird, or any product … composed in whole or in part, of any such bird or any part, nest, or egg thereof ….” Generally speaking, the MBTA protects the majority of birds that nest in North America (50 CFR 10.13). As of 2010, 1,007 species were on the List of Migratory Birds protected by the MBTA (50 CFR 10.21), including all bird species native to the United States except upland game birds.

### *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 and golden eagles. Take is defined by the Act as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Bald eagles can be found year-round in Massachusetts, where they most commonly occur in a variety of terrestrial environments, primarily near water (Buehler, 2000). Although they may occur in marine environments close to the coast, they are not normally expected to occur in pelagic environments as far from shore as the WEA (Buehler, 2000). Golden Eagles are primarily a species of western North America, though their breeding range does extend eastward as far as Quebec and small numbers do migrate through the eastern United States (Kochert et al., 2002). During migration, both bald and golden eagles typically migrate over land, where they tend to follow mountain ridgelines (Buehler, 2000; Kochert et al., 2002); hence, neither is expected to migrate through the WEA or onshore areas associated with the proposed action.

### *ESA-listed or Candidate Bird Species*

Two species of birds are listed under the ESA as endangered or threatened that may occur within the WEA. The northwestern Atlantic Ocean population of Roseate Tern (*Sterna dougallii dougallii*) is listed as endangered, and the Atlantic Coast population of the Piping Plover (*Charadrius melodus*) is listed as threatened. A third bird species that may occur within the WEA, the Red Knot (*Calidris canutus rufa*), is currently regarded by the USFWS as a candidate for ESA listing status (Niles et al., 2007).

*Roseate Tern:* The Roseate Tern is a small tern that breeds in colonies on islands. Within the western Atlantic Ocean, one population breeds along the coast of the northeastern United States and maritime provinces of Canada, winters along the northeastern coast of South America, and is listed under the ESA as endangered, while another population, listed as threatened, breeds in the Caribbean (USFWS, 2010). Only the northwestern Atlantic population is likely to occur within the WEA. The diet of Roseate Terns is almost exclusively restricted to small fish, including sand lances, for which it forages by flying slowly, gracefully, and buoyantly, typically 10–39 ft (3–12 m) above the water, and then plunge-diving to catch fish at depths no greater than a few inches (Gochfeld et al., 1998). Recent population declines in this species have been attributed largely to nesting colony failures caused by various predators including gulls and rodents (USFWS, 2010).

The northwestern Atlantic breeding population of Roseate Terns currently breeds on a handful of colonies located primarily on islands from the maritime provinces of Canada to Long Island, NY, though historically it bred as far south as North Carolina (Gochfeld et al., 1998; USFWS, 2010). In recent years, this population has become extremely concentrated and restricted, with as many as 87 percent of individuals breeding within just three colonies on islands off of Massachusetts and New York (Bird and Ram Islands in Buzzards Bay, MA, and Great Gull Island, NY)

(USFWS, 2010).

During both nesting and post-breeding staging periods, very little Roseate Tern activity is expected to occur within the WEA. Roseate Terns arrive on their northwestern Atlantic breeding colonies in late April to early May, at which time they initiate courtship activities and then nesting (Gochfeld et al., 1998). During the nesting period from mid-May through the end of July, adult birds typically remain within 7 km of their nesting colonies while foraging for fish to provision their young, occasionally traveling as far as 30 km from their colony during this period (Burger et al., 2011; Normandeau Associates Inc., 2011). Beginning as early as late July, and by mid-August, Roseate Terns have completed nesting activity, at which time adults and young move to post-breeding staging areas where they remain until mid-September before migrating southward (Burger et al., 2011; Normandeau Associates Inc., 2011). The coastal region of southeastern Cape Cod, MA, near Chatham and Monomoy Island, is the most important post-breeding staging area for this species, hosting up to 7,000 individuals representing nearly the entire northwestern Atlantic population (Burger et al., 2011; Normandeau Associates Inc., 2011). During this time, most foraging activity is concentrated in shallow water close to shore, but some individuals may occur up to 16 km from the coast (Burger et al., 2011; Normandeau Associates Inc., 2011). A predictive model looking at distribution and activity of uncommon terns (including Roseate Terns) around the Martha's Vineyard and Nantucket islands predicted a distribution of terns consistent with the observations just described. Tern activity was greatest in areas close to the islands, and there was little tern activity in the surrounding pelagic areas (Menza, 2012). Despite these predictions, the model outputs should be interpreted with caution given the low sample sizes and the grouping of multiple species to create the model.

The migration routes of Roseate Terns are not well known, but are believed to be largely or exclusively pelagic (far from shore) in both spring and fall (Gochfeld et al., 1998; Nisbet, 1984; USFWS, 2010); hence, Roseate Terns may likely traverse the WEA during this period (Burger et al., 2011; Normandeau Associates Inc., 2011). Only a small amount of offshore Roseate Tern observations have been recorded, including five recoveries of banded individuals at sea on ships (Nisbet, 1984), as well as a small number of additional boat-based observations (Normandeau Associates Inc., 2011).

*Piping Plover:* The Piping Plover is a small migratory shorebird that breeds in sandy dune-beach-riparian habitat along the Atlantic Coast, the Great Lakes, and the Great Plains regions of the United States, and winters in coastal habitats of the southeastern United States, coastal Gulf of Mexico, and the Caribbean (Elliot-Smith et al., 2004, 2009; USFWS, 2009). The Atlantic Coast and Great Plains breeding populations are listed as threatened, while the Great Lakes breeding population is listed as endangered (USFWS, 2009). Only the Atlantic Coast population is likely to occur within the WEA. Throughout its range, the primary threat to Piping Plovers, and most likely cause of its population declines, is coastal development, as well as disturbance by humans, dogs, and vehicles on sandy beach and dune habitat, to which it is highly specialized and ecologically restricted (Elliott-Smith et al., 2004; USFWS, 2009). Piping Plovers spend most of their time on the ground, foraging for small animals amidst the debris of coastal wrack lines and beaches, and using extremely cryptic coloration and behavior as protective camouflage (Elliott-Smith et al., 2004).

Nesting locations for the Atlantic Coast breeding population of Piping Plover extend from the maritime provinces of Canada through North Carolina, within relatively undisturbed areas of sand dune-beach habitats along the Atlantic Ocean (Elliott-Smith et al., 2004, 2009; USFWS, 2009). Piping Plovers may occur in Massachusetts from late March through mid-October, which encompasses their breeding season as well as their spring and fall migratory seasons (Normandeau Associates Inc., 2011). During the breeding season, particularly from mid-May through mid-August, this species is unlikely to occur within the offshore study area, as Piping Plovers are strictly confined to sandy coastal habitats (Burger et al., 2011; Normandeau Associates Inc., 2011). Migratory pathways of this species are not well known (Normandeau Associates Inc., 2011; USFWS, 2009). During their migratory periods, primarily April–May in springtime and August–September in fall, at least some individuals of this species likely traverse the WEA, as migration does not appear to be concentrated along the coast, both breeding and wintering sites include islands greater than 3 miles from the coast, and significant premigratory concentrations of this species have been observed in southeastern Cape Cod and Monomoy Island in late summer (Normandeau Associates Inc., 2011). Although there are no definitive observations of this species in offshore environments greater than 3 miles from the Atlantic Coast, this species may be very difficult to detect in offshore environments during migration because of nocturnal and/or high elevation migratory flights (Normandeau Associates Inc., 2011).

*Red Knot:* The Red Knot is a medium-sized shorebird in the sandpiper family. The North American breeding population of Red Knots is currently a candidate for ESA listing by the USFWS, largely based on severe population declines in recent years (Niles et al., 2007). In North America, this species breeds in the high Arctic and winters well to the south of Massachusetts (Harrington, 2001); hence, its potential occurrence within the WEA is restricted to migration. Wintering areas occur from the U.S. mid-Atlantic coast through southern South America (Harrington, 2001). The Red Knot forages for a variety of small animal prey while on the ground, or while wading in shallow water within coastal environments (Harrington, 2001). During the Red Knot's spring migratory stopover in the U.S. mid-Atlantic region, horseshoe crab eggs constitute an important food source, and one likely cause of recent Red Knot population declines has been excessive human harvesting of horseshoe crab eggs (Niles et al., 2007).

Migratory routes of this species are not very well characterized, but recent studies using birds tracked with light-sensitive geolocators, as well as analysis of large geospatial datasets of coastal observations, have begun to reveal some migratory patterns of Red Knots in the Atlantic OCS region (Burger et al., 2012a, 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011). These studies have revealed that migratory pathways of Red Knots through this region are fairly widespread and diverse, with some individuals traversing northern sections of the Atlantic OCS as they travel directly between northeastern United States migratory stopover sites and wintering areas or stopover sites in South America and the Caribbean, and others following the U.S. Atlantic coast or traversing the Atlantic OCS further to the south, as they move between U.S. Atlantic coastal stopover sites and wintering areas in the southern United States, Caribbean, or northern South America (Burger et al., 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011). Amid this migratory route variation, there appears to be more of a mid-Atlantic and southerly concentration of Red Knot coastal arrivals in spring, compared with a more northerly concentration, particularly in Massachusetts, of fall migrant activity and departure (Burger et al., 2012b; Niles et al., 2010; Normandeau Associates Inc., 2011); hence, more Red Knot migratory passage likely occurs through the WEA during fall migration than during spring migration.

#### 4.2.2.1.2 Impact Analysis of Alternative A

The PEIS (Section 5.2.9.2) discusses possible impacts from site characterization activities on marine and coastal birds. This analysis is incorporated here by reference. Several activities, including vessel traffic, meteorological towers, and meteorological buoys, associated with Alternative A could affect migratory birds including some threatened and endangered bird species. Impacts that may occur from these three sources vary in the way they would affect birds in the area, but the impacts are expected to be negligible.

### Routine Activities

*Increased Vessel Traffic*

Although vessel traffic would increase in the WEA with this project, proper vessel operating procedures and regulations would minimize the effects of this activity on birds. The potential release of wastes, debris, hazardous materials, or fuels would occur infrequently, and would occur at discrete points widely separated in both space and time. Such releases, to the extent that they occur, would cease following the completion of the activity, and would disperse rapidly in the open ocean resulting in a negligible effect. Noise from vessels could cause disturbance to birds using the WEA, but it is likely that birds would either acclimate or move away from the noise.

*Meteorological Towers*

Hundreds of millions of birds are estimated to be killed each year in collisions with communication towers associated with guy wires, windows, electric transmission lines, and other structures (Dunn, 1993; Klem, 1989; and 1990; Shire et al., 2000). Some birds (i.e., gulls, terns, shorebirds, petrels, shearwaters, sea ducks, and alcids) may collide with the meteorological towers out in the open ocean and be injured or killed.

BOEM anticipates that the meteorological towers contemplated in this EA would be self-supported structures and not require guy wires for support and stability (see Appendix B). Because of the small number of meteorological towers proposed and their distance from each other, relatively short height, and distance from shore, impacts on bird populations from collisions, should any occur, would be negligible. Under good weather conditions, most migratory bird species in the vicinity of the proposed lease areas (at least 12 nm from shore) would be flying at an altitude higher than the anticipated meteorological towers. However, individuals of some species (e.g., sea ducks, cormorants, loons, shearwaters, petrels, alcids, gannets) may fly lower.

Given the small number of anticipated structures scattered over a large area (five towers over 877 square nm) at distances greater than 12 nm from the coast, the proposed action is not expected to significantly affect birds in the WEA. Terns may perch on tower equipment, including handrails and equipment sheds. Lattice-type masts (Section 3.1.4, Figure 3-4) with numerous diagonal and horizontal bars are more likely to provide perching opportunities than monopole masts (Section 3.1.4, Figure 3-2). Perching does not pose a threat to the birds and may even be beneficial by providing roosting, loafing, and feeding locations for certain species.

Under poor visibility conditions, migratory species in the vicinity have the potential to collide with a meteorological tower. Also, lighting on tall structures during periods of fog and rain can disorient birds flying at night (Huppop et al., 2006). For instance, certain types of nighttime lighting, like steady burning lights, can confuse or attract birds when it is raining or foggy. Given the small number of structures contemplated and their distance from shore, migratory birds (including pelagic birds) colliding with meteorological towers is possible, but collisions would be rare and thus the impacts would be minor.

*Meteorological Buoys*

Meteorological buoys are much closer to the water surface than meteorological towers (buoys are generally less than around 39 ft [12 m] above sea level, while tower tops range from around 295 to 377 ft [90 to 115 m] above sea level). Most bird species would be flying above the buoy, so birds would not likely collide with a buoy. However, some individuals and species (e.g., shearwaters) may fly lower. Buoys also hold less equipment, so there would be fewer perching opportunities, although these opportunities would pose no threat to the birds. Even though there could be more buoys than towers (10 buoys over 877 square nm), the space between the buoys and the space between the buoys and shore would be great. As a result, the impacts of buoys on birds would be negligible.

*Migratory Birds*

Most migratory passerines would be flying well above the buoys and towers during the spring and fall migration. Other migratory birds would rarely encounter these structures because of the small footprint of the structures themselves and their distance from shore and great distances between buoys and towers. Low visibility and cloud ceiling could cause birds to fly lower and be more exposed to the tower and buoys, but the small number of structures in the ocean still makes exposure and risk unlikely. Therefore, the towers and buoys, as well as vessel activities within the proposed lease areas would not likely affect migratory birds.

*Bald and Golden Eagles*

Bald and golden eagles migrate and forage over land, inland water bodies, and bays and not the open ocean. The meteorological towers and buoys would be at least 12 nm offshore, thus the meteorological towers and buoys, including activities within the proposed lease areas, would not affect these eagles. Because the proposed action would not require expansion of existing onshore facilities and the vessel trips in coastal waters pose no threat to these animals, impacts on bald or golden eagles or their habitat would not be expected or would be negligible.

### *Endangered and Threatened Birds*

The roseate tern is listed as endangered under the ESA and may fly through the WEA during spring and fall migration as well as during the summer breeding season. During migration, roseate terns travel across the open ocean and may travel across the WEA when arriving during the spring or departing during the fall. Spring migration staging areas include Martha's Vineyard and Nantucket Island where birds congregate after arriving from spring migration but before dispersing to the breeding ground (Gochfeld et al., 1998; USFWS, 2008). Fall post-breeding and staging areas include eastern Cape Cod near the City of Chatham and Monomoy Island where birds congregate before departing for wintering grounds in South America (USFWS, 2008). Arrival from wintering grounds, departure from breeding grounds, and traveling to and from staging areas may involve roseate terns using areas within the WEA. Roseate tern may also potentially use the WEA during the breeding season while foraging. The closest roseate tern nesting colony to the WEA is located on Penikese Island in south Buzzards Bay. This colony is approximately 15.5 miles (25 km) to the northwest of the WEA. Although roseate terns have been documented traveling up to 15.5 miles (25 km) away from nesting colonies, most of the time they remain close to shore in shallow water (Burger et al., 2011). Possible roseate tern use of the WEA during migration and during the breeding season could expose them to meteorological towers and buoys in the WEA. The time of highest risk would be during migration when roseate terns could be migrating at night and meteorological towers would be less visible; foggy conditions may also increase collision risk. Despite slightly elevated levels of risk during low visibility periods, roseate tern exposure to towers and buoys is likely to be minimal given: 1) the long distance the of the WEA from any breeding colonies, 2) minimal time spent traveling in the WEA during migration and breeding, and 3) keen eyesight and diurnal activity (Gochfeld et al., 1998) will make the towers easy to see and avoid. Given these factors, the expected effects of the towers and buoys on roseate terns are likely to be negligible.

Piping plover primarily use coastal habitats for foraging and nesting, but may also use marine areas during migration or when flying among land masses. These species would rarely encounter the small number of buoys and towers given the small footprint of these structures and the great distances between buoys and towers. In addition, the piping plover's preference for coastal habitat (USFWS, 2008) makes it unlikely that birds would travel over the open ocean on a regular basis. Therefore, the towers and buoys, including activities within the proposed lease areas, would have a negligible effect on piping plover.

The Red knot, a candidate species for ESA listing, does not breed or winter in this area, so there would be no impacts on this species during these seasons. It may fly through the WEA during its spring and fall migration. Red knots are shorebirds and are not likely to use the open ocean habitats as a stopover and would likely be flying above the height range of the meteorological towers or buoys during migration. In addition, the towers and buoys occur infrequently throughout the area, which lowers the exposure even more. This small exposure suggests that impacts on red knots from meteorological tower and buoys would be negligible.

### *Non-Routine Events*

Birds could be exposed to operational discharges or accidental fuel releases from vessels that are involved with site characterization activities, surveys, and site assessment. Many species of birds (e.g., gulls) often follow ships and forage in their wake on fish and other prey that may be injured or disoriented by the passing vessel. By foraging behind boats, these birds may be affected by discharges of waste fluids (such as bilge water) generated by the vessels. As described in Section 4.2.1.5 on water quality, spill prevention and contingency plans would minimize the likelihood of waste discharges. Thus, impacts on marine and coastal birds from waste discharges from survey or construction vessels are expected to be negligible.

Marine and coastal birds may become entangled in or ingest floating, submerged, and beached debris (Heneman and the Center for Environmental Education, 1988; Ryan, 1987 and 1990). Entanglement may result in strangulation, the injury or loss of limbs, entrapment, or the prevention or hindrance of the ability to fly or swim, and any of these effects could be lethal or injurious. Ingestion of debris may irritate, block, or perforate the digestive tract, suppress appetite, impair digestion of food, reduce growth, or release toxic chemicals (Derraik, 2002; Dickerman and Goelet, 1987). However, the discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by the USCG (33 CFR 151, Annex V, Public Law 100–220 [101 Stat. 1458]). Thus, entanglement in or ingestion of project-related trash and debris by marine and coastal birds is not expected, and impacts on marine and coastal birds associated with project debris, if any, would be negligible.

#### *4.2.2.1.3 Conclusion*

Although birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, these potential impact-causing factors pose no threat of significant impacts on these animals. The risk of collision with towers would be minor given the small number of meteorological towers proposed, their size, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) is expected to be negligible, because buoys are much smaller and closer to the water surface than towers, and would be similarly dispersed over a wide area.

### *4.2.2.2 Bats*

#### *4.2.2.2.1 Description of the Affected Environment*

Nine bat species have been documented to occur in Massachusetts, with eight of these species' ranges extending into the eastern portion of the State (Table 4-6). There are no federally listed endangered species in eastern Massachusetts. However, hibernating bat species throughout the northeastern United States have experienced high mortality rates associated with White Nose Syndrome (USFWS, 2012b). This has led to a decline in hibernating bat populations, including the little brown bat, northern long-eared bat, and eastern small-footed bat. As a result, the scientific community has petitioned the USFWS to list these three species as endangered under the ESA, and they may be listed as early as 2013.

**Table 4-6**

**Bats of Massachusetts and their State and Federal Status**

| Common Name | Scientific Name | State Status | Federal Status | Cave hibernating bats | Migratory tree bats |
|---|---|---|---|---|---|
| Eastern small-footed bat | *Myotis lebeii* | E | | X | |
| Little brown bat | *Myotis lucifugus* | E | | X | |
| Northern long-eared bat | *Myotis septentrionalis* | E | | X | |
| Indiana bat[1] | *Myotis sodalis* | E | E | X | |
| Tri-colored bat | *Perimyotis subflavus* | E | | X | |
| Big brown bat | *Eptesicus fuscus* | | | X | |
| Eastern red bat | *Lasiurus borealis* | | | | X |

| Common Name | Scientific Name | State Status | Federal Status | Cave hibernating bats | Migratory tree bats |
|---|---|---|---|---|---|
| Hoary bat | *Lasiurus cinereus* | | | | X |
| Silver-haired bat | *Lasionycteris noctivagans* | | | | X |

[1]Does not occur in the eastern portion of Massachusetts

Like birds, migrating bats have been reported to use landmark aids during migration, following coastlines (Barclay, 1984; Tenaza, 1966), peninsulas (Jarzembowski, 2003), river valleys (Furmankiewicz and Kucharska, 2009), and mountain ranges (Baerwald and Barclay, 2009). For example, migratory tree-bats have been documented on a barrier island (Assateague Island National Seashore) off the coast of Maryland during migratory periods (Johnson and Gates, 2008), likely using the linear coastline as a landmark aid in migration.

Bats occur in the pelagic environment. As early as the 1920s, evidence of bats occurring offshore has been gathered through reports of bats landing on ships at sea (Carter, 1950; Mackiewicz and Backus, 1956; Norton, 1930; Peterson, 1970; Thomas, 1921), with migratory tree bats (hoary bats, eastern red bats, and silver-haired bats) making up a majority of offshore sightings (Stantec, 2012). Several records exist of eastern red bats and silver-haired bats found on ships up to 149 miles (240 km) from land (Mackiewicz and Backus, 1956). The farthest documented distance a bat was observed offshore was 500 miles (805 km) from Cape Race, Newfoundland (Griffin, 1940 as cited in Stantec, 2012). These sightings at sea were most often documented during the fall migratory period, and were, therefore, likely attributable to bats in the act of migrating (Stantec, 2012). During the fall migratory period, hoary bats have been routinely documented stopping over on Southeast Farallon Island, 29.8 miles (48 km) from the coast of California (Cryan and Brown, 2007). Additionally, migratory bats have been documented to occur on the island of Bermuda, roughly 670 miles (1,078 km) southeast of the North Carolina coast, during the fall migratory period (Stantec, 2012). Recent bat acoustic surveys have documented bat offshore occurrence. Stantec (2010) has been conducting bat acoustic surveys from 12 sites off the coast of Maine. An examination of temporal variation in migratory tree-bat activity indicated that hoary bat and silver-haired bat activity appeared to peak between early August and mid-October.

Migratory tree bats, considered long-distance migrants, as well as species from the *Myotis* genus, typically considered short-distance migrants, were detected at a site over 20 miles (32 km) from the mainland (Stantec, 2010). On an island 2.5 miles (4 km) from shore, bat activity was typically higher, indicating that as distance from shore increases, bat activity decreases. In an acoustic survey conducted along the Delmarva Peninsula, hoary bats, eastern red bats, bats belonging to the big brown bat/silver-haired bats species group (these two bat species are difficult to distinguish acoustically), and species belonging to the *Myotis* genus were detected as far as 11.9 miles (19.2 km) from shore, with an average distance of 6.6 miles (10.6 km) (NJDEP, 2010b). In a study conducted in the islands of the Scandinavian Peninsula, and the islands of southern Sweden and Denmark, 11 species of bats (both resident and migratory) were documented flying over the ocean up to 8.7 miles (14 km) from shore (Ahlen et al., 2007; Ahlen et al., 2009). Both migratory and resident bats were observed foraging over the ocean. Although bat activity may be sporadic in the open ocean, bat occurrence has been documented up to 500 miles (805 km) offshore (Griffin, 1940 as cited in Stantec, 2010) and, therefore, may occur in the WEA.

#### *4.2.2.2.2 Impact Analysis of Alternative A*

The most commonly observed bat species offshore are the migratory tree bats (hoary bat, eastern red bat, and silver-haired bat); although, non-migratory species may also occur in the WEA (see Section 4.2.2.2.1). Impacts on these species from Alternative A include avoidance or attraction to the installed structures (meteorological towers and buoys) as a result of perceived potential feeding and roosting opportunities (Cryan and Barclay, 2009).

### *Routine Activities*

*Site Characterization Activities*

If bats occur within the WEA, impacts from site characterization activities would be limited to avoidance or attraction responses to the vessels conducting surveys. Attraction or avoidance would be limited to nocturnal periods when bats are active and may be in the WEA. These potential avoidance and attraction responses are not anticipated to have any adverse effect on bats in the WEA.

*Site Assessment Activities*

Bats in the WEA may be impacted primarily by noise from meteorological tower and meteorological buoy construction that occurs at night, when bats are active. Bats rely heavily on auditory processes for orientation, communication with members of their same species, and prey capture; therefore, noise from the construction of meteorological towers and meteorological buoys may affect bats' communication and foraging behavior (Schaub et al., 2008). Construction completed during daylight hours when bats are not active and not present in the WEA, would not have an impact. Given the distance of the WEA from shore, the number of bats occurring within the WEA is expected to be low, and constructing a small number of structures over a large area far from shore (up to five meteorological towers or 10 meteorological buoys throughout the 877 square nm area) is expected to result in negligible impacts on bats. During the spring and fall when migratory tree-bats may be moving through the WEA, these bats may avoid or be attracted to the meteorological towers and/or meteorological buoys. However, any potential avoidance or attraction responses are expected to have negligible impacts on bats in the WEA.

### *Non-Routine Events*

Migratory tree bats may be blown off course by storms and high winds during the migratory period when these bats may be migrating over the ocean. While bats do not typically collide with stationary structures, bats have been found at the base of communication towers and large buildings during migratory periods after nights of inclement weather with low visibility (Crawford and Baker, 1981). Periods of inclement weather, especially during the fall migratory period, are when bat allision with meteorological towers within the WEA would be most likely, although the likelihood of such an event is very low because of the anticipated sporadic occurrence of bats in the WEA.

#### *4.2.2.2.3 Conclusion*

Bats foraging or migrating within the WEA is unlikely. Bat species with the highest potential for occurrence within the WEA include the three migratory tree bats (hoary bats, eastern red bats, and silver-haired bats). These bats may be driven into the WEA during inclement weather and may have an increased potential for meteorological tower allision, although even under these circumstances, the potential for allision would be very low. Bats in the WEA may display avoidance or attraction responses to the meteorological towers and meteorological buoys or research vessels conducting site characterization activities. These avoidance or attraction effects would only occur during the night when bats are active and are expected to be insignificant to bats that may occur in the WEA. The overall impact to bats by Alternative A would be negligible.

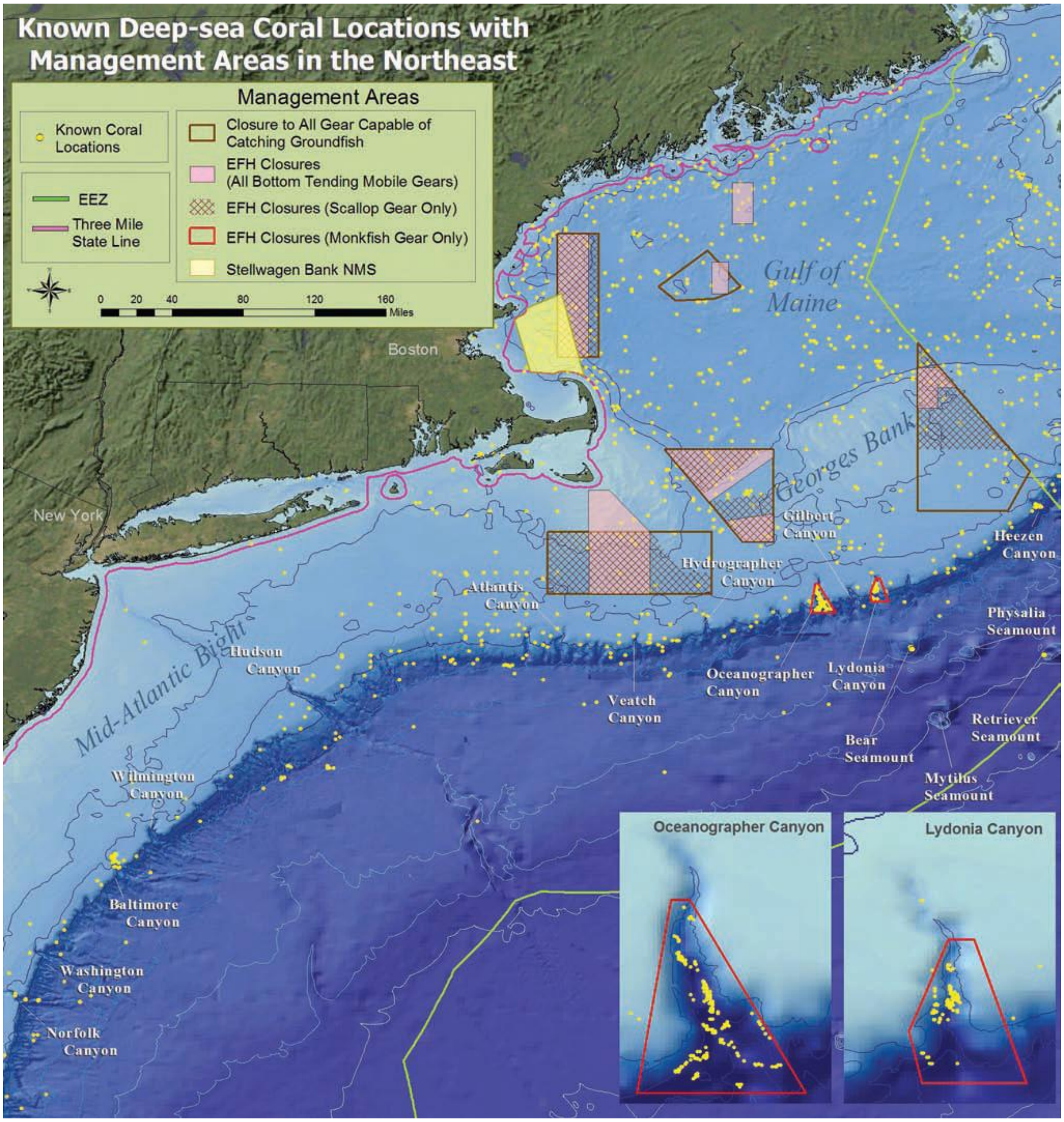
### *4.2.2.3 Benthic Resources*

#### *4.2.2.3.1 Description of the Affected Environment*

### *Reef Habitats*

Natural and artificial reefs form an important feature of the greater Georges Bank benthic habitat that extends to the WEA. Deep corals have been noted since the surveys of Verrill in the 19th century (Packer et al., 2007). Some of the specific locations with known occurrences include parts of the Gulf of Maine, Georges Bank, and a number of canyons that bisect the continental shelf and slope. Packer et al. (2007) also noted that the northeast region most likely does not have an abundance of large, structure-forming deep corals and deep coral habitats that are present in other regions. They collated data that indicated that in the Gulf of Maine and Georges Bank to the Cape Hatteras region, there are 16 species of stony corals, most of them solitary with

17 species in 7 families of gorgonians and 9 species in 3 families of true soft corals (Alcyonacea). Known coral locations within the WEA are shown in Figure 4-3 (Packer et al., 2007). The existence of more deep sea coral habitats than previously discovered is possible. At the time of writing this EA, a revised database of known deep sea corals, with considerably more records is being completed by NOAA (D. Dorfman, pers. comm.).



Source: Packer et al., 2007

**Figure 4-3. Known deep-sea coral locations with management areas in the northeast**

Artificial reefs include shipwrecks or other materials lost at sea, as well as materials (e.g., tires, subway cars, concrete or steel debris, rock) intentionally placed to support and enhance habitat or recreational fishing. Other, more limited uses for artificial reefs include commercial fisheries enhancement, subsistence fishing, recreational diving, habitat restoration or expansion, coastline protection, marine sanctuaries, mitigation for habitat loss, and as fisheries management tools (Rousseau, 2008). Off the coast of Massachusetts, four intentionally constructed artificial reef sites are located in Nantucket Sound (Yarmouth), Buzzards Bay (Dartmouth), Boston Harbor's Sculpin Ledge, and Brewster Island Reefs. No State-managed artificial reefs exist within the WEA, but shipwrecks and other obstructions provide artificial reef habitat.

Stevenson et al. (2004) reported that the greater Georges Bank area was divided into seven sedimentary provinces, which fit into the benthic assemblages developed by Theroux and Grosslein (1987). These assemblages were established to create a comprehensive relationship of bathymetric/morphologic subdivisions and faunal assemblages. Defining discrete boundaries between faunal assemblages is impossible, as there is substantial overlap of species between adjacent assemblages; however, the assemblages are distinguishable as described in Table 4-7.

**Table 4-7**

**Georges Bank Benthic Habitat Types**

| Habitat Type | Depth Range in feet (meters) | Description | Characteristic Benthic Macrofauna (benthic assemblage) |
|---|---|---|---|
| Northern Edge/Northeast Peak | 131–656 (40–200) | Dominated by gravel with portions of sand, common boulder areas, and tightly packed pebbles; strong tidal and storm currents. | Bryozoa, hydrozoa, anemones, and calcareous worm tubes are abundant in areas of boulders. |
| Northern Slope and Northeast Channel | 656–787 (200–240) | Variable sediment type (gravel, gravel-sand, and sand) and scattered bedforms; strong tidal and storm currents. | Transition zone between the northern edge and southern slope, characterized by benthic macrofauna common to both habitat types. |
| North/Central Shelf | 197–394 (60–120) | Highly variable sediment types (ranging from gravel to sand) with rippled sand, large bedforms, and patchy gravel lag deposits. | Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones. |
| Central and Southwestern Shelf–shoal ridges | 33–262 (10–80) | Dominated by sand (fine and medium grain) with large sand ridges, dunes, waves, and ripples; small bedforms in southern part. | Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones. |
| Central and Southwestern Shelf–shoal troughs | 131–197 (40–60) | Gravel (including gravel lag) and gravel-sand between large sandy ridges; patchy large bedforms, strong currents. | Minimal epifauna on gravel because of sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones. |
| Southeastern shelf | 262–656 (80–200) | Rippled gravel-sand (medium-and fine-grained sand) with patchy large bedforms with gravel lag; weaker currents; ripples are formed by intermittent storm currents. | Epifauna includes sponges attached to shell fragments and amphipods. |

| Habitat Type | Depth Range in feet (meters) | Description | Characteristic Benthic Macrofauna (benthic assemblage) |
|---|---|---|---|
| Southeastern slope | 1,312–6,562 (400–2,000) | Dominated by silt and clay with portions of sand (medium and fine), with rippled sand on shallow slopes and smooth silt sand deeper. | While Stevenson et al. (2004) did not describe an assemblage for this depth range, Steimle (1990) found brittlestars (*Amphioplus abdita*) as being dominant with bivalves (*Lucinoma* sp.) as occasionally being important. |

Source: Stevenson et al. (2004)

Although all the provinces in Table 4-7 are not in the immediate vicinity of the WEA, which occurs at depths between 98 and 197 ft (30 and 60 m), the closest province is described as the "Central and Southwestern Shelf–shoal ridges" (Stevenson et al., 2004). The characteristic benthic macrofauna for this zone is primarily amphipods, sand dollars, and burrowing anemones (Theroux and Grosslein, 1987). Benthic macroinvertebrates found in the silty sand off southern New England in water depths of 131–190 ft (40–58 m) include polychaetes, bivalves such as ocean quahog (*Arctica islandica*), amphipod crustaceans, anemones, and sea cucumbers (Provincetown Center for Coastal Studies, 2005). These benthic organisms are an important food source for northern groundfish (e.g., cod, haddock, yellowtail flounder, lobsters, crabs) in the area. Examples of other important sand fauna from Nantucket Shoals and Georges Bank include surf clams (*Spisula solidissima),* razor clams *(Ensis directus),* gastropods *(Polinices duplicates),* shrimp *(Crangon septemspinosus),* crabs *(Cancer irroratus),* sand dollars *(Echinarachnius parma),* brittle stars (*Ophiura Sarsi),* and sea squirt or tunicate (*Mogula arenata) (*Provincetown Center for Coastal Studies, 2005).

#### *4.2.2.3.2 Impact Analysis of Alternative A*

### *Routine Activities*

The main impacts on benthic resources would be crushing or smothering by anchors, the scour control system, driven piles, scour, or redeposition of suspended sediment during tower or buoy construction and deployment. Because most site characterization activities involve remote sensing of the seafloor, they would not directly impact benthic resources other than fish. Impacts on fish are addressed in Section 4.2.2.5.2. Site characterization activities that may disturb benthic resources include grab samples, borings, Vibracores, and CPTs. Impacts from site characterization activities are expected to be limited to the immediate area of the sample and any anchoring vessels. Additionally, the data collected during HRG surveys would indicate any potential sensitive benthic resources, such as those communities that occur on rocky reefs and deep-sea corals, so that the lessee can develop and implement appropriate avoidance measures prior to each sub-bottom sampling activity, avoiding the cost of unnecessary or additional sampling. BOEM anticipates that that the bottom disturbance associated with site assessment activities would impact the seafloor for a maximum radius of 1,500 ft (~450 m) or 162 acres around each bottom-founded structure, including all anchorages and appurtenances of the support vessels. This would result in a total of approximately 1.26 square miles (810 acres) of impacted seafloor in the WEA, or approximately 0.1 percent of the area of the entire WEA under Alternative A, if all five anticipated meteorological towers (one per leasehold) were installed and they each disturbed the maximum estimated area of seafloor. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would likely be approximately twice that of the towers, or 2.53 square miles (1,620 acres) of impacted seafloor, which is approximately 0.2 percent of the total WEA under Alternative A.

As described in Section 3.1.4.1, the area of ocean bottom affected by a meteorological tower would range from 200 square ft (19 square m) if supported by a monopole to 2,000 square ft (186 square m) if supported by a jacket foundation. While the bottom disturbance associated with buoy (if used) and vessel anchors would measure 784 square ft (73 square m). A scour control system, if used, would comprise installed rock armor or artificial seaweed mattresses attached to the seafloor by anchoring pins and would cover an area of approximately a 30 ft (9 m) radius surrounding the piling. If rock armor scour protection were used, the maximum seabed impacted for a single meteorological tower would cover approximately 16,000 square ft (0.37 acres) (ESS Group, Inc., 2006a). An artificial seagrass mat would disturb a maximum of 7,800 square ft of seabed, as further discussed in Chapter 3.1.4.1. If the proposed maximum of five meteorological towers were built, then the total area expected to be impacted by scour control systems or actual scour would be approximately 10,000 square ft (0.23 acres) (2,000 square ft x five meteorological towers). In some areas that are not expected to be subject to scour, or where expected scouring would not compromise the integrity of the structure, scour protection may not be required. However, if scouring does occur at a given location, the area impacted would be similar to or slightly larger than the projected area covered by a scour control system. The introduction of meteorological structures in the benthic environment would increase the hard surface available to support benthic marine organisms, thus increasing their habitats. This relationship is similar to the artificial reefs described in Section 4.2.2.3.1. Scour mats, in addition to providing scour protection, can potentially provide habitat to marine organisms that undergo settlement into the stabilized sediment trapped therein.

Upon decommissioning and removal, the equivalent area would be disturbed by severing the pile foundation at least 15 ft (4.5 m) below the mudline (30 CFR 285.910). Removing the scour control system would displace the same area disturbed when they were installed and would introduce a nearby turbid cloud over the seafloor at each leg. Resuspended sediment would temporarily interfere with filter feeding organisms until the sediment has resettled. The time of sediment suspension would depend upon ocean currents and sediment grain size, but is anticipated to be short lived. According to BOEM (2012a), depending on the actual species density and diversity in the immediate area at the time of disturbance, soft-bottom communities may take between 1 and 3 years to recover, in terms of number of individuals, to pre-disturbance levels. Brooks et al. (2006) suggest that the recovery of benthic assemblages occurs within 3 months to 2.5 years, with the caveat that these estimates are based on limited studies. These estimates are supported by Michel et al. (2007), who summarize the results of 7 years of monitoring at the Horns Rev Wind Park in Denmark. In this study, no statistically significant changes occurred in the abundance or biomass of the majority of the designated benthic indicator organisms between 2 years of pre-construction data and 3 years of post-construction data. However, Michel et al. (2007) also noted an increase in fouling organisms, or benthic communities that are very different than the native soft sediment benthos. This increase in overall biomass of the benthic community was also reported by Carney (2005); however, little is known about ecological impacts on the native communities. Other research also suggests that recovery of community composition or trophic structure that exploits all ecologic niches available may take longer than 1 to 3 years (Continental Shelf Associates, Inc., 2004).

The duration of activity directly impacting benthic communities from site characterization surveys, meteorological platform installation, and removal would likely be short term (8 days to 10 weeks for construction and ≤ 1 week for removal), and, given the limited area of disturbance within the WEA, the impact to benthic habitats would be minor.

#### *Non-Routine Events*

Collisions between vessels and allisions between vessels and meteorological towers and buoys is considered unlikely (see Section 3.1.4 of this EA). However in the unlikely event that a vessel allision or collision would cause a spill, the most likely pollutant to be discharged would be diesel fuel. If a diesel fuel spill were to occur, it would be expected to dissipate very rapidly in the water column, then evaporate and biodegrade within a few days, resulting in negligible impacts to the area of the spill.

#### *4.2.2.3.3 Conclusion*

Impacts of site characterization surveys, and construction, operation, and removal of meteorological towers and buoys on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and minor. The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. These impacts would be localized, given the areal extent of the benthic habitat types on the continental shelf, and would occur in approximately 0.1 to 0.2 percent of the WEA. If a specific area is adversely impacted, the ability of soft-bottom communities to recover, in number and diversity of individuals, to pre-disturbance levels make take 1 to 3 years. Recovery of community composition or trophic structure that exploits all ecologic niches available in that particular area may take longer (Continental Shelf Associates, Inc., 2004). The data collected during HRG surveys would indicate the presence of any potential benthic resources, so that sensitive habitat types, such as hard-bottom and live-bottom habitats, could be avoided by the lessee during sub-bottom sampling and when the meteorological facility siting decisions are made. The proposed action would not result in significant impacts on benthic communities. The duration of activity impacting benthic communities would likely be short term and given the limited area of disturbance within the WEA, impacts on benthic habitats from the proposed action are expected to be minor.

#### *4.2.2.4 Coastal Habitats*

##### *4.2.2.4.1 Description of the Affected Environment*

Massachusetts has approximately 92 miles (148 km) of oceanfront coastline along the Atlantic Ocean and over 1,519 miles (2,445 km) of shoreline. Massachusetts is home to three of the minor ports identified in Section 3.1.2 of this EA (Fall River, Falmouth, and Fairhaven/New Bedford) and 16 associated scientific support port/harbor facilities. The coastal resources of Massachusetts include seagrass beds, kelp beds, shellfish beds, sandy sediments (sand dunes), rocky shore, mudflats, saltmarshes, estuarine wetlands, and open water. A general description of these habitat types is provided in the following sections.

Seagrasses provide shelter for small fish, crustaceans, epiphytic algae, and other animals, and are important nursery areas for commercially valuable species such as bay scallops (*Argopecten irradians*), blue mussels (*Mytilus edulis*), and winter flounder (*Pseudopleuronectes americanus*) (Donovan and Tyrell, 2004). The closest seagrass beds to the WEA occur only on the northern shores of Martha's Vineyard and Nantucket; thus, they will not be considered further for this analysis.

Kelp inhabits the rocky subtidal zone forming kelp beds. The most common species in Massachusetts are sugar kelp (*Laminaria saccharina*), oarweed (*L. digitalis*), and shotgun kelp (*Agarum clathratum*). They are generally found in clear, cold waters attached to rock substrates, and are likely mostly limited to areas north of Cape Cod. Because of this distribution, they will not be considered further in this analysis.

Bivalve mollusks such as oysters, scallops, quahogs (*Mercenaria mercenaria*), and soft-shelled clams form dense groupings that create the shellfish bed habitat. This habitat supports polychaete worms, juvenile crabs, snails, and seastars in spaces between shells; while other organisms including slipper shells, sponges, hydroids, algae, and bryozoans attach to the shells' hard surface (Donovan and Tyrell, 2004). In the northernmost portion of the WEA, there are areas, defined as Shellfish Suitability Areas by the Massachusetts DMF, that are believed to be suitable for sea scallops, ocean quahogs, and surf clams.

Sandy sediments include sand dunes above the high tide line, the intertidal beach, and the sandy reaches below the surf. Sand is moved by the tides, winds, and storm surges, forces that are responsible for forming this habitat. The upper section of sandy beaches and sand dunes provide nesting areas for bird species, such as the endangered roseate tern (*Sterna dougallii*), the threatened Northern harrier hawk (*Circus cyaneus*), and piping plover (*Charadrius melodus*), and the common tern (*Sterna hirundo*) and least tern (*S. antillarum*). On the subtidal seafloor, some burying organisms proliferate, including moon snails, whelks, sand dollars (*Echinarachinius parma*), and American sand lances (*Ammodytes americanus*). Other species include flounders, gobies, skates, shrimp, surf clams (*Spisula solidissima*), coquina clams (*Donax variabilis*), hermit crabs, and other shellfish and crustaceans (Donovan and Tyrell, 2004). According to the Massachusetts Environmental Sensitivity Index data compiled in 2000 (NOAA, 2000), the majority of the southern coastline of Martha's Vineyard and Nantucket Island is comprised of sandy and gravel beaches.

High wave action removes fine-grained sediment from rocky habitats, leaving a range of larger material from solid rock ledges and boulders to cobble and gravel. Dark lichen thrives in the splash zone with barnacles in the high intertidal zone and mussels in the mid-intertidal zone, which is exposed as the tide retreats. Along the Massachusetts coast, the low intertidal zone is normally dominated by a dense mat of algae called Irish moss (*Chondrus cripsus*) and false Irish moss (*Mastocarpus stellatus*). Mobile inhabitants of the subtidal zone include lobsters, crabs, sea urchins, and a variety of fish species (Donovan and Tyrell, 2004).

Salt marshes are low-lying vegetated wetlands that are described as being either "low marsh area" (flooded twice daily) or "high marsh area" (flooded only during storms or spring tides). Low marshes in Massachusetts are dominated by the tall form of salt marsh cordgrass (*Spartina alterniflora*), while high marshes are composed of salt-tolerant flora including the short form of cord grass, salt meadow hay (*Spartina patens*), black grass (*Juncus geradii*), and spikegrass (*Distichlis spicata*). Common inhabitants of saltmarshes include mummichugs (*Fundulus heteroclitus*), striped bass (*Morone saxatilis*), quahogs, mussels, oysters, snails, green crabs, and fiddler crabs. Menhaden (*Brevoortia tyrannus*), winter flounder, and striped bass use salt marshes as breeding or nursery habitats (Donovan and Tyrell, 2004). Salt marshes also provide important forage habitat for a number of bird species, some of which breed and forage only in salt and brackish marshes (obligate species) and others that breed and forage in other habitats as well (facultative species).

### *Estuarine Wetland Ecosystems*

Estuarine wetlands consist of deepwater and wetland habitats subject to tidal flow. These areas are regularly inundated by the tides but are also diluted by freshwater runoff from the land (Stedman and Dahl, 2008). A broad description of wetland habitats in the Atlantic region is provided in the PEIS (MMS, 2007a), and that description is incorporated here by reference.

Thus, this section of the EA focuses on those wetlands found in proximity to major and minor ports that may be subject to increased ship traffic or other land-based activities required to support the proposed action. Twenty-seven ports have been identified within the region as likely to be used to support site assessment activities for the proposed action (see Section 3.1.2, Port Facilities). Major ports extend from Boston, MA, to Staten Island, NY, and minor ports from Falmouth, MA, to Islip, NY. Wetlands classified by Cowardin et al. (1979) as salt marshes, scrub-shrub wetlands, and forested wetlands are specifically addressed.

Salt marshes are one of the world's most productive ecosystems, and are the dominant wetland habitat from Massachusetts to New York (Mitsch and Gosselink, 2000). Scrub-shrub wetlands are often associated with the upper portions of a salt marsh. This wetland type is absent in the north, and found more frequently in the south from Rhode Island to New York. No forested estuarine wetlands are located within the vicinity of port facilities.

Many of the ports are either sufficiently armored, exposed to the energy of the open coast, or have coastlines that are too rocky to support vegetated wetlands. Port facilities with no wetlands (i.e., salt marshes, scrub-shrub wetlands, or forested wetlands) in close proximity include six ports in Massachusetts (Gloucester, Boston, Chelsea, Falmouth, Fairhaven, and New Bedford), five in Connecticut (Stonington, Groton, Avery Point, New London, and New Haven), three in Rhode Island (Newport, Quonset Point, and Kingston), and all of the New York ports except Montauk. Several ports that may be used to support the proposed action do have wetlands in close proximity. The presence of wetlands in certain ports reflects the availability of habitat in coves, inlets or back barrier areas that are conducive to the development of tidal marshes. Salt marshes occur along the shorelines of Fall River (MA), Westbrook and Clinton Harbors (CT), Providence, Davisville, and Galilee (RI), and Montauk (NY). Galilee and Montauk also have small pockets of scrub-shrub wetlands.

#### *4.2.2.4.2 Impact Analysis of Alternative A*

The proposed leases would be located approximately 12 nm from the nearest shoreline along Martha's Vineyard. Therefore, site characterization surveys, construction, operation, and decommissioning activities of meteorological towers/buoys occurring within the proposed lease areas would have no direct impacts on wetlands or other coastal habitats. Only coastal vessel traffic and use of coastal facilities have the potential to impact coastal habitats. However, as discussed below, coastal vessel traffic associated with Alternative A and the use of existing coastal and port facilities could contribute to impacts on coastal habitats.

### *Routine Activities*

Existing fabrication sites, staging areas, and ports in Massachusetts, Rhode Island, and Connecticut would support survey, construction, operation, and decommissioning activities as discussed in Section 3.1.4.4. No expansion of these existing areas is anticipated in support of the proposed action. Existing channels could accommodate the vessels anticipated to be used, and no additional dredging would be required as a result of the proposed action.

Indirect impacts from routine activities may occur from wake erosion caused by vessel traffic in support of the proposed action. A maximum of approximately 6,500 vessel trips from site characterization and assessment activities associated with Alternative A are projected to occur over a 5-year period, if the entire WEA were leased and the maximum number of site characterization surveys were conducted in the leased areas of the WEA. These trips would be divided among New Bedford, Providence, Quonset Point, New London, and Groton, adding an insignificant increase to traffic in already heavily used waterways. If all ports are used equally, this would average 268 round trips per year to each of the ports in Massachusetts, Rhode Island, and Connecticut.

Wake erosion and sedimentation effects would be limited to approach channels and the coastal areas near ports and bays used to conduct activities. Given the existing amount and nature of vessel traffic (including tanker ships, container ships, and other very large ships) into and out of the ports (see Section 4.2.3.8), there would be a negligible, if any, increase to wake-induced erosion of associated channels based on the relatively small size and number of vessels associated with Alternative A. Moreover, all approach channels to ports used are armored and speed limits would be enforced, which also helps to prevent most erosion.

### *Non-Routine Events*

Spills can occur within a channel or bay from several activities, such as transit of WEA-related vessels to or from the ports, survey activities in the WEA, or installation, maintenance, and decommissioning of meteorological towers and buoys. Should a spill occur within a channel or bay and contact shore, the impacts on coastal habitats would depend greatly on the type of material spilled, the size and location of the spill, the meteorological conditions at the time, and the speed with which cleanup plans and equipment could be employed. These impacts are expected to be minimal because the average spill size is likely to be small (approximately 88 gallons; see Section 3.2.3), and vessels are expected to comply with USCG regulations at 33 CFR 151 relating to the prevention and control of oil spills. Based on the distance from shore for which these activities would occur and the rapid evaporation and dissipation of diesel fuel, a spill occurring within the WEA would likely not contact shore. Collisions between vessels and allisions between vessels and meteorological towers and buoys are considered unlikely. However, if a vessel collision or allision was to occur, and in the unlikely event that a spill would result, the most likely pollutant to be discharged into the environment would be diesel fuel. Diesel is expected to dissipate very rapidly in the water column, then evaporate and biodegrade within a few days (see Section 3.2.3 of this EA), resulting in negligible, if detectable, impacts to the area of the spill.

#### 4.2.2.4.3 Conclusion

No direct impacts on wetlands or other coastal habitats would occur from routine activities in the WEA based on the distance of the WEA from shore. Existing ports or industrial areas in Massachusetts, Rhode Island, and Connecticut are expected to be used in support of the proposed project. In addition, no anticipated expansion of existing facilities is expected to occur as a result of Alternative A. Indirect impacts from routine activities may occur from wake erosion and associated added sediment caused by increased traffic in support of the proposed action. Given the volume and nature of existing vessel traffic in the area, a negligible increase of wake-induced erosion may occur. Should an incidental diesel fuel spill occur as a result of the proposed action, the impacts on coastal habitats would be negligible.

### 4.2.2.5 Finfish, Shellfish, and Essential Fish Habitat

#### 4.2.2.5.1 Description of the Affected Environment

## Finfish

The Northeast U.S. Shelf Ecosystem includes a broad range of habitats with varying physical and biological properties. These habitats range from the cold waters of the Gulf of Maine south to the more tempered climate of the Mid-Atlantic Bight; thus, oceanographic and biological processes interact to form a network of expansively to narrowly distributed habitat types (Stevenson et al., 2004). The Northeast Shelf ecosystem ranges from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea off shore to the Gulf Stream. Stevenson et al. (2004) further subdivides the area into four distinct sub-regions: the Gulf of Maine, Georges Bank, Mid-Atlantic Bight, and the continental slope. Occasionally, another sub-region, Southern New England, is described (Stevenson et al., 2004).

Table 4-8 lists the major demersal finfish assemblages of the Northeast continental shelf that occur in the vicinity of the WEA. The WEA supports both the intermediate and shallow finfish assemblages as defined by Overholtz and Tyler (1985). Many of the fish species in these assemblages are important because of their value in the commercial and/or recreational fisheries. However, some of these species are of special concern as a result of their depleted population status (BOEMRE, 2011b). All the species play some role in the ecosystem of the Northeast Shelf as a predator, prey, or in some other defined niche in the ecosystem. In addition to these demersal finfish, there are also important pelagic finfish found in the area of the WEA. Important managed shellfish in the Northeast continental shelf include Atlantic sea scallop (*Placopecten magellanicus*), long-finned squid (*Loligo pealeii*), short-finned squid (*Illex illecebrosus*), surf clam (*Spisula solidissima*), and ocean quahog (*Artica islandica*). Federally managed demersal fishes in the area include winter flounder (*Pseudopleuronectes americanus*), yellowtail flounder (*Limanda ferruginea*), and monkfish (*Lophius americanus*). Examples of Federally managed pelagic species in the WEA include Atlantic herring (*Clupea harengus*), Atlantic bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*Thunnus albacares*), king mackerel (*Scomberomorus maculates*), and whiting (*Merluccius bilinearis*). A complete list of the species with Essential Fish Habitat (EFH) designations in the WEA, as defined by the Magnuson-Stevens Fishery Conservation and Management Act, is included further on in this section of the EA.

**Table 4-8**

**Demersal Fish Assemblages in the Vicinity of the WEA**

| **Assemblage** | **Species** |
|---|---|
| Intermediate | silver hake, red hake, goosefish (monkfish), Atlantic cod (*Gadus morhua)*, haddock (*Melanogrammus aeglefinus*), ocean pout (*Macrozoarces americanus*), yellowtail flounder (*Scophthalmus aquosus*), winter skate (*Leucoraja ocellata*), little skate (*Raja erinacea*), sea raven (*Hemitripterus americanus)*, longhorn sculpin (*Myoxocephalus octodecemspinosus*) |
| Shallow | Atlantic cod, haddock, pollock, silver hake, white hake, red hake, goosefish (monkfish), ocean pout, yellowtail flounder, windowpane flounder, winter flounder, winter skate, little skate, longhorn sculpin, summer flounder (*Paralichthys dentatus*), sea raven, sand lance (*Ammodytes americanus*) |

Source: Overholtz and Tyler, 1985

### *Invertebrates*

Northern shortfin squid (*Illex illecebrosus*) and longfin squid (*Loligo pealeii*) compose an important commercial fishery in Nantucket Sound (ESS Group, Inc., 2006b). Longfin inshore squid occur from Newfoundland to the Gulf of Venezuela, and occur in commercial abundance in the United States from Georges Bank to Cape Hatteras (Jacobson, 2005). Northern shortfin squid use oceanic and neritic habitats and adults are believed to make long-distance migrations between boreal, temperate, and subtropical waters. Data indicate that northern shortfin squid are distributed on the continental shelf of the United States and Canada, between Newfoundland and Cape Hatteras, NC (Hendrickson and Holmes, 2004).

Although Nantucket Sound does not appear to support a major fishery for American lobster (*Homarus americanus*; ESS Group, Inc., 2006b), they are present in the WEA and are an important commercially harvested invertebrate within the broader Southern New England-New York Bight. This species is distributed in coastal rocky habitats and muddy burrowing areas with sheltering habitats and offshore in the submarine canyon areas along the continental shelf edge. Lobsters have been found to use the following substrates: mud/silt, mud/rock, sand/rock, bedrock/rock, and clay (Cooper and Uzmann, 1980). However, firm, complex, rocky substrate is the preferred habitat for all life stages of the lobster. Post-larval and juvenile lobsters tend to stay in shallow, inshore waters (Lawton and Lavalli, 1995), but adolescent and adult lobsters are highly adaptable in their choice of substrate and can be found on nearly all substrate types.

Conch were the highest federally reported species harvested within Nantucket Sound from 1994 to 2004 (ESS Group, 2006b). The term "conch" is the generic classification for a variety of whelks found in Southern New England waters, including knobbed whelk (*Busycon carica*), channeled whelk (*Busycotypus canaliculatus*), and lightning whelk (*Busycon contrarium*). Channeled whelk, which are found in water depths of 1 to 131 ft (0 to 40 m) (Rosenberg, 2009), tend to be the most prevalent in commercial catches. Other shellfish with important commercial fisheries within Nantucket Sound include bay scallops (*Argopecten irradians)*, Atlantic sea scallops (*Placopecten magellanicus*), blue mussels (*Mytilus edulis*), ocean quahogs (*Arctica islandica),* sea clams (various species), and soft shell clams (*Mya arenaria*) (ESS Group, Inc., 2006b; Malkoski, 2003). Bay scallops are found in the subtidal zone, sandy and muddy bottoms, and offshore in shallow to moderately deep water. Atlantic sea scallops are generally found from 82 to 650 ft (25 to 200 m) in waters south of Cape Cod, mainly on sand and gravel sediments where bottom temperatures remain below 68°F (20°C) (Hart, 2006). Blue mussels are most common in the littoral and sublittoral zones (< 325 ft [99 m] depths) of oceanic and polyhaline to mesohaline estuarine environments; however, the species can also be found in deeper and cooler waters (328 to 1,637 ft [100 to 499 m] depths; Newell, 1989). The greatest concentrations of ocean quahogs occur in offshore waters south of Nantucket to the Delmarva Peninsula (Cargnelli et al., 1999). Most ocean quahog individuals are found at depths from 82 to 167 ft (25 to 51 m); however, some are found at depths as shallow as 45 ft (14 m) and as deep as 840 ft (256 m) (Cargnelli et al., 1999). Adult softshell clams live in sandy, sand-mud, or sandy-clay bottoms, with their highest densities at depths of 10 to 13 ft (3 to 4 m) (Abraham and Dillon, 1986).

#### *ESA-Listed Threatened and Endangered Fish*

Several fish species on the continental shelf of the northwest Atlantic Ocean are federally listed as endangered, threatened, candidates for listing, or species of concern. Atlantic salmon (*Salmo salar;* Gulf of Maine population only), four populations of Atlantic sturgeon (*Acipenser oxyrinchus oxyrincus*; New York Bight, Chesapeake Bay, Carolina, South Atlantic), and shortnose sturgeon (*Acipenser brevirostrum*) are the only fish species currently listed as endangered under the ESA that are found in the northwest Atlantic Ocean. The Gulf of Maine population of Atlantic sturgeon is considered threatened. All three species are anadromous, living much of their adult lives in the ocean but returning to rivers to spawn.

Other species have been proposed for endangered status and not deemed candidates—or are currently candidates for listing and the status determination has not been made yet—these species are known as Federal "species of concern" and are discussed in the section below. Table 4-9 lists all species with ESA designations within the vicinity of the WEA.

**Table 4-9**

**Fish Species in the Northwest Atlantic Ocean Listed as Endangered, Threatened, Candidate Species, or Species of Concern under the ESA**

| Species | Status |
|---|---|
| Atlantic salmon (*Salmo salar*) – Gulf of Maine | E |
| shortnose sturgeon (*Acipenser brevirostrum*) | E |
| Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)–New York Bight | E |
| Chesapeake Bay | E |
| Carolina | E |
| South Atlantic | E |
| Gulf of Maine | T |
| Atlantic bluefin tuna (*Thunnus thynnus*) | S |
| Atlantic halibut *(Hippoglossus hippoglossus)* | S |
| Atlantic wolffish *(Anarhichas lupus)* | S |
| dusky shark *(Carcharhinus obscurus)* | S |
| porbeagle shark *(Lamna nasus)* | S |
| rainbow smelt *(Osmerus mordax)* | S |
| sand tiger shark *(Carcharias taurus)* | S |
| thorny skate *(Amblyraja radiata)* | S |
| alewife *(Alosa pseudoharengus)* | C/S |
| blueback herring *(Alosa aestivalis)* | C/S |
| cusk *(Brosme brosme)* | C/S |
| American eel (*Anguilla rostrata)* | C* |
| basking shark *(Cetorhinus maximus)* | C |
| scalloped hammerhead shark *(Sphyrna lewini)* | C |

*The USFWS is the lead Federal agency responsible for conservation of American eel

E = endangered
T = threatened
C = candidate
S = species of concern

Shortnose sturgeon can be found off the New England coast during oceanic life stages (Collette and Klein-McPhee, 2002). Shortnose sturgeon are not likely to be encountered in the WEA because they make very limited use of the offshore marine environment (Bain et al., 2007; Kynard, 1997). Therefore they are not discussed further in this section.

It is possible that adult Atlantic salmon may occur off the Massachusetts coast while migrating to rivers to spawn. Only certain Gulf of Maine populations of Atlantic salmon are listed as endangered, and it is unlikely that Gulf of Maine salmon would be encountered south of Cape Cod. Therefore they are not discussed further in this section.

*Atlantic sturgeon (Acipenser oxyrhincus):* The Atlantic sturgeon is an anadromous species that may be found in rivers and nearshore habitats throughout the Atlantic Coast. In Massachusetts, it uses the Taunton and Merrimack rivers for feeding and spawning habitat, and has been captured in offshore trawl and gillnet fisheries (Stein et al., 2004) but is rarely seen in State or Federal fishery-independent surveys (Dunton et al., 2010). Primary threats to Atlantic sturgeon include bycatch in trawl and gillnet fisheries, habitat degradation and loss, ship strikes, and general depletion from historical fishing (MADFW, 2008).

A status review for Atlantic sturgeon was completed in 2007 and eventually resulted in the listing of the Chesapeake Bay, New York Bight, Carolina, and South Atlantic populations of this species as endangered, and the Gulf of Maine population as threatened. The Gulf of Maine and New York Bight populations are geographically closest to the WEA and, therefore, any Atlantic sturgeon encountered there are likely to be from one of those two stocks. However, NMFS considers the WEA to be in the marine mixing component for all five distinct population segments (DPS) and thus all five DPS may be affected by the proposed action. Little is known about their movements and residence when at sea, but they are known to largely stay within shallow, coastal waters and thus would not be expected in the WEA unless passing through during migration. Threats in the area include bycatch in commercial fisheries, impediments to migration such as dams, historical overfishing, and pollution (MADFW, 2008).

### *Species of Concern*

Fish that are listed as species of concern under the ESA and are managed by the State and/or NOAA/NMFS in Massachusetts waters are fish have either been deemed to not need additional Federal protection at this time or will be monitored for possible ESA listing in the future (Table 4-9; NMFS, 2010a). Those species are described below.

*River herring:* Alewife and blueback herring, collectively known as "river herring," are species managed by the Commonwealth of Massachusetts under the DMF. Both species are anadromous and their declining numbers are attributed to loss of habitat due to decreased access to spawning areas from the construction of dams and other impediments to migration, habitat degradation, and fishing and increased predation due to recovering striped bass populations (NMFS, 2009a). On November 2, 2011, NOAA announced a 90-day finding for a petition to list alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) as threatened under the ESA and that this petition may be warranted (NOAA, 2011a). A status review of these two species was initiated and there will be a 12-month finding on whether the two species should be listed.

*Rainbow smelt (Osmerus mordax*): Similar to herrings, this species is found throughout the northeastern United States. They remain close to shore in estuaries, swim up streams and rivers to enter spawning grounds and then may migrate out to sea. Their decline is attributed to decreased access to spawning areas, habitat degradation and fishing pressure (NMFS, 2007).

*American eel (Anguilla rostrata*): American eel are found in fresh, brackish, and coastal waters from Greenland to northeastern South America. American eels begin their lives as eggs hatching in the Sargasso Sea. They take years to reach freshwater streams where they mature, and then they return to their Sargasso Sea birth waters to spawn and die. As a migratory catadromous species, the American eel may pass through the WEA but there is no data available to assess the population status in the WEA. Population status of the species in Massachusetts is considered stable. Threats to American eel include habitat loss, including riverine impediments, pollution and nearshore habitat destruction, and fishing pressure (Greene et al., 2009). On 29 September 2011, NOAA announced a 90-day finding for a petition to list American eel as threatened under the ESA and that this petition may be warranted (NOAA, 2011b). A status review was initiated and based on that review, from a 12-month finding, NOAA will make a listing determination.

*Atlantic bluefin tuna (Thunnus thynnus)*: Atlantic bluefin tuna is a highly migratory, pelagic species that is found from the Gulf of Mexico to Newfoundland in coastal and open ocean environments. Spawning is principally in the Gulf of Mexico and in the Florida Straits (NMFS, 2011a). Foraging occurs for both adults and juveniles in the waters along the western Atlantic coast, where they consume prey such as mackerel, herring, and squid (Collette and Klein-McPhee, 2002). It is not assessed within the States of Massachusetts and Rhode Island. As a highly migratory species the Atlantic bluefin tuna may use the waters of the WEA as a foraging ground, but there is no distinct population in this area. Threats to the species are largely in the form of fishing pressure, bycatch, and pollution such as major oil spills (Collette et al., 2011).

A*tlantic halibut (Hippoglossus hippoglossus):* As the largest species of flatfish in the northwest Atlantic Ocean, Atlantic halibut is a long-lived, late-maturing flatfish distributed between Labrador to southern New England (Bigelow and Schroeder, 1953; Brodziak and Col, 2006). The species was heavily overfished in the 19th and 20th centuries, and there has not been any recovery following this. As a result, this species is of concern because the Atlantic habitat stock in Gulf of Maine-Georges Bank has remained in a depleted condition (Brodziak and Col, 2006).

*Atlantic wolffish (Anarhichas lupus):* Atlantic wolffish is a sedentary and mostly solitary species that occurs in the northwest Atlantic Ocean from Davis Straits off Greenland to Cape Cod, and sometimes occurs in southern New England and New Jersey waters (Collette and Klein-McPhee, 2002; Keith, 2006). While they are typically found in 262 to 394 ft (80 to 120 m) within the Georges Bank-Gulf of Maine region, they are also found in waters from 131 to 787 ft (40 to 240 m) (Keith, 2006; Nelson and Ross, 1992). This species is of concern because biomass indices from the Northeast Fisheries Science Center (NEFSC) spring and fall surveys and commercial landings are at extremely low levels (Keith, 2006). They have been listed as a species of concern for several reasons, one of which is that they are primarily taken as bycatch in the otter trawl fishery (NMFS, 2009b). At this time, though, there is no fishery management plan in place for Atlantic wolfish (Keith, 2006).

C*usk* (*Brosme brosme):* Cusk, a species managed federally by NOAA\NMFS, are slow growing deep water fish that generally range from New Jersey to the Strait of Belle Isle and on the Banks of Newfoundland. In the United States, cusk are distributed primarily in the deeper water of the central Gulf of Maine. The major threat to this species is commercial fishing activities (NMFS, 2009c). Threats to cusk include habitat degradation from trawls and dredges and fishing mortality due to bycatch of the trawl fishery (NMFS, 2009c).

*Dusky shark* (*Carcharhinus obscurus*): Dusky shark is designated as vulnerable globally by the International Union for Conservation of Nature (IUCN) and as endangered by NOAA. They can live up to 40 years reaching sexual maturity around 19 to 21 years. They occur from southern Massachusetts and Georges Bank to Florida, the Bahamas and Cuba. Threats to the population include bycatch from longline gear and illegal landings in both recreational and commercial shark fisheries (NMFS, 2011b).

*Basking shark (Cetorhinus maximus):* In the northwestern Atlantic, basking sharks are typically found in coastal regions from April to October, with peak sightings between May and August (Kenney et al., 1985; NMFS, 2009d; Southall et al., 2005). Because this species is not taken commonly by fisheries, distribution data on this species is generally lacking. As a filter-feeding planktivore, individuals are typically seen at the surface from spring to autumn; however, some individuals form loose aggregations while feeding on the same patch of zooplankton (NMFS, 2009d; Sims et al., 2000). Large aggregations of basking sharks have been observed approximately 75 km south of Martha's Vineyard and 90 km south of Moriche's Inlet, Long Island (Kenney et al., 1985; NMFS, 2009d). Although fishing of this species is prohibited in U.S. waters and they are common along the east coast during winter months, it is listed as "Vulnerable" by the International Union of the Conservation of Nature Red List of Threatened Species (IUCN, 2012) and in the CITES document, Appendix II (NMFS, 2009d; UNEP-WCMC, 2005).

*Porbeagle shark (Lamna nasus):* Porbeagles are lamnid sharks commonly found in the deep, cold temperate waters of the North Atlantic, South Atlantic, and South Pacific Ocean, and are valued as food (NMFS, 2009d). It is an opportunistic piscivore with teleosts and cephalopods making up the majority of their diet in the northwest Atlantic Ocean (NMFS, 2009d). The fishery for this species is targeted in northern Europe and along the northeastern United States. The stocks of this species, wherever they have existed, have been depleted over the course of a few years as a result of intensive fisheries. This shows that the species cannot withstand heavy fishing pressure, and the species has been declared overfished (NMFS, 2009d).

*Sand tiger shark (Carcharias taurus):* Sand tiger sharks are large, coastal species with mature male and juveniles found between Cape Cod and Cape Hatteras and mature and pregnant female found in more southern waters between Cape Hatteras and Florida (Gilmore, 1993; NMFS, 2009d). Although fishing for this species in U.S. Atlantic waters has now been prohibited, it had been fished for its flesh and fins in coastal longline (NMFS, 2009d). In general, sand tiger sharks are very vulnerable to overfishing due to their large congregations in coastal areas during the mating season. They are also vulnerable because they have limited fecundity, only producing two pups per litter (NMFS, 2009d).

*Scalloped hammerhead shark (Sphyrna lewini):* While scalloped hammerhead shark is listed as a species of concern in the northwest Atlantic Ocean, it is found more in warm waters from North Carolina to Florida (NMFS, 2009d). They would likely not be found in the vicinity of the WEA.

*Thorny skate (Amblyraja radiata):* Based on stock size assessment, thorny skate is in an overfished condition; however, there is not enough information to declare whether overfishing is still occurring (NEFMC, 2009). Juvenile and adult thorny skate are found over bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud in the Gulf of Maine and Georges Bank (NEFMC, 2009). They are found at depths between 59 and 6,562 ft (18 and 2000 m) with the highest abundances at depths between 364 and 1,201 ft (111 and 366 m) (NEFMC, 2009).

### *Essential Fish Habitat*

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act mandated that the NMFS, Regional Fisheries Management Councils, and other Federal agencies identify and protect important marine and anadromous fish habit. Thus, the Fisheries Management Councils, with assistance from NMFS, were required to delineate EFHs in fishery management plans or fishery management plan amendments for all federally managed fisheries. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." In this definition, "waters" refers to aquatic areas and their associated physical, chemical, and biological properties that are used by fish where appropriate. "Substrate" refers to sediment, hard bottom, structures underlying the waters, and associated biological communities. In the definition, "necessary" refers to the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. "Spawning, breeding, feeding, or growth to maturity" refers to the stages representing a species' full life cycle. Additionally, the EFH process involves the identification and designation of "habitat areas of particular concern" (HAPC) within fishery management plans. HAPCs are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation (NMFS, 1999). There are no HAPCs in the vicinity of the WEA. Species with EFH designations for one or more life stages in the WEA are listed below in Table 4-10.

**Table 4-10**

**Species with EFH Designations for One or More Life Stages in the Massachusetts OCS WEA**

| New England Fishery Management Plan Species | | Mid-Atlantic Atlantic Fishery Management Plan Species | | Atlantic Highly Migratory Species Fishery Management Plan Species | | South Atlantic Fishery Management Plans Species | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** |
| *Clupea harengus* | Atlantic herring | *Scomber scombrus* | Atlantic mackerel | *Thunnus alalunga* | Atlantic albacore | *Rachycentron canadum* | Cobia |
| *Melanogrammus aeglefinus* | Haddock | *Centropristis striata* | Black sea bass | *Thunnus thynnus* | Atlantic bluefin tuna | *Scomberomorus maculatus* | Spanish mackerel |
| *Pollachius virens* | Pollock | *Pomatomus saltatrix* | Bluefish | *Katsuwonus pelamis* | Atlantic skipjack tuna | *Scomberomorus cavalla* | King mackerel |
| *Merluccius bilinearis* | Whiting | *Peprilus triacanthus* | Atlantic butterfish | *Thunnus albacares* | Atlantic yellowfin tuna | | |
| *Urophycis chuss* | Red hake | *Spisula solidissima* | Surf clam | *Cetorhinus maximus* | Basking shark | | |
| *Urophycis tenuis* | White hake | *Artica islandica* | Ocean quahog | *Prionace glauca* | Blue shark | | |
| *Glyptocephalus cynoglossus* | Witch flounder | *Stenotomus chrysops* | Scup | *Carcharhinus obscurus* | Dusky shark | | |
| *Pseudopleuronectes americanus* | Winter flounder | *Squalus acanthias* | Spiny dogfish | *Lamna nasus* | Porbeagle | | |
| *Limanda ferruginea* | Yellowtail flounder | *Paralichthys dentatus* | Summer flounder | *Carcharias taurus* | Sand tiger shark | | |
| *Scophthalmus aquosus* | Windowpane flounder | *Illex illecebrosus* | Short fin squid | *Carcharhinus plumbeus* | Sandbar shark | | |
| *Macrozoarces americanus* | Ocean pout | *Loligo pealei* | Long fin squid | *Isurus oxyrinchus* | Shortfin mako | | |

| New England Fishery Management Plan Species | | Mid-Atlantic Atlantic Fishery Management Plan Species | | Atlantic Highly Migratory Species Fishery Management Plan Species | | South Atlantic Fishery Management Plans Species | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** |
| *Placopecten magellanicus* | Atlantic sea scallop | | | *Alopias vulpinus* | Thresher shark | | |
| *Lophius americanus* | Monkfish | | | *Galeocerdo cuvieri* | Tiger shark | | |
| *Leucoraja erinacea* | Little skate | | | *Carcharodon carcharias* | White shark | | |
| *Leucoraja ocellata* | Winter skate | | | *Tetrapturus pfluegeri* | Longbill spearfish | | |

#### *4.2.2.5.2 Impact Analysis of Alternative A*

### *Routine Activities*

*Acoustic Effects*

This section provides a summary of what is known about sound sensitivity in marine fish and the impacts of sound that could be produced as a result of site characterization and assessment activity in the WEA. Myrberg (1981) has identified various categories of acoustic communication that are used by fishes. These include startle or warning sounds that may help protect individuals and groups from predation; sounds used by interceptor species to avoid predation or to locate prey; sounds overheard and used to competitive advantage by competitors; courting sounds used as part of the usual mating behaviors including advertisement; swimming sounds used in schooling and aggregation; aggressive sounds used when competing for mates; and sounds used in other aggressive interactions (e.g., in territorial defense).

Fish can perform the same basic auditory tasks, such as discrimination between sounds, determining the direction of a sound, and detecting biologically relevant sounds in the presence of noise as do terrestrial vertebrates (Thomsen et al., 2006). Popper et al. (2003) demonstrated that all species of fish tested were able to hear. However, hearing capabilities among species varied greatly (Table 4-11). Many fish have a swimbladder that is physically linked to the inner ear. The swimbladder is a gas-filled cavity that can act to transfer impinging sound-waves pressure information to the fish's otolith system. Fish of the family Clupeoidea, which includes herring (*Clupea harengus*), is an example of a fish having specialized auditory systems that include a structure called the prootic bulla, which improves sounds receptivity (McCauley and Salgado Kent, 2008).

**Table 4-11**

**Hearing Sensitivity Levels of a Variety of Fish Species**

| Species | Common Name | Family | Swimbladder connection | Sensitivity |
|---|---|---|---|---|
| *Clupea harengus* | Herring | Clupeoidea | Prootic auditory bullae | High |
| *Myoxocephalusscorpius* | Sculpin | Cottidae | No swimbladder | Low |
| *Gardus morhua* | Cod | Gadidae | None | Medium |
| *Melanogrammus aeglefinus* | Haddock | Gadidae | None | Medium |
| *Scomber scomber* | Atlantic mackerel | Sombridae | None | Medium |

Source: Adapted from Nedwell et al., 2004

As discussed in more detail in Section 4.2.2.6.2 below, sound frequency is measured in Hz or kHz; magnitude is measured in dB in terms of mean square pressure per unit frequency (e.g., dB re 1 μPa$^2$/Hz), and sound pressure is measured in micro Pascals (μPa). The duration of a noise event typically ranges from seconds to weeks, depending on the source. The frequency of the ambient noise present in the WEA is likely in the range of 1 Hz to 100 kHz and comprises both intermittent and continuous background noise (Cato, 1992; Wenz, 1962). The magnitude of noise in the present ambient acoustic environment is likely in the range of 20 to 100 dB re 1 μPa$^2$/Hz (Cato, 1992; Wenz, 1962).

Hastings et al. (1996) suggested that the inner ear of a fish may potentially be injured by sounds 90 to 140 dB above a fish's hearing threshold. This suggestion was supported in the findings of Enger (1981) in which injury to cod occurred after 1 to 5 hours of exposure to continuous synthesized sounds with a SPL of 180 dB re 1 μPa at 1 m. The fish in the Enger (1981) study were subjected to the sound at less than 3 ft (1 m) from the source. The data on other species, besides cod, are much less extensive. Chapman and Hawkins (1973) found that ambient noise at higher sea states in the ocean have masking effects in cod, haddock, and pollock. Additionally, sound could also produce generalized stress (Wysocki et al., 2006). Thus, based on limited data, for fish communication, masking and stress may occur in fish exposed to this level of sound.

With respect to threatened and endangered species, Atlantic sturgeon is a federally listed fish species that could be found in the WEA, but at a very low probability. Sturgeon have a swimbladder. Gearin et al. (2000) reported that sturgeon did not respond to "pinger" sounds at 2 kHz or 20 kHz, and knowledge of specific sound tolerance levels for Atlantic sturgeon is considered general at best (see Normandeau Associates Inc., 2012).

With respect to elasmobranch sound detection, most studies have been done on sharks, which do not have swimbladders, or any other air-filled cavity. Thus, they are incapable of detecting sound pressure and instead particle motion is assumed to be the only sound stimulus that can be detected. The hearing bandwidth for elasmobranchs has been measured as between 20 Hz and 1 kHz, with similar thresholds in all species above 100 Hz (UNEP, 2012). Generally, elasmobranchs do not appear to be as sensitive to sound as teleost fish when measured in comparable ways.

The impacts of sound on marine fish species can be divided into the three categories: (1) pathological effects, (2) physiological effects, and (3) behavioral effects. Pathological effects include lethal and sublethal physical damage to fish; physiological effects include primary and secondary stress responses; and behavioral effects include changes in exhibited behaviors of fish. Behavioral changes might be a direct reaction to a detected sound or a result of the manmade sound masking natural sounds that the fish normally detect and to which they respond. The three types of effects are often interrelated in complex ways. For example, some physiological and behavioral effects could potentially lead to mortality, which is the ultimate pathological effect.

Although some invertebrates also produce sound, most of these (e.g., spiny lobster, snapping shrimp, fiddler crabs) are found in southern and tropical coasts. However, New England (or blue) mussels (Mytilus edulis), which are found in the vicinity of the WEA, are known to produce sound (Rountree, 2007). These sounds are created when the mussel moves, and are thus not intentionally produced or used as a mode of communication. While mussels are typically anchored to a substrate via their byssal threads, when they move, they have to snap off the threads one at a time and then re-anchor themselves with new threads. When hundreds or thousands of mussels do this simultaneously within mussel beds, a continuous crackling sound can be heard (Rountree, 2007).

### *HRG Survey Acoustic Effects*

The impact HRG survey noise would have on marine fish and invertebrates that could occur in the WEA is not well understood. Estimated SPLs during HRG surveys are expected to range from 212 to 226 dB re 1 µPa RMS (1 micro Pascal root mean squared) at 1 m. Generally, noise generated by HRG surveys may have physical and/or behavioral effects on fish in close proximity to the area where the HRG survey activities are being conducted. Effects on fish are generally expected to be limited to avoidance of the area around the HRG survey activities and short-term changes in behavior. The region of best hearing in the majority of fish, for which there are data available, is from 100 to 200 Hz up to 800 Hz. Being highly mobile, adult fish may be expected to quickly leave an area when disturbed; thus, resulting in limited impacts. However, this is not the case for some of the less mobile shellfish (e.g., conch, quahogs, surf clams) that would be unable to quickly leave the area of disturbance. Noise effects on shellfish are generally not well understood. Similar to shellfish, fish eggs and larvae are often not able to move away from a sound source, and are at the mercy of currents and move very slowly, if at all (Hastings and Popper, 2005). Although data on the effects of sound on developing eggs and larvae are very limited and most studies have used explosion or large mechanical shocks, the limited data suggest that developing larvae have different levels of sensitivity to mechanical stimulation at different stages of development (Hastings and Popper, 2005). Although an HRG survey may disturb more than one individual, surveys associated with Alternative A are not expected to result in population-level effects. Individuals disturbed by a survey would likely return to normal behavioral patterns after the survey finished or after the animal has left the survey area.

Fish are not expected to be exposed to SPLs that could cause hearing damage. Based on fish hearing data, the only HRG survey tool—the boomer sub-bottom profiler—is expected to be detected by fish. Given that some offshore survey contractors may elect to use a CHIRP sub-bottom profiler instead of a boomer system, the electromagnetic sounds may not be detected by fish during HRG survey work. Particle motion from the HRG survey activity is not well understood. Regardless, few fish may be expected, in most cases, to be present within the survey areas because of the limited immediate area of ensonification and the duration of individual HRG surveys that may be conducted during site assessment. Thus, potential population-level impacts on fish from HRG surveys are expected to be negligible.

### *Geotechnical Sampling Acoustic Effects*

Acoustic impacts from borehole drilling are expected to be below 120 dB. Previous estimates submitted to BOEM indicate geotechnical drilling produces source sound levels that do not exceed 145 dB at a frequency of 120 Hz (NMFS, 2009e). Previous submissions to BOEM also indicated that boring sound should attenuate to below 120 dB by the 492 ft (150 m) isopleth. Therefore, although fish are expected to sense the sound, the impacts are anticipated to be negligible because of short duration, low sound levels, and the ability of the fish to leave the immediate area of the drilling.

### *Meteorological Tower Pile-Driving Acoustic Effects*

The extent of potential noise impacts on fish is not comprehensively understood. However, McCauley and Kent (2008) indicated that intensive impulsive signals, such as those produced by pile drivers, can cause fish kills, and signals of a smaller magnitude can cause behavioral change. The normal behaviors (e.g., feeding) of marine fish could be disturbed by meteorological tower construction noise. Depending upon several factors, including the sound source and physical oceanographic features, behavioral effects may be incurred at ranges of many miles, and impairment to hearing may occur at close range (Madsen et al., 2006a). Thomsen et al. (2006) concluded that the zone of physical damage is usually located closest to the noise source where the received noise level is strong enough to cause tissue damage to auditory or other systems, or even mortality. High-intensity sounds produced by pile driving could damage hearing in elasmobranchs in the form of a Temporary Threshold Shift (TTS) and result in a temporary loss of sensitivity. Also, the impact of the hammer on the pile may cause barotrauma in elasmobranchs, which has recently been reported in some organs, including the liver and kidneys, in teleost fish. Demersal elasmobranchs, such as skates and rays, may also be damaged by the intense vibrations in the sediments that are caused by pile driving (UNEP, 2012). In fact, Caltrans (2001) reported mortalities after pile driving in the course of the San Francisco Oakland Bay Bridge Demonstration Project, at a distance of 328 to 656 ft (100 to 200 m) from the pile, with sound levels between 160 and 196 dB RMS re 1 μPa. Fish were found dead primarily within a range of 164 ft (50 m); the zone of direct mortality was about 33 to 39 ft (10 to 12 m) from piling and the zone of delayed mortality was assumed to extend out to at least 150 m to approximately 3,280 ft (1,000 m) from the piling. However, Hastings and Popper (2005) reviewed these and other studies and concluded that the results were highly equivocal and that no clear correlation between the level of sound exposure and the degree of damage could be determined. As discussed in the impacts from HRG surveys, behavioral reactions may include avoidance of, or flight from, the sound source and its immediate surroundings, disruption of feeding behavior, and generalized stress (Wysocki et al., 2006).

The SOCs required by BOEM that are intended to reduce or eliminate the potential for adverse impacts on marine mammals and sea turtles would also benefit fish, including the implementation of a "soft start" procedure. This measure will be included as a condition on any leases and/or SAPs issued or approved under this proposed action. As a result of the "soft start" procedure, BOEM anticipates that the majority of fish would flee the area during the period of disturbance and return to normal activity in the area post construction. Those fish that do not flee the immediate action area during the pile-driving procedure could be exposed to lethal SPLs. However, significant effects to fish populations are not anticipated. Similarly, impacts on EFH from acoustic disturbance (from all sources) would be negligible.

### *Benthic Effects*

Section 4.2.2.3 discusses the benthic resources and associated impacts that would be anticipated from Alternative A. This section only discusses those impacts in relation to fish and their habitat. Benthic effects from Alternative A that would impact fish and fish habitat, including EFH, are anticipated to be temporary and limited to the immediate area surrounding the activity. Therefore, benthic fish habitats are not anticipated to experience significant negative impacts that could then impact fish populations.

*Geotechnical Sampling*

As stated in Sections 3.1.3.2 and 4.2.2.3, sub-bottom sampling would result in a negligible temporary loss of some benthic organisms (i.e., less than 1 ft diameter would be disturbed in the areas where cores are sampled), and a localized increase in disturbance due to vessel activity, including noise and anchor cable placement and retrieval. This activity could impact adult marine fish by removing a small amount of forage items. However, given the small footprint (i.e., less than 1 ft diameter that would be disturbed in the areas where cores are sampled), the temporary nature of the action, and availability of similar benthic habitat around the sampling location, BOEM expects that this activity would have negligible benthic effects that could impact fish species occurring in the WEA.

*Meteorological Tower/Buoy Installation*

The installation of a meteorological buoy and/or the construction of a meteorological tower would have benthic effects that are temporary in nature. Construction of the tower would result in direct effects on benthic invertebrates by burying or crushing them. BOEM anticipates that some sediment would become suspended around deployed anchoring systems and around monopoles resulting from the installation activity. This sediment would be dispersed and settle on the surrounding seafloor. Depending on the currents, this could potentially smother some benthic organisms. However, as discussed in Section 4.2.1.2, the WEA is considered in a relatively high-energy environment that sees much sediment transport in its natural state. BOEM expects that any sedimentation that would occur around an installed tower or buoy would have only minor temporary effects that could impact the habitat and food availability for fish species occurring in the WEA.

The loss of benthic habitat as a result of scour and/or scour control systems around foundations and moorings is discussed in Section 4.2.2.3. Sessile marine invertebrates, including molluscan shellfish, would be lost in the footprint of the foundation/mooring and any scour control system. However, a single meteorological tower or buoy within a lease area would not result in significant changes to the availability of habitat and forage items in the action area. Additionally, BOEM anticipates that fish would leave the area of the foundation and scour control system for adjacent, non-impacted areas. Although moorings and meteorological tower foundations will adversely affect EFH, their overall footprint is small, and will not significantly affect the quality and quantity of EFH in the action area.

*Meteorological Tower/Buoy Operation*

BOEM expects that meteorological towers and large anchoring systems installed in soft sediment areas would introduce an artificial hard substrate often preferred by opportunistic benthic species for colonization. Additionally, minor changes in species associated with softer sediments could occur as a result of scouring around the pilings (Hiscock et al., 2002). Certain fish species (e.g., tautog, black sea bass, Atlantic striped bass) would likely be attracted to the newly formed habitat complex, and fish population numbers in the immediate vicinity of the anchors and monopoles are likely to be higher than in surrounding waters away from the structures. However, a single meteorological tower or buoy within a lease area is not expected to result in significant changes in local community assemblage and diversity, nor the availability of habitat, including EFH, and forage items in the action area.

*Meteorological Tower and Buoy Decommissioning*

The decommissioning of meteorological towers and buoys is described in Section 3.1.4.1. Upon completion of site assessment activities, the meteorological tower would be removed and transported by barge to shore. During this activity, fish may be affected by noise and operational discharges as described for meteorological tower construction. Removal of the piles would be accomplished by cutting the piles (using mechanical cutting or high-pressure water jet) at a depth of 16 ft (5 m) below the seabed. Fish could be affected by noise produced by pile-cutting equipment, although cutting produces less intense noise than pile driving. Only fish in the immediate vicinity of the site (those that had not moved away from the area upon arrival of decommissioning vessels) would be expected to be affected during tower removal and transport and pile cutting. Disturbance of fish during decommissioning is expected to be minor resulting in negligible impacts on fish.

### *Discharge of Waste Materials and Accidental Fuel Leaks*

Fish could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels and to accidentally released solid debris. Operational discharges from construction vessels would be released into the open ocean where they would be rapidly diluted and dispersed, or collected and taken to shore for treatment and disposal. Sanitary and domestic wastes would be processed through onsite waste treatment facilities before being discharged overboard. Deck drainage would also be processed prior to discharge. Thus, waste discharges from construction vessels would not be expected to directly affect fish or their habitat.

Fish can be adversely impacted by the ingestion of, or entanglement with, solid debris. Fish that have ingested debris, such as plastic, may experience intestinal blockage, which in turn may lead to starvation, while toxic substances present in the ingested materials (especially in plastics) could lead to a variety of lethal and sub-lethal toxic effects. Entanglement in plastic debris can result in reduced mobility, starvation, exhaustion, drowning, and constriction of, and subsequent damage to, limbs caused by tightening of the entangling material. The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (33 CFR 151, Annex V, Public Law 100–220 [101 Stat. 1458]). Thus, entanglement in or ingestion of OCS-related trash and debris by fish would not be expected during normal operations.

Because of the limited duration and area of vessel traffic and construction activity that might occur with construction, operation, and decommissioning of a meteorological tower and/or meteorological buoy, the release of liquid wastes would occur infrequently. Accidental fuel release during site characterization activities is expected to be minimal. Thus, overall impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels during site assessment and site characterization activities are expected to be minor.

### *Non-Routine Events*

Collisions between vessels and allisions between vessels and meteorological towers and buoys are considered unlikely (see Section 3.2.2 of this EA). However, in the unlikely event that a vessel allision or collision were to occur, and in the unlikely event that such an allision or collision results in a discharge, the most likely pollutant to be discharged would be diesel fuel. If a diesel spill were to occur, it would be expected to dissipate very rapidly in the water column, then evaporate and biodegrade within a few days (see Section 3.2.3). BOEM expects that pelagic fish and larval fish that can be found high in the water column would be negatively impacted by such a spill. However, the impacts would not be significant to these fish populations because of the temporary nature of a spill and the limited area it affects. The meteorological towers and buoys could also serve as attractants for fish, which would, in turn, attract recreational fishermen to the area. Therefore, there is some potential for collisions between recreational fishing vessels that could result in an accidental release of diesel fuel. Additionally, storms may cause allisions and collisions that could result in a spill; yet, the storm conditions would cause the spill and its effects to dissipate faster. Overall impacts on fish resources from diesel spills resulting from collisions and allisions, should they occur, are expected to be minimal and temporary.

As with any structure placed in the ocean, there is a chance that a vessel, other than a maintenance or construction vessel, could collide with the structure causing catastrophic damage to the vessel, tower, or both. This type of collision is unanticipated because it would require a loss of vessel power or steerage, high winds, or a sea state that would drive the vessel toward the structure, and failure of the vessel's and/or structure's design to withstand the impact. In the absence of these factors, current regulatory measures require placement of structures outside of traffic lanes, lighting, and mariner notifications of the placement of structures that should prevent collisions of this type from occurring. If an unanticipated collision was to occur, and a vessel's cargo was discharged, the impacts would depend upon the type (oil, liquefied natural gas, chemicals, or other commodities) and amount of discharges.

During site assessment activities, there is a potential for natural and/or unanticipated events to cause impacts on the environment. In the case of a natural event, a hurricane or severe storm may impact meteorological towers or buoys at some time during the operation. Depending on the severity of the event, components of the facility could be damaged, destroyed, or cut loose resulting in temporary sea hazards until the device can be retrieved (as in the case of a buoy being repaired or removed). Buoys have GPS systems that alert investigators if they move beyond their operating area. The USCG would be notified immediately, and the USCG would notify mariners, if this were to happen. Similar alerts would occur if a meteorological tower were to experience severe damage.

#### *4.2.2.5.3 Conclusion*

Alternative A and the potential effects of HRG survey noise on marine fish are generally expected to be limited to avoidance around the HRG survey activities and short-term changes in behavior. Thus, potential population-level impacts, if any, on fish resulting from HRG surveys are expected to be negligible.

Similarly, while fish are expected to be able to sense the sound from geotechnical sampling, the impacts are anticipated to be negligible because of the short duration, low sound levels, and the ability of highly mobile, adult fish to leave the immediate area of the drilling. Conversely, fish eggs, larvae, and less mobile shellfish may not be able to leave the area of disturbance caused by noise. The effects of noise on these less mobile organisms are generally not well understood, but would likely be minor because of the short duration of exposure.

Meteorological tower construction noise could disturb normal behaviors. As discussed in the analysis of HRG surveys, behavioral reaction may include avoidance of, or flight from, the sound source. Fish that do not flee the immediate action area during pile-driving procedures could be exposed to lethal SPLs. However, the SOCs, including the implementation of a “soft start” procedure, will minimize the possibility of exposure to lethal sound levels.

As a result of the small sub-bottom sampling footprint, BOEM expects this activity would have negligible benthic effects that could impact fish species and their habitat, including EFH, which may occur in the WEA. Impacts related to meteorological towers/buoys installation, operation, and decommissioning are expected to be minor and are not expected to result in changes in local fish community assemblage and diversity.

Fish could be exposed to operational discharges or accidental fuel releases from construction sites and construction vessels and to accidentally released solid debris. The entanglement in or ingestion of OCS-related trash and debris by fish would not be expected during normal operations. Impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels are expected to be minor because of the limited number of structures and vessels involved with construction, operation, and decommissioning.

There is a potential for natural and/or unanticipated events to cause impacts on the environment during site assessment activities. A natural event such as a severe storm may impact meteorological towers or buoys at some point during operation. If unanticipated collisions were to occur, and a vessel’s cargo was discharged, the impacts would depend upon the type and amount of cargo discharged. Based on the limited number of structures anticipated in Chapter 3 and the considerations for their placement, the likelihood of natural and unanticipated events is low.

With respect to threatened and endangered species, Atlantic sturgeon is a federally listed fish species that could, although unlikely, be found in the WEA. Impacts on this species are the same as those discussed for non-listed fish species, and may include: acoustic effects from meteorological tower construction noise, benthic effects from tower installation, and water quality effects from discharge of waste materials and accidental fuel leaks. Based on the low probability of Atlantic sturgeon being found in the WEA, and the ability of this mobile species to avoid unfavorable stimuli, BOEM expects that any impacts on Atlantic sturgeon would be negligible. In addition, SOCs (see Appendix B), such as the implementation of a “soft start” procedure to minimize noise impacts during pile driving, may further reduce the potential for impacts.

Similar to the direct and indirect impacts from site assessment and site characterization activities to fish that are expected to be negligible such as population effects of HRG survey noise, effects of sound from geotechnical sampling on highly, mobile adult fish, and benthic effects from sub-bottom sampling, impacts on EFH are expected to be temporary in nature (in the case of acoustic disturbance and re-suspended sediment during pile driving and mooring placements). Although moorings and meteorological tower foundations may adversely affect EFH, their overall footprint is small, and will not significantly affect the quality and quantity of EFH in the action area. Additionally, there are no EFH HAPCs in the WEA.

#### *4.2.2.6 Marine Mammals*

##### *4.2.2.6.1 Description of the Affected Environment*

The Northwest Atlantic OCS region is inhabited by 38 species of marine mammals, including 6 mysticetes (baleen whales), 28 odontocetes (toothed whales, dolphins, and porpoise), and 4 fur seals (Table 4-12). These species rely on OCS habitats for a variety of important life functions, including feeding, breeding, nursery grounds, socializing, and migration. Descriptions of marine mammal species that occur in the Northwest Atlantic can be found in the PEIS (MMS, 2007a); that general information is incorporated here by reference. Thus, this section will focus on information specifically relevant to marine mammals in the vicinity of the Massachusetts WEA.

**Table 4-12**

**Marine Mammals in the North Atlantic OCS**

| Common Name | Scientific Name | ESA Status[1] | Relative Occurrence in Region[2] | Typical habitat | | |
|---|---|---|---|---|---|---|
| | | | | Coastal | OCS | Shelf Edge/Slope |
| **Order Cetacea** | | | | | | |
| **Suborder Mysticeti (Baleen whales)** | | | | | | |
| **Family Balaenopteridae** | | | | | | |
| [3]North Atlantic right whale | *Eubalaena glacialis* | E | Common | x | x | x |
| Blue whale | *Balaenoptera musculus* | E | Rare | | x | x |
| [3]Fin whale | *Balaenoptera physalus* | E | Common | x | x | x |
| [3]Sei whale | *Balaenoptera borealis* | E | Regular | | x | x |
| [3]Minke whale | *Balaenoptera acutorostrata acutorostrata* | | Common | x | x | x |
| [3]Humpback whale | *Megaptera novaeangliae* | E | Common | x | x | x |
| **Suborder Odontoceti (Toothed whales and dolphins)** | | | | | | |
| **Family Physeteridae** | | | | | | |
| [3]Sperm whale | *Physeter macrocephalus* | E | Common | x | x | x |

| Common Name | Scientific Name | ESA Status[1] | Relative Occurrence in Region[2] | Typical habitat | | |
|---|---|---|---|---|---|---|
| | | | | Coastal | OCS | Shelf Edge/Slope |
| **Family Kogiidae** | | | | | | |
| Dwarf sperm whale | *Kogia sima* | | Rare | | | x |
| Pygmy sperm whale | *Kogia breviceps* | | Regular | | | x |
| **Family Ziphiidae** | | | | | | |
| [4]Cuvier's beaked whale | *Ziphius cavirostris* | | Rare | | | x |
| [4]Blainville's beaked whale | *Mesoplodon densirostris* | | Rare | | | x |
| [4]Gervais' beaked whale | *Mesoplodon europaeus* | | Rare | | | x |
| [4]True's beaked whale | *Mesoplodon mirus* | | Rare | | | x |
| [4]Sowerby's beaked whale | *Mesoplodon bidens* | | Rare | | | x |
| **Family Delphinidae** | | | | | | |
| [3]Risso's dolphin | *Grampus griseus* | | Common | | | x |
| Long-fin pilot whale | *Globicephala melas* | | Common | | x | x |
| Short-fin pilot whale | *Globicephala macrorhynchus* | | Rare | | x | x |
| Killer whale | *Orcinus orca* | | Rare | | x | x |
| Pygmy killer whale | *Feresa attenuata* | | Hypothetical | | | x |
| False killer whale | *Pseudorca crassidens* | | Rare | | | |
| Melon-headed whale | *Peponocephala electra* | | Hypothetical | | | x |
| Northern bottlenose whale | *Hyperoodon ampullatus* | | Hypothetical | | | x |
| [3]White-beaked dolphin | *Lagenorhynchus albirostris* | | Regular | | x | |
| [3]Atlantic white-sided dolphin | *Lagenorhynchus acutus* | | Common | | x | x |
| [3]Atlantic spotted dolphin | *Stenella frontalis* | | Rare | | | x |
| Pantropical spotted dolphin | *Stenella attenuata* | | Rare | | | x |
| Clymene dolphin | *Stenella clymene* | | Hypothetical | | | x |
| Spinner dolphin | *Stenella longirostris* | | Hypothetical | | | x |
| [3]Striped dolphin | *Stenella coeruleoalba* | | Rare | | | x |
| Rough-toothed dolphin | *Steno bredanensis* | | Hypothetical | | x | x |
| Fraser's dolphin | *Lagenodelphis hosei* | | | | | x |
| [3]Short-beaked common dolphin | *Delphinus delphis* | | Common | | x | x |
| [3]Bottlenose dolphin (coastal and offshore morphotypes) | *Tursiops truncata* | | Common | x | x | x |

| Common Name | Scientific Name | ESA Status[1] | Relative Occurrence in Region[2] | Typical habitat | | |
|---|---|---|---|---|---|---|
| | | | | Coastal | OCS | Shelf Edge/Slope |
| **Family Phocoenidae** | | | | | | |
| [3]Harbor porpoise | *Phocoena phocoena* | | Common | x | x | |
| **Order Carnivora, Suborder Fissipeda, Family Phocidae** | | | | | | |
| [5]Harbor seal | *Phoca vitulina concolor* | | Common | x | x | |
| [5]Gray seal | *Halichoerus grypus* | | Common | x | x | |
| [5]Harp seal | *Phagophilus groenlandicus* | | Common | x | | |
| Hooded seal | *Cystophora cristata* | | Regular | x | x | |

[1]ESA status E = endangered

[2]Based on occurrence within Rhode Island OSAMP Study Area: Common = greater than 100 records, Regular = 10–100 records, rare = less than 10 records, hypothetical = the remote possibility to occur in the region at some time (Kenney and Vigness-Raposa, 2010).

[3]SPUE data available

[4]SPUE data are for beaked whales grouped together

[5]SPUE data are for all seals grouped together

The Right Whale Consortium sightings database provides the most comprehensive information available on the distribution and abundance of marine mammals in this region (Right Whale Consortium, 2012). This database contains thousands of sightings records for whales, dolphins, seals, and sea turtles in the North Atlantic Ocean. Although the vast majority of surveys are focused on right whales (with data for other species often reported), and survey efforts are concentrated in July through September, these data provide valuable information for understanding the distribution and abundance of marine mammals in and around the WEA. Sightings per Unit Effort (SPUE) data that are presented in this section were provided by the Right Whale Consortium (Right Whale Consortium, 2012). SPUE values represent animals sighted per 1,000 km of survey track, and were calculated by partitioning the study area into a regular grid based on latitude and longitude (in a 5 min x 5 min, or 9.3 km x 7.0 km grid) (Right Whale Consortium, 2012). Although survey data are available for the WEA, the survey effort level has been relatively low, historically. Additional information on calculation methods for the SPUE data presented in this section is available in the Rhode Island OSAMP (Kenney and Vigness-Raposa, 2010). The "Rhode Island Study Area" defined in the OSAMP also provides a key reference for occurrence data discussed herein. This area includes the coastal and continental shelf and slope waters from Long Island to Nantucket and outer Cape Cod (including the Massachusetts WEA). Because marine mammals may be sensitive to anthropogenic noise at long distances from the source (Madsen et al., 2006b; Nieukirk et al., 2004), the distribution of species will be discussed for both the WEA (within the delineated WEA), as well as in an expanded area within 40 nm from the WEA boundary.

Marine mammals found on the Northwest Atlantic OCS are listed in Table 4-12, along with habitat preferences for each species. The relative occurrence for each species in the vicinity of the WEA is also provided. Those species most likely to occur in or near the WEA (i.e., coastal or OCS waters) will be discussed in more detail in the following sections. Non-ESA listed species and federally listed species are discussed under separate sections below.

### *Non ESA-Listed Marine Mammals*

The majority of marine mammals that potentially occur in the WEA are not federally listed as threatened or endangered under the ESA. These non-listed species include:  1 species of mysticete, 27 species of odontocetes, and 4 species of seals. The following 10 non-listed species are most likely to occur within the WEA: minke whales, long-finned pilot whales, short-beaked common dolphins, Atlantic white-sided dolphins, bottlenose dolphins, harbor porpoise, harbor seals, gray seals, harp seals, and hooded seals (Right Whale Consortium, 2012). An additional two species are likely to occur in the nearby waters surrounding the WEA (i.e., within 40 nm from the WEA) in relatively high abundance: Risso's dolphins and white-beaked dolphins (Right Whale Consortium, 2012). Beaked whales have occurred in relatively high numbers in the region, but were concentrated near the shelf edge (Right Whale Consortium, 2012). Appendix E provides maps showing SPUE for these non-listed marine mammals, and each species is discussed briefly below.

*Minke whales*

Within the North Atlantic, there are four separate populations of minke whales: the Canadian East coast, West Greenland, Central North Atlantic, and Northeast Atlantic. Minke whales off the east coast of the United States belong to the Canadian East coast stock (from Davis Strait to the Gulf of Mexico). The best abundance estimate from the Gulf of Maine to North Labrador is 8,987 (Waring et al., 2011).

Minke whales are widely distributed within the continental shelf waters, with the highest abundances in New England waters seen in the spring and summer. In this region, few minke whales are typically present in the fall, and this species is nearly absent in the winter (Waring et al., 2011). Within the WEA, SPUE ranged from 0.1 to 35 whales per 620 miles (1,000 km) in the spring and summer and there were no sightings in winter or fall (Appendix E, Figure 1). Within 40 nm of the WEA, SPUE ranged from 0.1 to 155 whales per 620 miles (1,000 km) in the spring and summer and few sightings were reported for winter and fall (Appendix E, Figure 1).

*Long-finned pilot whales*

In the western Atlantic, two species of pilot whales are known to exist: the long-finned pilot whale (*Globicephala melas*) and the short-finned pilot whale (*G. macrorhynchus*). Pilot whales occurring north of the area between New Jersey and Cape Hatteras are likely long-finned, and those to the south are likely to be short-finned pilot whales. However, these species are difficult to differentiate at sea; therefore, some of the descriptions below refer to pilot whales, *Globicephala* sp. (Waring et al., 2011). The best estimate of abundance of western North Atlantic pilot whales (the portion of the population occupying U.S. waters) is 12,619 animals (Waring et al., 2011).

Long-finned pilot whales are typically distributed along the continental shelf edge, but may also occur within the continental shelf waters. This species has been observed in the Nantucket Shoals year round, but sightings from 1978 to 1992 indicate that the highest concentration of occurrence in the area is during the spring and summer (Abend and Smith, 1999). This occurrence is corroborated by the seasonal SPUE data. Within the WEA, no sightings were reported in the summer, fall, or winter, and SPUE in the spring ranged from 0.1 to 1,710 whales per 620 miles (1,000 km) (Appendix E, Figure 2). Within 40 nm of the WEA, SPUE ranged from 0.1 to 1,710 whales per 620 miles (1,000 km) in the spring, summer, and winter (Appendix E, Figure 2).

*Atlantic white-sided dolphins*

White-sided dolphins in the WEA region belong to the Gulf of Maine stock, and can be found in shelf waters from Hudson Canyon (off New Jersey) to Georges Bank. This species may occur both within the continental shelf and edge waters, in large groups of up to 500 animals (Waring et al., 2011). The best estimate of abundance for the North Atlantic Stock (to which the Gulf of Maine stock belongs) is 63,368 dolphins, with a minimum population of 50,883 dolphins (Waring et al., 2011).

SPUE data corroborate this information of large group size. SPUE within the WEA ranged from 0.4 to 16,325 whales per 620 miles (1,000 km) in the spring, 0.4 to 1,975 whales per 1,000 km in the summer, and 0.4 to 5,620 whales per 620 miles (1,000 km) in the fall (Appendix E, Figure 3). Within 40 nm of the WEA, SPUE ranged from 0.4 to 5,620 whales per 620 miles (1,000 km) in the spring and summer, and from 0.4 to 1,975 in the fall and winter (Appendix E, Figure 3).

*Short-beaked common dolphins*

Short-beaked common dolphins are one of the most widely distributed cetaceans, found worldwide in temperate, tropical, and subtropical waters. These dolphins are typically within continental shelf waters between the 328 ft to 1.2 mile (100 to 2,000 m) isobaths (Waring et al., 2011). The best estimated abundance for this species in the Western North Atlantic is 120,743 animals, with a minimum population of 99,975 animals (Waring et al., 2011).

Within the WEA, short-beaked dolphins occurred in all seasons with SPUE ranging from 0.4 to

1,600 dolphins per 620 miles (1,000 km) in the fall (Appendix E, Figure 4). Within 40 nm of the WEA, SPUE (mostly to the west and south of the WEA) were relatively high and regularly distributed in all seasons, with sightings as high as 15,170 to 33,000 dolphins per 620 miles (1,000 km) in the winter, and 5,730 to 15,170 dolphins per 620 miles (1,000 km) in the spring, summer, and fall (Appendix E, Figure 4).

*Bottlenose dolphins (Western North Atlantic Offshore Stock)*

Bottlenose dolphins belonging to the Western North Atlantic offshore stock can be found in coastal waters and throughout the continental shelf and slope waters. In the northeastern U.S. waters, their distribution is separated into two distinct morphotypes: coastal and offshore. Inshore sightings are concentrated near the Maryland and Virginia border, while offshore sightings are concentrated from Cape Hatteras to the eastern end of Georges Bank (Kenney, 1990).

Bottlenose dolphins (Western North Atlantic offshore stock) were only sighted during the summer within the WEA, and SPUE ranged from 1 to 1,240 dolphins per 620 miles (1,000 km) (Appendix E, Figure 5). Within 40 nm of the WEA, most sighting were reported south of the WEA during the spring, summer, and fall; SPUE were as high as 1,241 to 3,220 dolphins per 620 miles (1,000 km) in the spring and summer and 3,221 to 7,120 dolphins per 620 miles (1,000 km) in the fall, (Appendix E, Figure 5).

*Risso's dolphins*

Risso's dolphins are known to occur in the Northwest Atlantic from Florida to Newfoundland. This species can be found along the continental shelf and shelf edge year round. Currently, no information is available on the stock structure for this species in the Western North Atlantic. The best abundance estimate for Risso's dolphins is 20,479 animals (Waring et al., 2011).

Within the WEA, sightings of Risso's dolphin occurred in the spring, with SPUE ranging from 3 to 250 dolphins per 620 miles (1,000 km), and in the fall with SPUE ranging from 250 to 900 dolphins per 620 miles (1,000 km) (Appendix E, Figure 6). Within 40 nm south of the WEA, relatively high SPUE were reported primarily in the summer and fall, with a few sightings in the spring ranging from 3 to 250 dolphins per 620 miles (1,000 km) and one in the winter ranging from 900 to 6,050 dolphins per 620 miles (1,000 km). In the summer, SPUE were as high as 900 to 6,050 dolphins per 620 miles (1,000 km); and SPUE in the fall were as high 6,050 to 16,585 dolphins per 620 miles (1,000 km) (Appendix E, Figure 6).

*White-beaked dolphins*

White-beaked dolphins the WEA region can be found within the continental shelf and slope waters in the western Gulf of Maine and around Cape Cod. The best abundance estimate for this species in the western North Atlantic is 2,003 (Waring et al., 2011). This estimate is assumed to be negatively biased resulting from survey data from only part of the known habitat (Waring et al., 2011).

There were no sightings of white-beaked dolphins within the WEA. Within 40 nm of the WEA, this species was sighted in the spring with SPUE ranging from 10 to 270 dolphins per 620 miles (1,000 km) (Appendix E, Figure 7).

*Harbor porpoise*

Within the Northwest Atlantic, this species consists of four separate stocks: Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland. During the fall (October to December) and spring (April to June), the Gulf of Maine/Bay of Fundy stock of harbor porpoises is widely distributed from New Jersey to Maine. This species is known to occur from the coastline to areas with bottom depths greater than 1.1 mile (1,800 m) (Waring et al., 2011). However, most of the population occurs over the continental shelf waters. The best abundance estimate for this species is 89,054, with a minimum population of 60,970 animals (Waring et al., 2011).

Harbor porpoise occurred within the WEA primarily during the spring (SPUE ranging from 0.2 to 120 porpoise per 620 miles [1,000 km]), but also occurred in the WEA during the summer (SPUE ranging from 0.2 to 30 porpoise per 620 miles [1,000 km] and as high as 120 to 265 porpoise per 620 miles [1,000 km]; Appendix E, Figure 8). Within 40 nm of the WEA, harbor porpoise were regularly distributed on all sides of the WEA in the spring (ranging from 0.2 to 265 porpoise per 620 miles [1,000 km]), but also occurred in summer and winter; SPUE values also ranged from 0.2 to 265 porpoise per 620 miles (1,000 km) (Appendix E, Figure 8).

*Beaked whales*

Beaked whales are known to occur in deep, continental edge and slope waters, and live sightings are very rare. Beaked whales of the genus *Mesoplodon* are extremely difficult to differentiate at sea, and distribution information is based mostly on stranding data (Mead, 1989). Four species of *Mesoplodon* may occur in the western North Atlantic: *M. europaeus* (Gervais'), *M. densirostris* (Blainville's), *M. mirus* (True's), and *M. bidens* (Sowerby's). Blainville's beaked whale is the most widely distributed species and can be found in tropical to temperate waters throughout the world (Mead, 1989).

Beaked whales have not been sighted within the WEA; however, they have been reported along the shelf edge approximately 40 to 50 nm south of the WEA (Appendix E, Figure 9). The sightings were recorded in relatively high numbers (360 to 665 whales per 620 miles [1,000 km]) primarily during summer months, and in the spring (22 to 360 whales per 620 miles [1,000 km]; Appendix E, Figure 9).

*Seals*

Four species of seals are most likely to occur in the WEA: harbor seals, gray seals, harp seals, and hooded seals. Figure 10 in Appendix E presents SPUE data for seals (all species). Seal SPUE in the WEA region almost certainly include four species (harbor, gray, harp, and hooded), but the majority are likely to be harbor and gray seals (Kenney and Vigness-Raposa, 2010). Within the WEA, seal sightings have occurred primarily in the spring. In the waters between Martha's Vineyard and Nantucket, seals have been reported in high numbers during the spring, summer, and fall. Seal sightings (and abundance estimates) are more often made from counts at haul-out sites and stranding records, rather than from counts in the water.

*Harbor seals*

Harbor seals are the most widely distributed species in the coastal waters of southern New England. This species is concentrated along the Maine/New Hampshire coast during their breeding season (spring to fall) and typically migrate south to Cape Cod, from September through May (Waring et al., 2011). No current abundance estimate is available for this species (Waring et al., 2011). Stranding records between 2004 and 2008 indicate that of 1,823 harbor seals that stranded along the U.S. east coast from Maine to Florida, 446 were stranded in Massachusetts and 34 in Rhode Island (Waring et al., 2011).

*Gray seals*

The western North Atlantic stock of gray seals ranges from New York to Labrador. In the Western North Atlantic, gray seals give birth between January and February. This species was first observed in small numbers along the islands of Maine and Nantucket/Vineyard Sound, MA, in the 1980s. Currently, approximately 400+ animals belong to a year-round breeding population on outer Cape Cod and Muskeget Island (Waring et al., 2011). Massachusetts is now considered the center of gray seal abundance in U.S. waters, with survey data indicating that pupping is increasing at an undetermined rate (Waring et al., 2011). Monitoring surveys have recently recorded occasional mother/pup pairs on Monomoy Island (MA) and Nomans Land (MA), 10 nm north of the WEA (NMFS, 2012c).

A population estimate for gray seals is not available for U.S. waters. From 2004 to 2008, of all the stranding mortalities along the U.S. coast, most were in Massachusetts (191 of 305 stranding mortalities), with 24 strandings recorded in Rhode Island (Waring et al., 2011).

*Harp seals*

Harp seals are highly migratory and known to occur throughout most of the North Atlantic. The west North Atlantic stock is equivalent to the Front/Gulf stock, which is a combination of the Front herd, breeding off the coast of Newfoundland, and the Gulf herd breeding near Magdalen

Island in the Gulf of St. Lawrence (Waring et al., 2011). Pupping for this species occurs near the southern limits of their range from late February through mid-March. The best estimate of abundance for the western North Atlantic stock is 6.9 million seals (Waring et al., 2011). Data are not available for an estimate within U.S. waters. Beginning in the mid-1990s, harp seals have been observed from Maine to New Jersey, with these extralimital appearances and strandings (from January to May) occurring more frequently in recent years (Waring et al., 2011). According to the Massachusetts DMF, the harp seal is considered an "annual vagrant" to Dukes and Nantucket Counties (MADFW, 2012). From 2004 to 2008, 255 harp seals were stranded in Massachusetts and 29 in Rhode Island, amounting to approximately half of the total of 541 seals from Maine to North Carolina (Waring et al., 2011).

*Hooded seals*

Hooded seals are known to occur throughout the North Atlantic and Arctic Oceans, preferring deep water, farther offshore than harp seals (Waring et al., 2011). The Northwest Atlantic stock is one of three separate stocks for this species. This species is highly migratory and can be found as far south as Puerto Rico, with increased occurrence along the U.S. east coast from Maine to Florida (Waring et al., 2011). In New England waters, hooded seals are typically observed between January and May. The most current population estimate for the Western North Atlantic stock of hooded seals is 512,000 animals (Waring et al., 2011). Data are not available to estimate the abundance of seals in U.S. waters. From 2001 to 2005, a total of 138 hooded seals stranded along the U.S. east coast from Maine to North Carolina, 53 of which stranded in Massachusetts and 2 in Rhode Island (Waring et al., 2011).

### *ESA-Listed Threatened and Endangered Marine Mammals*

Six endangered species of whales occur within the waters of the North Atlantic OCS, five mysticetes and one odontocete:  North Atlantic right whales, blue whales, humpback whales, fin whales, and sei whales, and the sperm whale (the odontocete). Of these whale species, only North Atlantic right whales, fin whales, sei whales, humpback whales, and sperm whales are likely to occur within the vicinity of the WEA (Right Whale Consortium, 2012).

*North Atlantic Right Whales*

The western North Atlantic right whale is known to inhabit continental shelf and coastal waters in the northeast United States, ranging from wintering and calving grounds in coastal Florida and Georgia, to summer feeding and nursery grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf (NOAA NCCOS, 2006). There are currently six major habitat areas for North Atlantic right whales: coastal waters off the southeastern United States, the Great South channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Scotian Shelf (Waring et al., 2011). Movements within and between habitats may be more extensive than previously known (Mate et al., 1997). The most current minimum population estimate for the North Atlantic stock is 361 whales (Waring et al., 2011).

*Sightings per unit effort*

Regionally, SPUE for right whales was highest in the spring and summer (ranging from 0.5 to 25 whales per 620 miles [1,000 km]) along the 328 ft (100 m) isobath southeast of Cape Cod (see Figure 1 in Appendix F). Within the WEA, sightings occurred in three locations during the spring (SPUE ranging from 0.5 to 25 whales per 620 miles [1,000 km]) and one in the fall (SPUE ranging from 0.5 to 25 whales per 620 miles [1,000 km] [Figure 1 in Appendix F]). Within 40 nm of the WEA, three sightings locations (SPUE ranging from 50 to 100 whales per 620 miles [1,000 km]) were observed in the spring. One of the three sightings locations (SPUE ranging from 50 to 100 whales per 620 miles [1,000 km]) was on the northeast WEA boundary line, and another (SPUE ranging from 25 to 50 whales per 620 miles [1,000 km]) was in very close proximity to the same boundary line in the spring (Figure 1 in Appendix F). Several other sightings within 40 nm of the WEA were also reported in the spring and summer (see Figure 1 in Appendix F).

The SPUE data in for right whales on Figure 1 in Appendix F includes data only through 2009. However, high numbers of right whales were observed in the nearby waters to the west of the WEA during both 2010 and 2011. Right whale sightings documented in the NMFS NARWSS reports (from 2002 to the present), are summarized in Table 4-13. These reports showed very high numbers in 2010 and 2011 in the nearby waters to the west of and within the WEA (Table 4-13). The 2010 event, with a total of 98 whales, triggered a dynamic management area (DMA). DMAs were also implemented off Nantucket in February, March, and April, 2010 (Khan et al., 2011). DMA are triggered when three or more right whales are sighted outside of a seasonal management area (SMA): "DMAs are put in place for two weeks and encompass an area commensurate to the number of whales present. Mariners are notified of DMAs via email, the internet, Broadcast Notice to Mariners (BNM), NOAA Project Weather Radio, and the Mandatory Ship Reporting system (MSR), and are requested to reduce their speed when transiting through DMAs. Unlike SMAs, compliance is voluntary for DMAs" (Khan et al., 2011). These data indicate that this region is, at a minimum, an occasional area of use, and possibly a regularly used area as nursery and feeding grounds. However, because of the relatively low survey efforts prior to these most recent reports, more data are needed for a more definitive summary of right whale abundance in and use of this area.

**Table 4-13**

**Summary of Confirmed Right Whale Sightings Compiled from National Marine Fisheries Service, North Atlantic Right Whale Sightings Survey (NMFS NARWSS) Reports from 2002 to 2011**

| NARWSS Report Year | Months WEA surveyed | [1]SPUE/Number of sightings in WEA or within 40 nm | Reference |
|---|---|---|---|
| 2002 | March–July; September–November | SPUE = low (<0.25) | Cole et al., 2007 |
| 2003 | April–December | 1–4 Sightings | Rone et al., 2007a |
| 2004 | February–July; September–December | 1–4 Sightings | Rone et al., 2007b |
| 2005 | April–December | 1–2 Sightings | Niemeyer et al., 2007a |
| 2006 | January–December | 1–2 Sightings | Niemeyer et al., 2007b |
| 2007 | January–March (only 1 transect line) | 2–4 Sightings | Niemeyer et al., 2008 |
| 2008 | 0 | 1 Sighting (source = whale watch) | Khan et al., 2009 |
| 2009 | 0 | 0 Sightings | Khan et al., 2010 |
| 2010 | April–June | 21 Sightings (98 whales)[2,3] | Khan et al., 2011 |
| 2011 | NA | 1–40 whales at 10 sightings locations | NMFS NEFSC, 2012b[4] |

Sightings sources include aerial and shipboard surveys, whale watches, and opportunistic (i.e., the general public, U.S. Coast Guard, commercial ships, and fishing vessels). Unconfirmed reports were not included in the reports.

[1]Sightings reported as SPUE in 2002 and by count from 2003–2011; depending on presentation in report.

[2]DMA (triggered by ≥3 right whales outside a SMA) in Rhode Island Sound, April–May.

[3]Source: Kenney and Vigness-Raposa, 2010

[4]Sightings map (October 2010–June 2011) only, report not available yet.

*Right whale sightings in the WEA during 1998, 2010, and 2011*

Kenney and Vigness-Raposa (2010) described what they called an "aggregation of feeding right whales just east of Block Island in April 1998" that lasted for at least 3 weeks. Eighteen whales were identified either against the right whale catalog or as uncataloged individuals that were seen on multiple days. Most individuals were males. The rate of resightings was low, however, and observers suspected that there were substantially more than 18 individuals feeding in Rhode Island Sound during this period. Observers were not able to determine the spatial extent of this high-use area. Knowlton et al. (2005) noted that six individuals observed in Block Island Sound in 1998 had actually been recorded earlier in the year in the traditional winter/spring feeding grounds of Cape Cod Bay. No further sightings of these particular individuals were made until they reached the Bay of Fundy in the summer.

During the week of April 23, 2010, 98 right whales were reported feeding in the waters between Martha's Vineyard and Block Island (Khan et al., 2011). From October 2010 through September

2011, a relatively high number of right whales were observed at 10 sightings locations ranging from 1 to 25 right whales at each location within the WEA (see Figure 1 in Appendix F).

Although the stranding location is not necessarily indicative of the location or area inhabited by the whale, strandings data for the south coast of Massachusetts and Rhode Island are included for two reasons: 1) as potentially showing a whale's presence in the area, and 2) as a baseline for serious injuries and mortalities to this species to be used when assessing potential risks from associated Project activities. Five right whale strandings have been recorded in the WEA region in the past decades (Table 4-14).

**Table 4-14**

**Records of Right Whales Stranded in the WEA Region in the Past Decades**

| Date | Location | Cause of Mortality |
|---|---|---|
| 19 January 2000 | 15 km southeast of Block Island | Not determined |
| 12 October 2002 | Nantucket | Entangled in fishery gear |
| 28 April 2005 | Monomoy Island, MA | Ship strike |
| 13 May 2005 | 39 km south of Martha's Vineyard | Not determined |
| 21 May 2006 | 56 km south of Block Island | Not determined |

Source: Henry et al., 2011; Kenney and Vigness-Raposa, 2010

In the RI OSAMP, all marine mammals species likely to occur in the study area were prioritized on a scale from 1 to 5 (1 being the highest priority and 5 the lowest) for management purposes. North Atlantic right whales were ranked as Priority 1A, the only species in this highest-priority level. The other endangered whale species ranged in priority from 1B to 4 (Kenney and Vigness-Raposa, 2010). Kenney and Vigness-Raposa (2010) stated that "the North Atlantic right whale almost deserves to be in a category by itself" as it is one of the rarest mammals in the world, with serious concern about long-term population viability, and known anthropogenic mortality from vessel collision and entanglement in fisheries gear. In the right whale section of the Rhode Island OSAMP, Kenney and Vigness-Raposa (2010) concluded that right whales are most likely to occur in the area during their northward migration in the spring but are also likely to be present during the southward migration in the fall. Data show, however, that right whales could occur in the area during any season.

In summary, North Atlantic right whales were rare (SPUE 0.1 to 25 whales per 620 miles [1,000 km]) within 40 nm of the WEA through 2010 during the winter, summer, and fall, and were most abundant (SPUE as high as 50 to 100 whales per 620 miles [1,000 km]) in the spring (Right Whale Consortium, 2012). Periods of high right whale activity in or near the WEA during 1998, 2010, and 2011 demonstrate that the current knowledge of migratory and feeding activities is incomplete, and that there is interannual variability in the timing and location of these activities.

*Blue Whales*

Within the northwest Atlantic, blue whales are thought to belong to one stock, ranging from the Arctic to mid-latitude waters (Ramp et al., 2006; Waring et al., 2011). However, acoustic records of blue whales have been detected over the entire North Atlantic Ocean basin, with most records detected around the Grand Banks off Newfoundland and west of the British Isles (Waring et al., 2011). Reeves et al. (2004) have indicated that this species appears to have an east/west distribution pattern in tropical and temperate waters, and a more northerly distribution in the summer. In the Blue Whale Recovery Plan, NMFS (1998) concluded that, based on sightings and strandings, blue whales occur along the U.S. east coast only occasionally. This species may be an occasional visitor to the WEA. Only one record of stranded blue whale has occurred within the vicinity of the WEA in the past decades. In March of 1998, a dead male blue whale was brought into Rhode Island waters on the bow of a tanker. The cause of death was ship strike, from the same tanker (Waring et al., 2011). The population estimate for blue whales in the western North Atlantic is 400 to 600 whales (Waring et al., 2011).

*Fin Whales*

Fin whales are very common over the continental shelf waters from Cape Hatteras, NC, north to Nova Scotia (Waring et al., 2011). According to Shoop and Kenney (1992), fin whales represent approximately 46 percent of large whales and 24 percent of all cetaceans sighted over the continental shelf.

Within the Rhode Island OSAMP study area (continental shelf and slope waters from Long Island to Nantucket), the highest occurrence of fin whales was in the outer half of the area from south of Montauk Point to south of Nantucket. This area is “precisely the same area as the dense aggregations of sighting records from the whale watch boats” (Kenney and Vigness-Raposa, 2010). In other words, this area is targeted by whale watch boats because of the high probability of finding fin whales in the area. The most recent abundance estimate for the North Atlantic stock is 3,985 (Waring et al., 2011).

Fin whales are the most commonly stranded large whale in the Rhode Island OSAMP study area, with 28 strandings recorded from 1970 to present (Kenney and Vigness-Raposa, 2010). Fin whale strandings are also common in Massachusetts (Kenney and Vigness-Raposa, 2010), although none were reported there from 2004 to 2008 (Waring et al., 2011).

Regionally, SPUE for fin whales were relatively high in all seasons along the 328 ft (100 m) isobaths southeast of Cape Cod, and along the continental shelf west, south, and east of the WEA (Figure 2 in Appendix F). Within the WEA, fin whales were relatively abundant in all seasons with SPUE ranging from 0.3 to 350 whales per 620 miles (1,000 km) in the summer, 0.3 to 135 whales per 620 miles (1,000 km) in the winter, 0.3 to 50 whales per 1,000 km in the spring, and 0.3 to 135 whales per 620 miles (1,000 km) in the fall (Figure 2 in Appendix F). Within 40 nm of the WEA, fin whales were reported in all seasons, with highest numbers in the winter (SPUE values up to 665 to 2,055 whales per 620 miles [1,000 km]), and summer and fall (SPUE ranging from 350 to 665 whales per 620 miles (1,000 km); Figure 2 in Appendix F).

*Sei Whales*

The Nova Scotia stock of sei whales is distributed across the continental shelf waters from the northeast U.S. coast to south of Nova Scotia (Waring et al., 2011). According to Olsen et al. (2009), sei whales' movements appear to be associated with oceanic fronts, sea surface temperatures, and specific bathymetric features, and this species is typically sighted on the U.S. Atlantic mid-shelf and the shelf edge and slope. However, sei whales are also known to come inshore into more shallow waters episodically (Schilling et al., 1992). For example, a group of at least 40 sei whales, as part of a larger, multi-species group of whales, were sighted in the continental shelf waters off Cape Cod in Hydrographer Canyon in April 1981 (Kenney and Winn, 1987). Baumgartner et al. (2011) have observed sei whales in the Great South Channel during spring from 2004 to 2010, indicating that this species is more common in the area than previously thought. The best estimate of abundance for the Nova Scotia stock is 386 (Waring et al., 2011).

Regionally, the highest SPUE for sei whales occurred in the Great South Channel during the spring and summer (ranging from 0.004 to 4,840 whales per 620 miles [1,000 km]; Figure 3 in Appendix F). Within the WEA, SPUE were at relatively low levels and scattered in all seasons, ranging from 0.004 to 25 whales per 620 miles (1,000 km), with slightly higher SPUE in the spring (25 to 100 whales per 620 miles [1,000 km]). Within 40 nm of the WEA, sightings were rare (SPUE from 0.004 to 25 whales per 620 miles [1,000 km]) in the winter, summer, and fall, and higher in the spring (ranging from 100 to 380 whales per 620 miles [1,000 km]) (Figure 3 in Appendix F).

*Humpback Whales*

Humpback whales in the North Atlantic belong to several discrete subpopulations; the most common subpopulation in the WEA is the Gulf of Maine stock (Barco et al. 2002; Waring et al. 2011). According to Kenney and Vigness-Raposa (2010), the humpback whale occurrence in significant numbers in southern New England is relatively unpredictable and likely dependent on prey availability, both locally and within the Gulf of Maine. Humpbacks are known to possess strong and consistent fidelity to specific foraging areas (Stevick et al., 2006). The amount of time spent at each site is related to the relative density of prey, and local changes in humpback abundance in the western North Atlantic are correlated to prey variation (Stevick et al., 2006). The best estimate of abundance for the Gulf of Maine stock is 847 whales (Waring et al., 2011).

Over the past decades, 13 humpback whale strandings have been recorded in Massachusetts and Rhode Island; 4 of the strandings were recorded in Rhode Island from 2001 to 2005, and 9 were recorded in within Massachusetts waters (Kenney and Vigness-Raposa, 2010; Waring et al., 2011).

Regionally, SPUE for humpback whales were highest in the Great South Channel during summer and fall, with levels ranging from 0.2 to 1,090 whales per 620 miles (1,000 km) (Figure 4 in Appendix F). Within the WEA, SPUE ranged from 0.2 to 40 whales per 620 miles (1,000 km) in the spring, 40 to 100 whales per 620 miles (1,000 km) in the winter, and 100 to 200 whales per 620 miles (1,000 km) in the summer. Within 40 nm of the WEA, humpback whale sightings were higher in the winter, spring, and fall, with SPUE ranging from 40 to 100 whales per 620 miles (1,000 km), and lower in the summer (SPUE ranging from 0.2 to 40 whales per 620 miles [1,000 km]; Figure 4 in Appendix F).

*Sperm Whales*

The overall distribution of sperm whales along the U.S. east coast is centered along the shelf break and over the slope (NMFS, 2010b). An exception to this distribution pattern is found in the shallow continental shelf waters of southern New England, where relatively high numbers of sightings have been reported (Scott and Sadove, 1997). Geographic distribution of sperm whales may be linked to social structure, with females and juveniles generally found in tropical and subtropical waters, and males ranging more widely (Waring et al., 2011).

Sperm whales occurring in the North Atlantic are considered to be one stock, with those occurring in the western North Atlantic likely representing only a fraction of the total stock (Waring et al., 2011). The best abundance estimate of the North Atlantic population is 2,607 animals (Waring et al., 2011). Within the Rhode Island OSAMP study area, “sperm whales are predicted to be present in all four seasons, but in scattered and low abundance” (Kenney and Vigness-Raposa, 2010). There have been no sperm whale strandings in Rhode Island in recent decades, and only two in Massachusetts (from 2001 to 2005; Kenney and Vigness-Raposa, 2010; Waring et al., 2011).

SPUE data support this information, with the highest SPUE found along the continental shelf edge and slope south of the WEA in all seasons. The highest overall SPUE in the shelf waters occurred in the summer, with up to 3,000 whales per 620 miles (1,000 km) (Figure 5 in Appendix F). Within the WEA, SPUE were highest in the fall (ranging from 125 to 335 whales per 620 miles [1,000 km]) followed by the spring and summer (ranging from 2 to 125 whales per 620 miles [1,000 km]). Within 40 nm of the WEA, sperm whales occurred in all seasons. SPUE ranged from 125 to 335 whales per 620 miles (1,000 km) in the winter, spring, and fall, and from 2 to 125 whales per 620 miles (1,000 km) in the summer (Right Whale Consortium, 2012).

#### *4.2.2.6.2 Impact Analysis of Alternative A*

In the section below, impacts on marine mammals from site characterization and site assessment activities are divided into two categories. The first category includes those impacts from acoustic sources (i.e., HRG surveys, sub-bottom reconnaissance, pile driving for meteorological tower installation, and vessel traffic noise). The second category of impacts includes all other, non-acoustic impacts (i.e., benthic habitat, vessel collision, spills, waste discharge, and accidental fuel leaks). The analysis of all impact types for site characterization and assessment is based on the overlap of project work and important ecological considerations for each species group.

### *Acoustic Impacts*

Ambient sound levels in the WEA (principally within 18 to 62 miles (30 to 100 km) of Martha's Vineyard, MA, and Nantucket, MA) may be significantly higher than those in the deep ocean as a result of relatively high levels of human and marine life activity in these coastal waters (Normandeau Associates Inc., 2012). Marine mammals and many other marine organisms depend on sound to communicate information with conspecifics and to derive information about their environment.

The ambient acoustic environment (also called soundscape) is quantified using the frequency, magnitude, and duration of noise within the WEA, and these metrics are used to parameterize noise budgets, which are useful in determining the characteristics of the acoustic environment (Miller et al., 2008). Sound frequency is measured in Hz or kHz. Magnitude, conventionally termed spectrum density level, is measured in dB in terms of mean square pressure per unit frequency (e.g., dB re 1 µPa2/Hz), with sound pressure measured in µPa. The duration of a noise event typically ranges from seconds to weeks, depending on the source. The frequency of the ambient noise present in the WEA is likely in the range of 1 Hz to 100 kHz, and comprises both intermittent and continuous background noise (Cato, 1992; Wenz, 1962). The magnitude of noise in the present soundscape is likely in the range of 20 to 100 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). The existing soundscape contains contributions from anthropogenic, physical, and biological sources.

The prevailing anthropogenic background noise in the WEA is dominated by ocean traffic, including commercial and industrial shipping, fishing vessel, and recreational boat traffic. These activities contribute to background noise levels as well as local and intermittent sound effects. Additionally, sound contributions from these sources display temporal and spatial variability, as the intensity of activities vary with weather and season. The sound from vessels is in the frequency range of 10 Hz to 10 kHz (Wenz, 1962), and the sound spectrum density level is in the range of 40 to 100 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). Information on vessel traffic from military, commercial, and recreational activities in the lease area is provided in Section 4.2.3.8 of this EA.

Physical processes contribute to ambient sound in the WEA. Turbulent pressure fluctuations resulting from surface waves and water motions dominate the ambient noise at frequencies of 1 to 10 Hz (Normandeau Associates Inc., 2012). Noise from surface agitation (e.g., bubbles, spray) contributes to the ambient soundscape at frequencies above 100 Hz, and is weather dependent with the spectrum density level increasing as sea state increases (Wenz, 1962). Intermittent noise resulting from precipitation events would contribute frequencies in the range of 100 Hz to 20 kHz, with heavy precipitation contributing a spectrum density level of approximately 80 dB re 1 $\mu Pa^2/Hz$ (Wenz, 1962). Noise contributions from sediment transport would have an expected frequency of approximately 10 kHz, and the molecular agitation created by moving water molecules may produce frequencies of about 50 kHz (Mellen, 1952).

Biological noise in the existing soundscape contains contributions from marine mammals, fish, and invertebrates. The sound generated from biological sources is in the frequency range of around 10 Hz to greater than 100 kHz, with magnitudes of 50 to 90 dB re 1 $\mu Pa^2/Hz$ (Cato, 1992; Wenz, 1962). Contributions from marine mammals may be intermittent, as these species display temporal variability in occurrence within the WEA (*see* Section 4.3.2.6). The soundscape also includes vocalizations from fish species, particularly from the cod (*Gadidae*) and drum and croaker (*Sciaenidae*) families (Kaatz, 2002). Sounds produced by fish result from breeding, fighting, feeding, and swimming behaviors (Normandeau Associates Inc., 2012). Contributions to the ambient noise levels from biological sources fluctuate throughout the year as a result of the seasonality of noise-producing behaviors. There are potential ambient sound contributions from invertebrates within the WEA, especially from arthropods, mollusks, and echinoderms (Normandeau Associates Inc., 2012). As with other biological sound sources, the contribution to the soundscape from invertebrates varies temporally and spatially with the distribution and density of each species.

Site characterization activities under Alternative A are likely to produce noise events that are intermittent (e.g., sub-bottom sampling) to nearly continuous (e.g., sonar, vessel operation) within a given work day. Total survey work durations would range from days to weeks within each of the OCS blocks. Additionally, sound generated by high-energy activities that are related to site characterization, such as pile driving, could produce noise pulses that have the potential to impact marine life. Changes to the pre-existing soundscape can be reasonably expected from site characterization surveys and the development and operation of meteorological and oceanographic data collection facilities, although the magnitude of the effects will be dependent on the type and duration of such activities. Therefore, the generation of additional noise within the WEA resulting from individual procedures is considered. The site characterization methods for Alternative A include HRG, geotechnical, and biological surveys. Additionally, the installation of meteorological towers and foundations and deployment of meteorological buoys would require methods that would produce sound at levels greater than pre-existing levels. Vessel noise in the WEA would also be increased as a result of the traffic that is necessary for survey and tower installation activities.

Underwater sound from Alternative A can be divided into two categories relevant to marine organisms (e.g., marine mammals, sea turtles, fish): (1) impulsive and (2) non-impulsive (Table 4-15). Impulsive noise can be a single pulse (single pile strike, single ping of certain sonars) or multiple pulses (sequential pile strikes). Impulsive noises are brief, broadband, atonal, and transient with a rapid rise from ambient pressure to a maximal pressure followed by oscillating maximal and minimal pressures (Southall et al., 2007). Pile-driving noise is low frequency with a high source level, and low frequency sources in general have a significant potential for long-range propagation. However, propagation is variable depending on multiple factors, including water temperature, water depth, and bottom type (Hildebrand, 2009).

**Table 4-15**

**Summary of Noise Sources from Site Characterization and Assessment Work**

| Sound source | Sound type | Frequency | Source Level | Reference |
|---|---|---|---|---|
| Survey work, sonar | Non-impulsive | Narrowband | Generally 202–220 with a maximum of 242 dB re 1 µPa/m | NSF and USGS, 2011 |
| Pile driving | Impulsive (multiple pulse) | Broadband 20 Hz to > 20 kHz | >200 dB re 1 µPa RMS | Madsen et al., 2006a |
| Vessel noise | Continuous | Low frequency, 10–1,000 Hz | 150–180 dB re 1 µPa/m | MMS, 2007a |
| Tug boat | Continuous | 100–500 Hz | 140–170 dB re 1 µPa/m | Shell U.K. Limited, 2012 |
| Dynamic Positioning Vessel[1] | Continuous | 500–1,000 Hz | 170–180 dB re 1 µPa/m | Shell U.K. Limited, 2012 |

[1]Source levels are during use of bow thrusters, not transit.

Hz = hertz, kHz = kilohertz, dB re 1 µPa/m = source level, received level measured or estimated 1 m from the source

Noise model results from areas off Delaware and New Jersey and in Nantucket Sound for pile driving associated with offshore wind construction has been submitted to BOEM for previous lease applications and plans (BOEM 2012a). These results indicate that underwater noise levels produced from pile driving may be greater than 180 dB re 1 µPa RMS at 1,640 to 3,280 ft (500 to 1000 m) from the source, and greater than 160 dB re 1 µPa RMS at 2.1 to 4.5 miles (3.4 to 7.2 km) from the source. However, the local environmental characteristics, sources of sound, and monopole diameters are variable, thus causing the isopleths to vary. Nonimpulsive (continuous or intermittent) sound can be tonal, broadband, or both. Some nonimpulsive sounds can be transient signals of short duration but without the rapid rise time (i.e., vessels and many active sonar systems). Although sonar sound is a “tone pulse,” it is considered non-impulsive because it is often narrowband (any sound that is a tone, rather than broadband; NSF and USGS, 2011). Non-impulsive sounds can have very long durations and can be received (audible) at a distance of tens of kilometers (Southall et al., 2007).

Source level of noise refers to the level of noise produced from the emitting source (i.e., vessel or pile strike), and received level of noise refers to the measurement of noise that the animal receives (accounting for noise propagation and distance of the animal from the noise source).

*Hearing in Marine Mammals*

Marine mammals use sound for many important biological functions, including foraging, orientation, response to predators, and social interactions (Southall et al., 2007). The impacts from noise and interference with these functions can cause a variety of responses ranging from mild behavioral changes to physical injury. Impacts on marine mammals from anthropogenic noise are dependent on multiple factors, including characteristics of the local acoustic environment (i.e., water depth and bottom type), novelty of sound to the animal, the individual animal's hearing sensitivity, and the animal's activity during the noise emission (NSF and USGS, 2011). Impacts on marine mammals may occur if the frequencies of sound from project activities are generally similar to, or overlap, the frequency range of hearing for the animal exposed to the sound, and/or the SPLs are high enough for a sufficient duration (NSF and USGS, 2011).

To best analyze acoustic impacts on marine mammals, Southall et al. (2007) have divided marine mammals into hearing groups according to their hearing ranges (Table 4-16). For more details on underwater hearing and sound production for each species, summary tables for mysticetes, odontocetes, and seals are available in the *Final Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research funded by the National Science Foundation or conducted by the U.S. Geological Survey* (NSF and USGS, 2011).

**Table 4-16**

**Marine Mammals Hearing Group and Hearing Range for Those Species in the WEA**

| Marine mammal hearing group | Species in WEA | Hearing range |
|---|---|---|
| Low-frequency mysticetes | North Atlantic right, blue, fin, sei, humpback, minke whales | 7 Hz to 22 kHz |
| Mid-frequency odontocetes | Sperm whales, dolphins, pilot whales, beaked whales, killer whales, northern bottlenose whales | 150 Hz to 160 kHz |
| High-frequency odontocetes | Harbor porpoise, dwarf sperm whales, pygmy sperm whales | 200 Hz to 180 kHz |
| Seals in water | Harbor, gray, harp, and hooded seals | 75 Hz to 75 kHz |
| Seals in air (hauled out) | Harbor, gray, harp, and hooded seals | 75 Hz to 30 kHz |

Southall et al., 2007. Hz = hertz; kHz = kilohertz.

*Current Noise Criteria for Behavioral Disturbance and Potential Injury*

Auditory masking is defined as obscuring of sounds of interest by interfering sounds, generally at the same or similar frequency. Although not considered injurious, masking may nonetheless cause significant behavioral changes to exposed marine mammals. Two different levels of potential injury to marine mammal hearing sensitivity have also been defined: (1) TTS is a non-permanent decrease in hearing sensitivity; (2) physical injury, or permanent threshold shift (PTS) is a permanent decrease in hearing sensitivity.

Current NMFS criteria for determining impacts on marine mammals are based on the following received levels (not source levels): 1) behavioral disturbance or harassment from a *continuous* source of sound 120 dB re 1 µPa, 2) behavioral disturbance from a *non-continuous* source of 160 dB re 1 µPa, and 3) potential injury from received levels of 180 dB re 1 µPa. Additionally, Southall et al. (2007) have proposed and recommended the use of sound exposure level (SEL) to measure potential risks to marine mammals (Table 4-17). SEL a cumulative measurement over the duration of a sound, measured as decibels referenced at 1 micro Pascal squared per meter (i.e., dB re 1 µPa$^2$/m). This metric is the most useful for risk analysis because measurements for impulsive sound are cumulative (across pulse) and SEL characterizes sounds of different durations as total energy (Southall et al., 2007). However, because of differences in how the units are measured, the SEL threshold criterion for TTS of 183 dB re 1 µPa$^2$/m is not directly comparable to the NMFS criterion of 180 dB RMS (received level, single pulse; Southall et al., 2007). Measurements for various studies are not always available in SEL units, but may also be referred to (among other units of sound) in units of peak sound pressure and peak-to-peak sound pressure. Peak sound pressure is the maximum absolute value of instantaneous pressure during a specified time; peak-to-peak sound pressure is the algebraic difference between the maximum positive and maximum negative instantaneous peak pressure.

**Table 4-17**

**Summary of Proposed Peak Pressure and SEL Threshold Criteria for Physical Injury (PTS)**

| | **Sound type** | |
|---|---|---|
| | **Multiple pulse** | **Non-pulse/continuous** |
| **Cetaceans** | | |
| Peak Sound Pressure Level | 230 dB re 1 µPa (peak) | 230 dB re 1 µPa (peak) |
| SEL | 198 dB re 1 µPa$^2$ –sec | 215 dB re 1 µPa$^2$ –sec |
| **Seals (in water)** | | |
| Peak Sound Pressure Level | 218 dB re 1 µPa (peak) | 218 dB re 1 µPa (peak) |
| SEL | 186 dB re 1 µPa$^2$ –sec | 203 dB re 1 µPa$^2$ –sec |

Southall et al., 2007

dB re 1 µPa (peak) = the maximum absolute value of instantaneous pressure during a specified time

dB re 1 µPa$^2$ –sec = cumulative sum-of-square pressures over the duration of a sound

Impacts of sound on marine mammals from site assessment and site characterization activities include the following activity and equipment types: site surveys (including single and multibeam depth sounders, multibeam and side-scan sonar, magnetometers, and shallow-[CHIRPs] and medium-penetration [boomers] sub-bottom profilers), pile driving, and vessel traffic noise. Each of the different survey instrument types produce different sound sources depending on manufacturer and model, resulting in variable ranges of sound produced. Impacts from each of these activities are assessed by identifying similar or overlapping acoustic characteristics for each hearing group with those of the acoustic sources generated by the project activity.

*HRG Survey Acoustic Effects*

Details of HRG surveys for the proposed action are described in Section 3.1.3.1, and the typical (e.g., expected) noise contribution to the pre-existing soundscape from each HRG survey method is shown in Table 3-3. The increase in both instantaneous and cumulative background noise in the WEA would be directly proportional to the duration of HRG surveys, currently estimated at 1,500 vessel round trips (14,250 hours) to survey the entire WEA, non-inclusive of vessel transit to/from survey location. Vessel speeds during survey operations would be relatively low (approximately 7 to 9 km/hour), but would likely be higher during transit to and from the lease block areas. The spatial extent of the noise contribution for HRG surveys would be proportional to the area covered by such surveys, and attenuation of noise away from the source vessel would be influenced by local weather (sea state) and geological attributes of the seafloor. The assumption that the digital dual-frequency side-scan sonar systems used for HRG surveys of seafloor surface conditions would be in the 100 to 900 kHz range indicates an increase in high frequency noise when compared to the assumed pre-existing soundscape. However, these frequencies are outside the hearing range of baleen whales (mysticetes) and at the upper limits of toothed whale (odonticete) hearing (see Table 4-16).

Sub-bottom profiling of the WEA using CHIRP systems would introduce sound frequencies of 2 to 200 kHz at an estimated broadband source level of 222 dB re 1 µPa at 1 m from the source. Although the sound frequencies produced by CHIRP sampling systems are within the expected pre-existing soundscape, the sound pressure produced by these systems may exceed ambient levels. The attenuation of sound pressure from the source would vary depending on the CHIRP system used and sampling site conditions. When calculated using the short pulse duration (received level) of the source the 180 dB radius for the CHIRP sub-bottom profiler is 26 to 35 m and the 160 dB radius is 240 to 689 m from the source (BOEM, 2012c). Medium penetration sub-bottom profiling using boomers (impulse type) is expected to produce sound frequencies in the range of 200 Hz to 16 kHz at an estimated broadband source level of 212 dB re 1 µPa RMS at 3 ft (1 m). The sound frequency used by boomers would be within the range of that present in the pre-existing soundscape, while the SPL produced using boomer systems would exceed pre-existing SPLs. CHIRP and boomer sub-bottom profiling would not likely occur from the same vessel (it is an either/or scenario between sub-bottom profiling types). BOEM assumes that the use of sub-bottom profiling systems will increase noise above ambient levels during their use. The impact potential of active sonar (multibeam echosounders, side-scan sonar, and sub-bottom profilers) depends on multiple factors, including type and model of equipment, power output (source level, dB), beam width, duty cycle of the device (percentage of time when the source is emitting sound), frequency of sound, and the particular sound transmission characteristics of the local marine environment (NSF and USGS, 2011). The potential for impact also depends on the animal's distance from and position relative to the sonar beam, the received level of sound, and the animals hearing frequency range and activity during the production of noise (NSF and USGS, 2011).

As indicated in Table 4-18, boomer and CHIRP sub-bottom profiler operating frequencies overlap with the hearing frequency ranges for all marine mammal hearing groups (Table 4-16), and are thus audible to all marine mammals (BOEM, 2012c). Side-scan sonar overlaps only with hearing frequencies for odontocetes, while frequency level for multibeam depth sounders is above the frequency hearing range for all marine mammals, and thus would not be audible (BOEM, 2012c). Peak source levels for these instruments reach high levels, ranging from 212 to 226 dB re 1 µPa at 1 m. SOCs, including surveillance of an exclusionary zone of 656 ft (200 m) for all marine mammals, are designed to decrease the potential for any animals to incur injury or PTS (180 dB). Sound propagation modeling for acoustic sources used during HRG surveys was conducted and described in Appendix D of the *Atlantic OCS Proposed Geologic and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement*. Based on peak source levels for each electromechanical source, the 180 dB radii are estimated to be within the 656 ft (200 m) exclusionary zone, and therefore no physical injuries are expected for marine mammals in the area (Table 4-18). The extended exclusion zone of 1,500 ft (457 m) for right whales includes the 160 dB isopleth for all electromechanical sources except potentially CHIRP sub-bottom profilers, which may exceed the 160 dB isopleth within the 1,500 ft (457 m) exclusionary zone (Table 4-18). In the unlikely event that right whales are within 1,500 ft (457 m) of HRG survey activities, received levels of 160 dB may cause behavioral changes or harassment, but are not expected to incur injury to the whales.

**Table 4-18**

**Summary of Potential Acoustic Impacts During HRG Surveys**

| Survey Method | Peak source level (dB re 1 µPa at 1 m) | Operating frequency within cetacean hearing range (Y=yes; N=no) | Hearing Group with frequency overlap | Radial distance[2] to 180 dB (RMS) isopleth from single pulse (m) | Radial distance[2] to 160 dB (RMS) isopleth from single pulse (m) |
|---|---|---|---|---|---|
| Boomer | 212 | Y (0.2–16 kHz) | Mysticetes,[1] Odontocetes | <5 | 16 |

| Survey Method | Peak source level (dB re 1 µPa at 1 m) | Operating frequency within cetacean hearing range (Y=yes; N=no) | Hearing Group with frequency overlap | Radial distance[2] to 180 dB (RMS) isopleth from single pulse (m) | Radial distance[2] to 160 dB (RMS) isopleth from single pulse (m) |
|---|---|---|---|---|---|
| | | | Pinnipeds | | |
| Side-scan sonar | 226 | Y (100 kHz)<br>N (400 kHz) | Odontocetes NA | 65–96 | 337–450 |
| CHIRP sub-bottom profiler | 222 | Y (3.5 kHz, 12 kHz)<br>N (200 kHz) | Mysticetes Odontocetes<br>Seals<br>NA | 26–35 | 240–689 |
| Multibeam depth sounder | 213 | N (240 kHz) | NA | <5 | 12 |

Source: BOEM, 2012c

[1]Mysticetes = low frequency hearing group; Odontocetes = mid-frequency and high-frequency hearing group; NA = not applicable. Gray shaded cells indicate potential for sound level to exceed harassment level of 160 dB beyond the exclusion zone.

[2]Radial distances represent recalculated values to account for short pulse duration.

dB re 1 µPa at 1 m = source level, received level measured or estimated 1 m from the source

dB (RMS) = sound pressure level, decibel measurements of the average of the squared pressure (RMS = Root Mean Squared) over some duration

kHz = kilohertz

A study on right whales' reactions to alarm and vessel noise indicated that artificial alarm signals (made specifically for the study) consisting of tonal down sweeps elicited a strong behavioral reaction from right whales (Nowacek et al., 2004). These alarm signal SPLs were as low as 130 to 150 dB re 1 µPa, with frequency levels that overlap those in boomers and CHIRP sub-bottom profilers. Ten whales were tagged to record received sound and measure movement in three dimensions during sound exposure. Five of the six exposed whales reacted strongly (i.e., stopped foraging and swam rapidly to the surface; Nowacek et al., 2004). These whales remained at or near the surface for the duration of the exposure (an abnormally long surface time), which most likely increased their risk of ship strike (Nowacek et al., 2004). The sixth whale showed no detectable response. There is a negative energetic consequence for the whales responding in this way, both by losing foraging time and expending extra energy during the high-powered ascent and subsurface swimming (Nowacek et al., 2004). Because five of six whales responded with the same, relatively extreme manner to a low received level, the cause for alarm is clearly not the sound level. Instead, this study suggests that the novelty or specific type/characteristics of the sound were *interpreted* as alarming.

Even with experienced operators, HRG survey activities can involve some potential scenarios that may increase the risk of exposure to high sound levels for animals in the survey area. Firstly, although the main beam is downward pointing, off-beam side lobes of sound ("waste noise") may also occur (Weilgart, 2010) at levels well above 180 dB. Secondly, if the beam is off axis by a relatively small amount (e.g., 20–30°), the beam would be emitted in a more horizontal direction, thereby increasing the risk of potential area of exposure to any animals nearby. Thirdly, by definition, active sonar is producing sound that is meant to bounce off the ocean bottom or other objects, returning to the surface receivers approximately 1,970 ft (600 m) behind the vessel. This entire area, including the downward and upward beam, would be ensonified with high-level sound, again potentially above 180 dB. According to Southall et al. (2007), regardless of SEL, there is a concern for PTS with a single instantaneous peak pressure greater than 230 dB re 1 µ Pa (peak).

Nonetheless, adverse impacts on right whales and other marine mammals from HRG surveys are not expected. The SOC requirement of a 1,500 ft (457 m) exclusion zone for right whales will encompass the 160 dB isopleth for a majority of survey equipment within which harassment may occur. The 656 ft (200 m) exclusionary zone for all marine mammals will encompass the 180 dB isopleth, providing protection from physical injuries.

*Geotechnical Sampling Acoustic Effects*

Samples to characterize bottom surface composition (<3 m below seafloor) would be collected using methods such as piston or gravity coring, grab sampling, and dredging. These geotechnical bottom-sampling surveys do not use high-energy sound sources; therefore, the mechanical surveys themselves would have minimal, if any, impact on the soundscape. Noise generation related to bottom surface sampling would result from stationary vessel engine noise for maintaining position while samples are taken, and noise from generators and hydraulics necessary to operate (e.g., raise, lower) sampling equipment. The cumulative vessel noise generated would be dependent on the time necessary for sufficient sample collection.

Sub-bottom samples can be obtained using Vibracoring, deep boring, or CPT techniques. Using one or more of the sub-bottom sampling techniques, Alternative A assumes a maximum total of up to 2,900 geotechnical samples (one sample per nm) could be collected for site characterization studies. The shallow bottom sampling methods do not produce high-energy sound (see Section 3.1.3.2). Vibracore sampling would likely produce sound frequencies in the 10 Hz to 10 kHz range, which is within the frequency range of the pre-existing ambient soundscape (Reiser et al., 2011). This indicates that any alteration to the soundscape from Vibracore sampling would be related to total sound pressure rather than the introduction of new frequencies. Deep geologic borings can be expected to produce sound levels in the range of 118 to 145 dB at a frequency of 120 Hz.

The noise produced when using Vibracores would be essentially limited to the vessel noise (approximately 45 ft [13.7 m] vessel). During vessel positioning, prior to boring, noise may be produced from a jack-up barge, four-point anchoring system, or dynamic positioning. During sampling using the CPT method, noise produced may include a medium vessel, jack-up barge, barge with four-point anchoring system, or dynamic positioning. Sub-bottom sampling vessels, dynamic positioning vessels, and support vessels, may all produce noise levels ranging from 150 to 180 dB re 1 μPa/m (Table 4-15). Noise levels from these project vessels may remain above the 120 dB level up to several kilometers from the source (NMFS, 2010d). As described in Section 4.2.3.8 of this EA, vessel traffic in this area is relatively high with vessels transiting frequently; marine mammals are presumably habituated to this noise. In a recent Biological Opinion for the Neptune Deepwater Port in Massachusetts Bay, NMFS (2010d) considered sound levels above 120 dB (the continuous noise threshold use to determine harassment under the MMPA) to constitute a take for North Atlantic right whales, humpback whales, fin whales, and sei whales. However, NMFS determined that this would be a permittable action, stating that "while whales may experience temporary impairment of behavior patterns, no significant impairment resulting in injury (i.e., "harm") is likely" (NMFS, 2010d).

Noise would be produced from borehole drilling in addition to the vessels, both continuous sounds for which the NMFS threshold for harassment is at the 120 dB level. Previous noise estimates submitted to BOEM for borehole drilling ranged from 118 to 145 dB at 120 Hz frequency, with indications that the sound would attenuate to below 120 dB at 492 ft (150 m) from the source (NMFS, 2009e). Noise generated by drilling is not likely to negatively impact any marine mammals in the area because the distance of attenuation to 120 dB is less than the zone of exclusion.

Sound produced during sub-bottom reconnaissance and the increase in vessel traffic may also cause behavioral disturbance to marine mammals in the WEA, potentially causing some animals to leave the area during the work period. The species most at risk from this activity is right whales, because of potential loss of feeding habitat (from avoidance of vessels, not from sea floor disturbance) and an increased risk of vessel strike during transit to and from the WEA when vessel speeds may be relatively high. The Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B and visual monitoring of the 1,500 ft (457 m) radius exclusion zone for right whales, 300 ft (91 m) radius for all non-delphinoid cetaceans, and 150 ft (45 m) radius for delphinoid cetaceans are expected to minimize impacts during vessel transit and drilling during sub-bottom sampling.

*Meteorological Tower Pile-Driving Acoustic Effects*

The installation of meteorological towers under Alternative A is assumed to require impact pile-driving for foundation placement (see Section 3.1.4.1). Pile driving uses high-energy sources that can produce high sound pressure in excess of 200 dB re 1 μPa/m and broadband frequencies ranging from 20 Hz to >20 kHz to drive foundation piles into the sea floor (Madsen et al. 2006a; Thomsen et al., 2006), and can, therefore, be expected to generate noise greater than pre-construction ambient sound levels. Increased vessel traffic and continuous presence in the WEA would be required for transportation of equipment to meteorological tower and buoy installation sites, as well as onsite operation of vessels during installation and maintenance. Approximately 900 hours of onsite vessel time would be required per meteorological tower installation (Table 3-5), although the intensity of vessel operation onsite would be dependent upon the work required. Although vessel noise would be in the frequency range assumed for pre-existing ambient levels, any stationary vessel operation at a construction site would increase the cumulative sound for the duration of the operation. This noise increase would be directly proportional to the number of vessels operating onsite at a given time.

Pile driving is generally identified as the activity with the greatest potential impact on marine mammals (Madsen et al., 2006a). A study of wind turbine noise on harbor porpoises, bottlenose dolphins, harbor seals, and northern right whales indicated that "pile-driving sounds are audible to these marine mammals at very long ranges of more than 100 km, and possibly up to more than a thousand kilometers" Madsen et al. (2006a). The frequency range for pile-driving sound overlaps with the hearing frequency for all marine mammals, and thus would be audible to all hearing groups up to 15 to 50 km (Carstensen et al., 2006; Tougaard et al., 2008), and potentially causing TTS or PTS within 100 m (Bailey et al., 2010). Lower levels of noise from pile driving could interfere with foraging or social behavior, potentially leading to avoidance of a preferred habitat (Bailey et al., 2010).

Pile-driving noise levels depend on multiple factors, including the size and type of the hammer and monopole, and the properties of the sea floor. Acoustic impacts for marine mammals from pile-driving operations depend on the source level, the transmission-loss properties of the habitat, and the hearing abilities of the animal (Madsen et al., 2006a). A summary table of known and anticipated effects of seismic and other noise can be found in the *Atlantic OCS Proposed Geologic and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement* (BOEM, 2012c) and the in the *Final Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research funded by the National Science Foundation or conducted by the U.S. Geological Survey* (NSF and USGS, 2011).

In Alternative A, each leasehold area may contain from zero to one meteorological towers (with a total of up to five meteorological towers for the entire WEA), and one to two meteorological buoys (total of up to 10 buoys for the WEA). If each pile would take a maximum of 8 hours to place and assuming the maximum of four piles per tower, the total duration of pile-driving sound generated would be a maximum of 32 hours per tower. Thus, a maximum of 4 days per tower and 20 days of pile driving and associated acoustic effects could be expected for the WEA.

### *Mysticetes*

Information on the response of mysticetes to pile driving is not available. Airguns, which produce a similar type of sound as pile driving, have been studied and these studies provide an indication of the impacts. In general, mysticetes (blue, fin, sei, and minke whales) tend to avoid seismic sounds from airguns by remaining significantly farther from the sound source during seismic activity than non-seismic periods (Stone and Tasker, 2006). However, behavioral reactions appear to be dependent on the activity of the whale. Migrating bowhead whales (which belong to the same family as right whales) showed significant behavioral disturbance, avoidance out to a distance of 11 to 16 nm (20 to 30 km) from a medium-sized airgun with multiple pulses at received levels of approximately 120 to 130 dB re 1 µPa RMS (Southall et al., 2007). During foraging in the summer, bowhead whales were not as sensitive to seismic sounds and typically began to show avoidance at received levels of 160 to 170 dB re 1 µPa RMS, presumably due to the greater energetic cost to stop foraging (NSF and USGS, 2011). Assuming the right whale responds the same way its congener the bowhead does, right whales would be at greater risk of injury from these sound types and levels while feeding. For all other low-frequency cetaceans (including bowhead whales not migrating), the onset of behavioral reaction was around 150 to 160 dB re 1 µPa (Southall et al., 2007).

The potential risk of injury from pile driving or temporary avoidance of foraging habitat depends on multiple factors, including the species and time of year. The season with the overall highest number of SPUE in the WEA for all species is in the spring. The fewest number of species (only fin whales) appears to occur in the WEA during the fall and winter. The time of year at which right whales would be at the highest risk of acoustic impacts from pile driving would be primarily during the late winter and spring. BOEM has implemented the most conservative protective measures for all ESA-listed species by prohibiting pile-driving work to occur from November 1 through April 30, thus avoiding the period with the most species present. Under the Proposed Action, the mysticete species that may be affected by pile-driving noise are fin and humpback whales in the summer, fin whales in the fall, and minke whales in the summer. However, exposure of mysticetes to high levels of pile-driving noise from May 1 to October 31 will be minimized by the required surveillance of an exclusion zone of 3281 ft (1000 m) for all marine mammals, and by the "soft start" method to warn animals away from the vicinity.

### *Odontocetes*

The frequency range for pile driving overlaps the frequency hearing range for all odontocetes, and pile-driving noise would therefore be audible. However, the limited data on effects of multiple pulse noise such as pile driving on mid-frequency cetaceans indicate variable reactions between and within species (Southall et al., 2007). For example, in certain conditions, multiple pulses as low as received levels of 80 to 90 dB re 1 µPa caused sperm whales to stop vocalizing (Southall et al., 2007). In other cases with slightly different stimuli, received levels of 120 to 180 dB re 1 µPa, elicited no observable reaction (Southall et al., 2007). According to Barkaszi et al. (2012), during seismic activities, sperm whales nearest to the seismic activity appeared to exhibit more surface behavior than those farther away.

Bailey et al. (2010) predicted the following sound levels and distance from pile-driving activities for which behavior reactions are expected: 1) bottlenose dolphins at a SPL of 140 dB re 1 µPa = 31 mile [50 km] range; and 2) harbor porpoise at a SPL of 90 to 155 dB re 1 µPa = 12 to 43 mile [20 to 70 km] range. Pile driving would be capable of masking strong vocalizations by bottlenose dolphins within 6.2 to 9.3 mile (10 to 15 km), and weak vocalizations up to 25 miles (40 km) (Bailey et al, 2010). In a study to determine physiological responses to similar exposures, Romano et al. (2004) observed significant differences in aldosterone and monocyte counts in dolphins with exposures ranging from 213 to 226 dB re 1 µPa (peak-to-peak). Aldosterone is one of the primary stress hormones in cetaceans and may be a more sensitive indicator to stress than cortisol (Romano et al., 2004).

Sperm whales are known to occur in the WEA during the spring and summer; however, the limit of pile-driving occurrence to summer and fall would eliminate the potential risk of noise exposure from pile driving for sperm whales in the spring. In general, the season in which all other odontocetes are expected to occur in the highest numbers in the WEA is the spring, with the lowest numbers expected to occur in the winter. Because of the seasonal limitation of pile driving, impacts from pile-driving noise are eliminated from November 1 to April 31. Although greatly minimized by the seasonal limitation, impacts from pile-driving noise may still occur for the following odontocete species that are known to occur in the WEA during the following seasons: Sperm whale during the summer, Atlantic white-sided dolphin and short-beaked common dolphin during the summer and fall, common bottlenose during the summer, Risso's dolphin during the fall, and harbor porpoise in the summer (Right Whale Consortium, 2012). However, exposure of odontocetes to high levels of pile-driving noise from May 1 to October 31 will be minimized by the required surveillance of an exclusion zone of 3281 ft (1000 m) for all marine mammals, and by the "soft start" method to warn animals away from the vicinity.

### *Seals*

The frequency range for pile driving overlaps with both the underwater and in-air frequency hearing ranges known for seals, and would, therefore, be audible underwater during pile driving. Results from studies on behavioral reactions of seals to seismic signals (including pile driving) are variable. In a study in the German Bight with peak SPLs from pile driving measuring 189 dB 0-peak re 1 µPa, behavioral responses were possible up to 12.4 miles (20 km) from the source, masking was possible up to 80 km, and hearing loss may have been a concern at 1,312 ft (400 m) for seals (Thomsen et al., 2006). While in a different study, predicted sound levels and distance from pile-driving noise expected to elicit a behavioral response in harbor and gray seals was 143 dB re 1 µPa at 705 ft to 8.7 miles (215 m to 14 km) (Bailey et al., 2010). Additionally, pile-driving activities appear to have a significant effect on the haul-out behavior of harbor seals. Madsen et al. (2006a) reported a 10 to 60 percent reduction in the number of seals hauled-out approximately 6.2 miles (10 km) from the pile driving, compared to periods with no pile driving.

According to the SPUE data, seals occur in the highest numbers in the WEA in the spring and to a lesser extent during the winter and summer (Right Whale Consortium, 2012). The limitation of pile driving during the winter and spring would eliminate impacts during those seasons, resulting in a very small potential for exposure to pile-driving sound in the summer. Standard operating conditions including an exclusion zone of 3281 ft (1000 m) and the use of "soft start," are expected to minimize the likelihood of acoustic impacts from pile driving for any seals in the WEA from May 1 to October 31.

*Vessel Traffic Acoustic Effects*

The human activity that puts out the greatest amount of sound energy into the ocean is vessel noise (Weilgart, 2007). Vessel noise may result in multiple impacts for marine mammals, including reduced communication, interference with predator/prey detection, and avoidance of habitat areas (Southall, 2005). Ship engines and vessel hulls themselves emit broadband, continuous sound, generally ranging from 150 to 180 dB re 1 µPa/m, at low frequencies below 1000 Hz (NSF and USGS, 2011). The frequency range for vessel noise overlaps the hearing frequency range for all marine mammals.

Potential acoustic impacts from vessel noise during site assessment and characterization activities will consist of vessel noise produced during vessel transit to and from ports as well as the vessel noise produced during the HRG surveys, sub-bottom sampling, and construction, maintenance, and decommissioning of meteorological towers. Vessels for this project may be transiting from 10 major ports and 21 minor ports throughout a region in which heavy vessel traffic already exists. To what extent the increase of up to 6,500 vessel round trips (the maximum trips anticipated for site characterization and site assessment) would add to the acoustic environment in the region is unknown.

### *Mysticetes*

Possible effects from vessel noise are variable and can depend on species, location, the whale's activity, novelty of the noise, vessel behavior, and habitat. Right whales are known to produce a variety of sounds with most of the energy below 1,000 Hz (Parks and Tyack, 2005) overlapping with the energy of vessel noise. In a study investigating north Atlantic right whales' reactions to shipping noise, tagged whales showed no response to playback of vessel noise and were approached to within less than 1 nm by actual passing vessels (Nowacek et al., 2004). This lack of response suggests that whales are unlikely to respond to the sounds of oncoming vessels even when they hear them, thereby increasing their risk of ship strike (Nowacek et al., 2004). This is particularly a problem for whales swimming below the surface where they are less likely to be observed by mariners.

A recent study indicates that vessel noise increases stress in right whales (Rolland et al., 2012). The reduced ship traffic in the Bay of Fundy following the events of September 11, 2001 resulted in a 6 dB (primarily below 150 Hz) noise reduction in underwater noise (Rolland et al., 2012). The noise reduction corresponded to decreased levels of glucocorticoids (stress-related fecal hormone metabolites) in right whales (Rolland et al., 2012). Additionally, estimates from data modeling and analytical methods indicated that acoustic communication space of calling right whales was reduced by 84 percent by passage of only two commercial ships over 13.2 hours (Clark et al., 2009). Communication space for singing fin and humpback whales was also decreased, but to a lesser extent because of species-specific differences in acoustic signals (Clark et al., 2009).

As described in Section 4.2.1.3.8 of this EA, the current level of vessel traffic is relatively high in the project area, and thus whales in the area would presumably be habituated to vessel noise. Although received levels of vessel noise may at times be above the Level B criterion for harassment (120 dB), right whales are known to continue to feed in Cape Cod Bay and Great South Channel in spite of frequent disturbance from passing vessels (NMFS, 2007). For a majority of time throughout site characterization and site assessment work (i.e., during the actual survey work), vessels would be traveling at reduced speeds (4 to 5 knots), which would produce lower noise levels than at higher speeds. Additionally, the Vessel Strike Avoidance Measures and Reporting for Mariners, including maintaining a distance of 1,500 ft (457 m) from right whales and 300 ft (91 m) from all other mysticetes, combined with a vigilant watch for marine mammals by vessel operators and crew at all times, will reduce the likelihood of marine mammals in close proximity to vessels where the noise levels are the highest. Thus, the effects of project-related vessel traffic noise on mysticetes are expected to be negligible.

### *Odontocetes*

A relatively large number of odontocetes have been observed responding to vessel noise in field and laboratory studies. Several studies suggest sperm whales within 1,476 ft (450 m) of whale-watching vessels respired significantly less frequently, had shorter surface intervals, and took longer to start clicking at the start of the dive descent compared to when vessels were absent (Gordon et al., 1992). The source level recorded was 157 dB re 1 µPa/m with received levels of 104 dB re 1 µPa at 1,476 ft (450 m) over a bandwidth of 100 to 600 Hz (Gordon et al., 1992). Results from studies on acoustic impacts from vessel noise for ondontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 ft (50 m) of the vessel by 26 percent (Jensen et al., 2009). Pilot whales in a quieter, deep-water habitat could experience a 50-percent reduction in communication range from a similar size boat and speed (Jensen et al., 2009). Nonetheless, given current traffic levels in the region, the effects of project-related vessel traffic noise on odontocetes are expected to be negligible.

### Seals

The effects of nonpulse exposures (vessel noise) on pinnipeds in water are poorly understood, and studies of behavioral responses to vessel noise in pinnipeds are lacking (Southall et al., 2007). The range of frequency for hearing in seals in water (75 Hz to 75 kHz) overlaps with the frequency range for vessel noise. Studies on impacts on seals from vessel noise indicate that seals are likely to avoid vessels at 328 to 1,640 ft (100 to 500 m) (Jansen et al., 2010). Exposures to nonpulsed sound in water between 90 and 140 dB re 1 µPa generally do not appear to illicit strong behavioral responses in pinnipeds (Southall et al., 2007). In a study of harbor seals in captivity, no response was indicated from 80 to 100 dB re 1 µPa exposure, and a single avoidance behavior was recorded for exposure to sound levels of 100 to 110 dB re 1 µPa (Kastelein et al., 2009). However, in a study on the effects of human disturbances on harbor seal haul-out behavior, Lelli and Harris (2001) found that "the level of boat traffic was, by far, the single strongest predictor of harbor seal haul-out number, accounting for 27% of its variability." In 122 days of observation, 85 incidents in which the harbor seals were flushed off their haul-out ledges were observed; of these, 93 percent were caused by boats (Lelli and Harris, 2001). Nevertheless, based on current traffic levels in the region seals are presumably habituated to vessel noise. As with mysticetes and odontocetes, the effects of project-related vessel traffic noise on seals are expected to be negligible.

### Non-acoustic Impacts

*Benthic Habitat Effects*

Impacts on benthic habitats for marine mammals are considered to be negligible. Short-term and temporary disturbance to the benthic community would occur during sub-bottom sampling and meteorological tower/buoy installation. These activities may cause an indirect loss of a minimal number of benthic prey organisms for the fish species that seals and some whale species prey on (i.e., herring, sand lance, and mackerel). Meteorological tower/buoy installation would also cause re-suspension and subsequent increased turbidity, which is also expected to be temporary, and negligible for marine mammals in the WEA.

*Vessel Collision Effects*

Collisions with ships resulting in serious injury or death are not uncommon with cetaceans and are a significant threat to the recovery of the North Atlantic right whale (Kraus et al., 2005). The highest risk for vessel strike for right whales is most likely during the transit to and from the WEA (and specific lease block) as a result of vessel speeds greater than 10 knots. The potential risk for ship strike during survey work is lower because vessel speeds range from 4 to 5 knots. Vessels transiting between the leasehold and shore at night may pose a potential strike risk to right whales. Right whales are difficult to spot, with their black coloration and absence of a dorsal fin, and may be even less observable at night.

The total number of vessel round trips estimated over 5 years for site characterization and site assessment is anticipated to be a maximum of 6,500. This would increase the vessel traffic rate in an area with existing high levels of vessel traffic by approximately 3.2 vessel roundtrips per day ([6,500 vessel roundtrips/5.5 years] x 365 days). The Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B of this report is expected to minimize the potential for ship strikes to all marine mammals.

*Spills*

As discussed in Section 3.2.3, the severity of an oil or fuel spill depends on the material, size, and location of the spill, as well as the current meteorological conditions. The average fuel spill size for project vessels is estimated at 88 gallons, which is relatively small, and would, therefore, contribute a negligible potential for negative impacts on marine mammals. In the unlikely event of a vessel spill, the most likely material to be spilled would be diesel fuel, which would be expected to dissipate fairly quickly.

*Discharge of Waste and Accidental Fuel Leaks*

The operational waste from site characterization and assessment work, including bilge and ballast water, trash debris, and sanitary and domestic waste, would be disposed of per regulations discussed in Section 3.1.3.5. All project operators, employees, and contractors would be briefed on marine trash and debris awareness elimination as outlined in Appendix B; thus, negative impacts for marine mammals from waste discharge and accidental fuel leaks are not likely.

*Meteorological Tower Decommissioning*

Details regarding decommissioning of the meteorological towers are described in Section 3.1.4.1. The potential effects from decommissioning work include sound and operational discharges similar to those described during meteorological construction. Noise levels and vessel traffic rates are expected to be similar to meteorological tower construction, with the exception of pile driving. Piles and foundations would be removed using non-explosive methods such as mechanical cutting or high-pressure water jets at a depth of 15 ft (4.6 m) below the mudline. Noise levels associated with these methods have not been established in this region. SOCs for meteorological tower decommissioning include those outlined for construction and the Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B.

##### 4.2.2.6.3 Conclusion

The SOCs (e.g., surveillance by trained observers, exclusionary zones, and prohibition periods) applicable to vessel transit, survey work, and pile driving are expected to minimize impacts on marine mammals from site characterization and site assessment activities (see Appendix B). Marine mammals are most abundant in the WEA during spring; therefore, the additional seasonal limitation for pile-driving activities (no pile driving from November 1 to April 30; see Appendix B) would greatly minimize the potential effects for all species.

Reasonably foreseeable adverse impacts on marine mammals under Alternative A may still exist for the following activities under certain circumstances: 1) acoustic effects from pile-driving activities and HRG surveys, and 2) increased potential for vessel strike especially during transit to and from the WEA as a result of potential speeds above 10 knots and/or transits at night or when visual sight detection is impaired. Although the seasonal limitation on pile driving will significantly reduce the risk for pile-driving noise to impact right whales, right whales could potentially be present in the WEA during a time of year when they are not known to occur in the area (May 1 through October 31). Impacts from these circumstances are expected to be minor. Biological surveys (including passive acoustic monitoring) are expected to confirm this species' seasonal occurrence in the region. SOCs are expected to minimize potential effects from HRG surveys. As a result of the SOCs, no significant impacts on marine mammals are anticipated as a result of the proposed action.

#### *4.2.2.7 Sea Turtles*

##### *4.2.2.7.1 Description of the Affected Environment*

Five species of sea turtles may potentially occur in the Northwest Atlantic waters: Kemp's ridley, loggerhead, green, Hawksbill, and leatherback sea turtle. All five species of these sea turtles are listed as threatened or endangered under the ESA (Table 4-19). Kemp's ridley, hawksbill, and leatherback turtles are listed as endangered. Loggerhead sea turtles are separated into nine DPS, and the Northwest Atlantic DPS of this species is listed as threatened. Green sea turtles are divided into two "listed populations" (these populations were listed prior to the 1978 ESA amendment restricting population listings to DPS). The Florida and Mexico's Pacific coast breeding colonies are listed as endangered, and all others are listed as threatened.

**Table 4-19**

**Sea Turtles in the North Atlantic OCS**

| Common Name | Scientific Name | Distinct Population Segment (if applicable) | ESA Status | [1, 2]Relative Occurrence within Rhode Island OSAMP Study Area |
|---|---|---|---|---|
| Family Cheloniidae | | | | |
| Loggerhead sea turtle | *Caretta caretta* | Northwest Atlantic | Threatened | Common |
| Green sea turtle | *Chelonia mydas* | Florida breeding | Endangered | Unknown |

| Common Name | Scientific Name | Distinct Population Segment (if applicable) | ESA Status | [1, 2]Relative Occurrence within Rhode Island OSAMP Study Area |
|---|---|---|---|---|
| | | colonies | | |
| | | All others | Threatened | Rare |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | | Endangered | Rare |
| Hawksbill sea turtle | *Eretmochelys imbricata* | | Endangered | Remote Possibility |
| Family Dermochelyidae | | | | |
| Leatherback sea turtle | *Dermochelys coriacea* | | Endangered | Common |

[1]Common = greater than 100 records, Regular = 10–100 records, Rare = less than 10 records, Remote Possibility= the remote possibility to occur in the region at some time (Kenney and Vigness-Raposa, 2010).

[2]The WEA is included in the Rhode Island Ocean Special Area Management Plan (OSAMP).

Four of the sea turtle species above are likely to occur in the WEA: Kemp's ridley, loggerhead, green, and leatherback sea turtles. These four species are highly migratory and are known to occur in the coastal waters of the northeast United States in the summer and fall. Hawksbill sea turtles are rare in Massachusetts, and not likely to occur in the WEA; therefore, they are not considered further in this EA.

Sightings data for sea turtles are difficult to obtain and data for the WEA are sparse. Sea turtles are very difficult to observe in the water, in part because they are typically underwater for an average of 92 percent of each day (Morreale and Standora, 1998). Several sightings of sea turtles (34 leatherback and 3 Kemp's ridley) have been recorded from Block Island to the east coast of Nantucket from June to mid-October 2003 to 2011 (Massachusetts Audubon, 2012a). These sightings indicate that sea turtles may be impacted by increased vessel traffic associated with survey work in the most nearshore waters, including ports in Massachusetts, Rhode Island, Connecticut, and New York.

### *Sea Turtle Strandings in the WEA and Surrounding Waters*

Although information for sea turtle abundance and distribution are sparse in the WEA, data are available for the nearby Cape Cod Bay because a relatively large number of cold-stunned sea turtles are known to wash ashore there each fall. Green, loggerhead, Kemp's ridley, and leatherback sea turtles, are known to forage in Cape Cod Bay from June to October (Massachusetts Audubon, 2012a), and these species would, therefore, be expected to occur in the WEA region during the same time period.

Another dataset of sea turtle strandings by State can be found at the NMFS Sea Turtle Stranding and Salvage Network. This dataset includes sea turtle stranding data for Massachusetts and

Rhode Island from 1986 through 2007, including species, year, month, and location by county. NMFS Southeast Fisheries Science Center (SEFSC) has verified all data through 2005, and may make changes as needed for 2006 and 2007 data. Compared to the Cape Cod Bay strandings data, relatively few sea turtles have stranded on either Martha's Vineyard (Dukes County) or Nantucket, the nearest land to the WEA (NMFS SEFSC, 2012; Table 4-20). A total of 39 turtles stranded (not necessarily from cold-stunning) on Martha's Vineyard and Nantucket from 1986 to 2007; 1 green, 3 Kemp's ridley, 20 leatherback, and 15 loggerheads (NMFS SEFSC, 2012). Sea turtles are less likely to become stranded from cold-stunning on the south side of Martha's Vineyard and Nantucket because there is no geologic impediment (i.e., "land trap") to the turtles' southward migration in response to declining temperatures.

**Table 4-20**

**Species of Sea Turtles Stranded in Dukes and Nantucket Counties, MA, from 1986 to 2007**

| Species | Number | Months | Location[1] (County) |
|---|---|---|---|
| Green | 1 | November | Nantucket |
| Kemp's Ridley | 3 | August–December | Dukes and Nantucket |
| Leatherback | 20 | January, July–December | Dukes and Nantucket |
| Loggerhead | 15 | June–December | Dukes and Nantucket |

Source: NMFS SEFSC, 2012

[1]Dukes County is equal to Martha's Vineyard, and Nantucket County is equal to Nantucket

### *Loggerhead Sea Turtle*

Loggerheads can be found throughout the global ocean in subtropic and temperate waters (NMFS, 2012b). This species is known to occur within essentially all shelf waters of the northwest Atlantic from Florida to Nova Scotia (NMFS and USFWS, 2008). Adult and juvenile loggerhead turtles are known to forage in coastal areas from Florida to Cape Cod from June to mid-September and into the fall. However, most loggerheads in southern New England waters are juveniles, ranging in length from 15 to 36 inches (38 to 91 cm) and in weight from approximately 24 to 99 pounds (11 to 45 kilogram [kg]) (Massachusetts Audubon, 2012a). As of 2009, the estimated number of nesting females in the Northwest Atlantic DPS is approximately 30,000, and if the adult sex ratio is 1:1, the resulting estimated number of adult loggerheads in this DPS is approximately 60,000 (TEWG, 2009). The most recent regional abundance estimate for this species was in 2010. The preliminary regional abundance was approximately 588,000 individuals based on only positive identifications of loggerhead sightings, and approximately 801,000 individuals based on positive identifications and a portion of unidentified turtles from the survey (NMFS NEFSC, 2011).

Stranding data for Cape Cod Bay indicate that loggerheads are relatively common in southern

New England waters. Among the 279 loggerheads known to strand in Massachusetts from 1986 to 2007, 10 were stranded on Martha's Vineyard and 5 were stranded on Nantucket (NMFS SEFSC, 2012). SPUE data support this information, with loggerhead turtles observed relatively consistently in low numbers within the WEA and waters south of the WEA in the summer and fall (ranging from 1 to 85 turtles per 620 miles (1,000 km); Right Whale Consortium, 2012; see Figure 6 in Appendix F). SPUE are likely to be underestimated for this species as a result of the relatively small size of the turtles, and their long submergence time, which make observation of this species difficult.

### *Kemp's Ridley Sea Turtle*

Kemp's ridley sea turtles inhabit the Gulf of Mexico and Northwest Atlantic as far north as the Grand Banks and Nova Scotia (NMFS USFWS and SEMARNAT, 2011). During the summer and early fall, this species can be found inshore along the Atlantic seaboard from Florida to New England, but only juveniles (12 to 15 inch [30 to 38 cm] and approximately 4.4 pounds [2 kg]) have been reported in New England (Massachusetts Audubon, 2012a). Adults are rare in New England waters (TEWG, 2000). When inshore, Kemp's ridleys can be found in waters less than 50 m deep. The most recent population estimate is 7,000 to 8,000 nesting females (NMFS and USFWS, 2007a). This species is female biased, but there are likely an additional several thousand males (NMFS and USFWS, 2007a).

SPUE are likely to be underestimated for this species as a result of the relatively small size of the turtles, and their long submergence time, which make observation of this species difficult. SPUE for Kemp's ridley sea turtles support the above information, with only two locations with SPUE, in low numbers (from 21 to 45 turtles per 620 miles (1,000 km) during the summer south of the WEA; Right Whale Consortium 2012; Figure 7 in Appendix F).

Although the numbers of Kemp's ridley strandings are relatively high in Massachusetts (more specifically Cape Cod Bay), the stranding numbers are low near the WEA, with two on Martha's Vineyard, one on Nantucket, and four in Rhode Island from 1986 to 2007 (NMFS SEFSC, 2012).

### *Green Sea Turtle*

Green sea turtles are known to occur in tropical and sub-tropical waters, with occasional occurrence in cooler, temperate waters (NMFS and USFWS, 2007b). Only juvenile green turtles have been recorded in New England (Massachusetts Audubon, 2012a). Green turtles probably frequent Cape Cod Bay waters with some degree of regularity but would not be considered common because, on average, only one strands per year (Massachusetts Audubon, 2012b). According to Kenney and Vigness-Raposa, (2010), green sea turtles tend to be too small to be observed during aerial surveys, and densities have not been calculated because sightings are too rare (RICRMC, 2010). The population, estimated by the number of nesting females from 1999 to 2003, ranges from 17,402 to 37,290 (NMFS and USFWS, 2007b). SPUE data area not available for this species.

### *Leatherback Sea Turtle*

Leatherback sea turtles nest in the tropics and remain in warmer southern waters as juveniles (NMFS and USFWS, 1992). Once they become subadults or adults (at approximately 100 cm curved carapace length), they head north to feeding grounds near the Arctic Sea where they feed primarily on jellyfish (Eckert, 2002). Adult leatherback sea turtles are known to occur within a wide range of water temperatures, and have been observed along the entire U.S. east coast from Maine to Puerto Rico and the U.S. Virgin Islands (NMFS, 2012a). Leatherbacks are the only species of sea turtles that can regulate their body temperature to some degree, and generally do not strand as a result of cold-stunning. The most current population estimate (total number of adults) of leatherbacks in the Atlantic (estimated from the seven nesting sites within the Atlantic from the Caribbean to Florida) is 34,000–94,000 (NMFS and USFWS, 2007c; TEWG, 2007).

A recent tagging study of 38 leatherbacks off Nova Scotia during the summers of 1999 through 2003 showed that these turtles' movements are concentrated in the waters off eastern Canada and the northeastern United States in June through December, although most turtles left the area for the southward migration during October (James et al., 2005). The Continental Shelf waters south of Cape Cod were among the highest areas visited among the tagged leatherbacks.

Relatively high SPUE were recorded within the WEA region, ranging from 20 to 105 turtles per 1,000 km in the fall and 20 to 35 turtles per 620 miles (1,000 km) in the summer and winter (Right Whale Consortium, 2012). In the surrounding continental shelf waters to the southwest, south, and southeast of the WEA, SPUE were as high as 105 to 230 turtles per 620 miles (1,000 km) in the summer and fall (Right Whale Consortium, 2012; Figure 8 in Appendix F). According to Kara Dodge of the Large Pelagics Research Center (pers. comm., 2012), the area of Nantucket Shoals south of Martha's Vineyard and Nantucket is considered a "hot spot" for leatherbacks from at least July (and maybe June) through September.

Leatherback sea turtle strandings have been recorded for Rhode Island and Massachusetts. Leatherback sea turtles are the most common species to strand in Rhode Island, with 144 records from 1986 to 2007 (NMFS SEFSC, 2012). Among the 159 leatherbacks known to strand in Massachusetts from 1986 to 2007, a relatively high percentage, 21 percent, were stranded in the WEA region; 29 were stranded on Martha's Vineyard and 4 were stranded on Nantucket (NMFS SEFSC, 2012).

#### *4.2.2.7.2 Impact Analysis of Alternative A*

Impacts on sea turtles from site characterization and site assessment activities are divided into two categories, acoustic and non-acoustic impacts. Acoustic impacts include the following activities: HRG surveys, sub-bottom reconnaissance, pile driving for installation of meteorological towers, and vessel traffic noise. Non-acoustic impacts associated with Alternative A activities are subdivided into the following categories: 1) effects to benthic foraging habitat, 2) vessel strike or entanglement with towed acoustic gear, 3) discharge of waste and accidental fuel leaks, and 4) meteorological tower and buoy decommissioning.

Important ecological considerations for sea turtles that affect their vulnerability to these impacts in the WEA region include foraging, migration, diving at depth for extended periods of time, and possibly extended rest periods on the ocean bottom. Because of their high submergence rate, sea turtles are difficult to spot during surveys, and their occurrence in the WEA is likely underestimated. Data from the Right Whale Consortium (2012) database indicate that sea turtles are expected to be in the area foraging and migrating during the summer and fall and, therefore, could be affected by Alternative A during that time period (Section 4.2.2.7.1). Additional discussion of impacts on sea turtles from site characterization and site assessment activities is available in the PEIS (MMS, 2007a; Section 5.2.12.2).

#### *Acoustic Impacts*

*Hearing in Sea Turtles*

Studies indicate that hearing in sea turtles is confined to low frequency, below 1,000 Hz, with the range of highest sensitivity between 200 and 700 Hz and a peak near 400 Hz (Bartol et al., 1999). Sea turtles hearing sensitivity is relatively low, with a hearing threshold of approximately 160 to 200 dB, and a possible upper hearing limit of 1,600 Hz (Lenhardt, 1994). Current data for hearing range frequencies by species is summarized in Table 4-21. Studies of behavioral reactions have elicited startle response from sea turtles at frequencies between 200 and 700 Hz (Samuel et al., 2005). The project activities that have potential acoustic impacts for sea turtles are medium-depth sub-bottom profilers, pile driving, and vessel noise, which overlap with sea turtles' hearing frequency range.

**Table 4-21**

**Hearing Ranges for Sea Turtles**

| Sea Turtle Species | Sound Production Frequency Range (Hertz) | Hearing Range (Hertz) | Most Sensitive Hearing Range (Hertz) | Reference |
|---|---|---|---|---|
| Green | NA | 100–800; 50–1,600 | 200–400 subadult; 600–700 juvenile | Bartol and Ketten, 2006; Dow et al., 2008 |
| Hawksbill | NA | NA | NA | |
| Loggerhead | NA | 25–1,000 | 250 | Bartol et al., 1999; O'Hara and Wilcox, 1990 |
| Kemp's ridley | NA | 100–500 | 100–200 | Bartol and Ketten, 2006 |
| Leatherback | 300–4,000 | NA | NA | Cook and Forrest, 2005 |

*Current noise criteria for behavioral disturbance and potential injury*

Currently, there are no hearing criteria for sea turtles. NMFS, during its Section 7 ESA consultations, typically applies the criteria for marine mammals to evaluate the potential for similar impacts. The current NMFS criterion for Level A harassment of cetaceans is a received SPL of 180 dB re 1 μPa and 160 dB re 1 μPa for Level B harassment (BOEM, 2012c). However, the USGS used a 166 dB threshold for Level A harassment in its assessment of survey activities based upon a study by McCauley et al. (2000), which showed behavioral responses to airgun pulses in a tank setting at or above 166 dB.

*HRG Survey Acoustic Effects*

The HRG surveys of renewable energy sites would use only electromechanical sources such as side-scan sonar, boomer and CHIRP subbottom profilers, and multibeam depth sounders. The effects from these sources on sea turtles are expected to range from no effect to negligible, based on the audibility of the source to sea turtles (which may be a function of distance). Sea turtles are unlikely to hear the electromechanical sources except perhaps the boomer, which has an operating frequency range of 200 Hz to 16 kHz, at very close range. However, the boomer has a very short pulse length (180 μs) with a radius of less than 16 ft (5 m) for the 180 dB isopleth, and 52 ft (16 m) for the 160 dB isopleth. The SOC included in Appendix B recommends a separation distance of 656 ft (200 m) for sea turtles, and the confirmation of no sea turtles within the 200 m exclusionary zone 60 minutes prior to startup. Therefore, impacts from HRG surveys using boomer subbottom profilers on sea turtles are expected to range from negligible to minor, based on the distance of the individual sea turtle from the sound pulse (BOEM, 2012c).

*Geotechnical Sampling Acoustic Effects*

During geo-technical sampling (e.g., deep borings, Vibracores, CPTs), sea turtles in the area could be exposed to noise levels ranging from 150 to 180 dB re 1 µPa from vessels associated with sub-bottom sampling, as well as noise from deep boring, estimated to be below 145 dB at frequency of 120 Hz (NMFS, 2009e). Both deep-boring noise and noise generated from vessels associated with boring are continuous noise, with a threshold for harassment of 160 dB re 1 µPa (BOEM, 2012c). Although boring time per hole is dependent on the target depth and bottom substrate, and is thus unknown, noise produced during boring is not likely to cause negative impacts on sea turtles in the area because the source noise (below 145 dB) is below the harassment level (160 dB), and the noise will attenuate to even lower levels within the exclusion zone. Sub-bottom sampling vessels, dynamic positioning vessels, and support vessels, may all produce noise levels ranging from 170 to 180 dB re 1 µPa/m (see Table 4-15), and to what distance attenuation to 160 dB would be is unknown. The mitigation measure of surveillance of the exclusion zone of 656 ft (200 m) for 60 minutes prior to activation of an acoustic sound source is expected to minimize the potential for exposure of any sea turtles to high levels of noise. However, there is still a potential for negative acoustic impacts during use of dynamic positioning and other sub-bottom sampling vessels for sea turtles that may occur in, but are not detected within the perimeter of noise above 160 dB from the vessel.

*Meteorological Tower Pile-Driving Acoustic Effects*

High-intensity SPLs generated during pile driving are known to exceed 200 dB re 1 µPa. These sound-pressure levels are above the Level A harassment criteria used by NMFS for sea turtles (180 dB). Response of sea turtles to pile driving has not been documented. It is reasonable to assume, however, that turtles could react the same way they do to seismic sounds at the same frequency. National Science Foundation (NSF) and USGS (2011) reported that sea turtles responded to seismic sounds with behavioral changes, including a startle response, increased swim speed, and a local avoidance of the sound source.

Pile driving for meteorological towers will take place for a relatively short period of time (a maximum of 4 days per tower for five towers). However, the work would occur during May through November when sea turtles are known to be in the WEA. The SOCs (see Appendix B), including surveillance of the exclusion zone of 1000 m for sea turtles, limiting of pile-driving activities to daylight hours, implementation of “soft start” to warn sea turtles away from the immediate area, and requiring a 60-minute observation period before beginning activities are expected to minimize the potential negative effects from exposure to high levels of noise.

*Vessel Traffic Acoustic Effects*

Potential acoustic impacts from vessel noise during site assessment and characterization activities would consist of vessel noise produced during vessel transit to and from ports, as well as the vessel noise produced during the HRG surveys, sub-bottom sampling, and construction, maintenance, and decommissioning of meteorological towers. The overlap in sea turtle occurrence and vessel traffic noise is most likely to occur in the transit routes to and from the WEA, because sea turtles tend to forage near shore. Vessels for this project may be transiting from 10 major ports and 21 minor ports throughout a region in which heavy vessel traffic already exists. To what extent the increase of up to 6,500 vessel round trips would add to the acoustic environment in the region is unknown.

The frequency range for vessel noise overlaps with sea turtles' known hearing range and would therefore be audible. However, Hazel et al. (2007) suggests that sea turtles' ability to detect approaching vessels is vision-dependent, not acoustic. Sea turtles may respond to vessel approach and/or noise with a startle response and a temporary stress response (NSF and USGS, 2011). The potential effects of vessel traffic noise from site characterization and assessment work on sea turtles are expected to be short-term and minimal. In addition, the SOCs detailed in Appendix B require a 656 ft (200 m) separation distance for sea turtles for project-related vessels.

#### *Non-acoustic Impacts*

*Benthic Habitat Effects*

Project activities known to disturb the sea floor bottom and near-bottom, such as sediment sampling, pile driving, and buoy anchoring, may indirectly affect sea turtle habitat and associated prey. However, these activities would affect a very small percentage of the total area of the WEA and would not be significant. Sub-bottom sampling would result in a temporary loss of benthic or near-benthic organisms, including potential prey species for sea turtles as a result of anchor placement and removal of the core sample. However the area is extremely small (less than 1 ft [0.3 m] diameter), and potential loss of habitat area would be negligible.

Potential effects during meteorological tower/buoy installation and operation include the loss of bottom area from each meteorological foundation (less than 2,745 square ft [255 square m]) and/or the buoy anchor (6 square ft [0.5 square m]) and chain drag 370,260 square ft (8.5 acres). During foundation and anchor installation, re-suspension of sediment resulting in temporary and localized increased turbidity is expected. The meteorological tower foundation would add an area of vertical, hard substrate to a soft bottom habitat. The surface area of the artificial substrate would be too small to change the diversity or structure of the existing benthic community dramatically.

*Vessel Collision Effects*

Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike data from 1997 to 2005 for loggerhead sea turtles indicates that 14.9 percent of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico had evidence of some type of propeller or collision injuries, although the proportion of these injuries that were post or ante-mortem is unknown (NMFS and USFWS, 2008). The incidence of propeller wounds in the U.S. Atlantic and Gulf of Mexico rose from approximately 10 percent in the late 1980s to a record high of 20.5 percent in 2004 (NMFS and USFWS, 2008).

Sea turtles are likely to be most susceptible to vessel collision in coastal waters, where they are known to forage, during transit from ports when vessel speed may exceed 10 knots. The increase of up to 6,500 vessel round trips in the region is likely to increase the relative risk of vessel strike for sea turtles. However, the Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B is designed to minimize the potential for vessel strikes for sea turtles by proposed action vessel traffic.

*Spills*

As discussed in Section 3.2.3, the severity of an oil or fuel spill depends on the material, size, and location of the spill, as well as the current meteorological conditions. The average fuel spill size for vessels during site characterization and assessment is estimated as 88 gallons, which is relatively small, and would, therefore, contribute a negligible potential for negative impacts on sea turtles. In the unlikely event of a vessel spill, the most likely material to be spilled would be diesel fuel. If a sea turtle surfaced within the spill, there is a potential for ingestion. However, the overall potential risk for spills to occur and subsequently impact sea turtles is extremely small.

*Discharge of Waste and Accidental Fuel Leaks*

Debris, plastics, and other foreign material present a serious risk of injury to sea turtles by ingestion or entanglement. The operational waste from site characterization and assessment work, including bilge and ballast water, trash debris, and sanitary and domestic waste, would be disposed of per regulations discussed in Section 3.1.3.5. All vessel operators, employees, and contractors would be briefed on marine trash and debris awareness elimination as outlined in Appendix B; thus, negative impacts for sea turtles from solid debris, waste discharge, and accidental fuel leaks are not likely.

*Meteorological Tower Decommissioning*

Details regarding decommissioning of the meteorological towers are described in Section 3.1.4.1. The potential effects from decommissioning work include sound and operational discharges similar to those described during meteorological tower construction. Noise levels and vessel traffic rates are expected to be similar to meteorological tower construction, with the exception of pile driving. Piles and foundations would be removed using non-explosive methods such as mechanical cutting or high-pressure water jets at a depth of 15 ft (4.6 m) below the mudline. Noise levels associated with these methods have not been established in this region. Mitigation measures for meteorological tower decommissioning include those outlined for meteorological towers and the Vessel Strike Avoidance Measures and Reporting for Mariners outlined in Appendix B.

##### *4.2.2.7.3 Conclusion*

The seasonal occurrence of leatherback and loggerhead sea turtles in the WEA region overlaps with the timeframe for activities under Alternative A that occur from May 1 through October 31. Thus, these species could be exposed to potential negative acoustic effects from HRG surveys, pile driving, and vessel noise, and an increased potential for vessel strike. Although SPUE data are not available for green and Kemp's ridley sea turtles, BOEM assumes that any of these species of sea turtles occurring in the WEA from May through October may also be at risk from project activities during this time period. SOCs, including exclusionary zones during operations, surveillance by trained observers during vessel operations, and a 60-minute clearance period prior to noise-producing activity are expected to reduce the potential of harassing levels of noise to a discountable level. Overall, most effects on sea turtles within the WEA and surrounding waters are expected to be short term and minor. Population-level impacts are not expected to occur.

### 4.2.3 Socioeconomic Resources

#### *4.2.3.1 Cultural Historic and Archaeological Resources*

Both site characterization (i.e., HRG survey and geotechnical sampling) and site assessment activities (i.e., installation of meteorological towers and/or buoys) have the potential to affect historic and pre-contact cultural resources. Construction activities associated with the placement of site assessment structures that disturb the ocean bottom have the potential to affect archaeological sites and traditional cultural properties on or under the seabed. Vessel traffic associated with surveys and structure construction, although indistinguishable from existing ocean vessel traffic could, at times, be visible from coastal areas of Massachusetts, potentially impacting historic sites, structures, districts, and traditional cultural properties onshore (historic properties). Similarly, although indistinguishable from other lighted structures on the OCS, some meteorological towers and/or buoys might be visible from historic properties onshore. The information presented in this section is based on existing and available information, and it is not intended to be a complete inventory of historic properties within the WEA. BOEM requires that lessees submit results of HRG surveys in SAPs and COPs to identify historic properties and to consider the effects of those undertakings on historic properties (see Section 3.1.3).

##### *4.2.3.1.1 Description of the Affected Environment*

An overview of the cultural resources that might be expected on the Atlantic OCS is presented in Chapter 4.2.19 of the PEIS (MMS, 2007a). Both shipwrecks from the 17th to 20th centuries—

particularly ocean-going and coastal sailing vessels and steamers, fishing vessels, and small vernacular craft—as well as submerged pre-contact sites could be located in the WEA (Albion et al., 1972; Bauer, 1988; MA CZM, n.d.(a); MA CZM, n.d.(b); MA EOEEA, 2009; Mather and Jensen, 2010; McLoughlin, 1978; NOAA Office of Coast Survey, n.d.; Rhode Island Shipwreck Database, n.d.; RICRMC, 2010; Robinson et al., 2003; TRC Environmental Corporation, 2012).

The potential for finding shipwrecks increases in areas of historic shipping routes, harbor approaches, fishing grounds, and narrow straits, reefs, and shoals. Positioned between larger ports in Boston and New York, the WEA is situated in an area that has experienced extensive regional and national maritime activity from the 17th century to the present. Archaeological material discovered on the outer reaches of Cape Cod suggests that European settlers were trading goods with native inhabitants from the early-17th century up to 1620 (MHC, 1987:63-5). As coastal development increased, maritime shipping and packet routes were established between the mainland and the islands south of Cape Cod. The waters south and west of the islands contain one of the primary shipping channels for southbound vessel traffic going into New Bedford and New York that was used from the mid-18th century up to the present (MHC, 1987:93). During the 19th century, several maritime industries thrived in the region, including passenger and cargo transportation, whaling, fishing (fin and shell fish), tourism, and shipbuilding (commercial and naval). This extensive maritime history increases the potential for the presence of shipwrecks within the WEA (Bauer, 1988; Mather and Jensen, 2010). Accordingly, BOEM's Atlantic OCS Shipwreck Database identifies the WEA as located in a region of high probability for shipwreck presence (TRC Environmental Corporation, 2012). BOEM's Atlantic OCS Shipwreck Database currently lists 762 known or reported wrecks offshore the State of Massachusetts. Within the current boundaries of the WEA, there are 21 known shipwrecks, obstructions, or objects of unknown character.

Submerged pre-contact cultural resources also could be present in the WEA. The area is designated as having a high potential for the presence of such sites (TRC Environmental Corporation, 2012), although the potential for the preservation of these sites is complex and localized (Merwin and Bernstein, 2003; Merwin, Lynch, and Robinson, 2003; Stanford and Bradley, 2012). Around 18,000 before present day (BP), the glaciation began receding, and by about approximately 16,500 BP, portions of the southern New England area were exposed as dry land (Boothroyd and August, 2008; Coleman and McBride, 2008; Peck and McMaster, 1991; RICRMC, 2010). Relative sea level and isostatic rebound in southern New England indicate that the WEA would have been subaerial prior to ~13,000 BP (Oakley, 2012). By 12,300 BP (sea level 200 ft [60 m] below present), marine water began to inundate the southern end of the WEA. Shoreline transgression and sea level rise through the southern half of the WEA would have been relatively consistent (approximately 3.3 ft [1 m]/1,000 years) based on the eustatic curve of Peltier and Fairbanks (2006), and approximately half of the site was inundated by 11,500 BP (sea level 165 ft [50 m] below present) (Oakley, 2012). Sea level rise across the northern half of the

WEA would have been relatively rapid between 11,500 and 11,000 BP (sea level 165 ft [50 m] to 130 ft [40 m] below present) (Bard et al., 2010). The entire WEA was inundated by 10,000 BP (sea level 100 ft [30 m] below present) (Oakley, 2012; Oakley and Boothroyd, 2012).

During the time period that these portions of the OCS were exposed as dry land the region experienced varying levels of sea level rise. The highest rate of sea level rise during a period of known prehistoric occupation along North America is currently estimated as taking place at 11,600 to 11,100 years BP. This period, which based on sea level curves for the region corresponds to 180 to 138 ft (55 to 42 m) isobaths and encompasses all of the WEA, experienced rapid sea level rise averaging 79 to 118 inch (200 to 300 cm) per year (Lowery, 2009). This period was followed by a much slower rate of sea level rise (approximately 0.31 inch [0.8 cm] per year) until ca. 7,000 BP, after which the rate of sea level rise slowed even further (0.08 inch [0.2 cm] or less per year). The area of the WEA is likely to have been drowned by 6,000 BP. Therefore, the potential exists for submerged pre-contact archaeological sites within the WEA to range from the pre-Clovis times (earlier than 13,000 BP) and Clovis Paleoindian times (between 13,000 and 11,500 BP), to Early Archaic times (between 11,500 BP to 9,000 BP) (RICRMC, 2010, Robinson et al., 2004; TRC Environmental Corporation, 2012). Oldale and O'Hara (1980) estimate submergence of the inner continental shelf (and the WEA) began 11,000 BP during the Early Archaic, and younger sites would not be expected in the WEA (see also Blanchon, 2011; Boothroyd and August, 2008).

#### *4.2.3.1.2 Impact Analysis of Alternative A*

Chapter 5.2.19 of the PEIS discusses possible impacts on potential cultural resources, both direct and indirect, that could occur as a result of site characterization and assessment activities (MMS, 2007a). Potential cultural resources offshore of Massachusetts that could be impacted by leasing, site characterization, and site assessment associated with Alternative A are discussed below.

### *Routine Activities*

*Site Characterization*

As detailed in Chapter 3.5.2 of the PEIS (MMS, 2007a), site characterization activities entail "integrated marine geophysical/hydrographic surveys and geotechnical/sediment sampling programs." Geophysical surveys do not impact the bottom and, therefore, have no ability to impact cultural resources. Geotechnical/sediment sampling does impact the bottom and, therefore, does have the ability to impact cultural resources. However, if the lessee conducts HRG surveys prior to conducting geotechnical/sediment sampling, the lessee would be able to avoid impacts on historic properties. Therefore, BOEM would require the lessee to conduct HRG surveys prior to conducting geotechnical/sediment sampling, and, when a potential historic property is identified, the lessee will be required to avoid it. Inclusion of the following elements in the lease(s) will ensure avoidance of historic properties. The following language would be included in leases issued within the WEA under the Smart from the Start Initiative:

> The lessee may only conduct geotechnical (sub-bottom) sampling activities in areas of the leasehold in which an analysis of the results of geophysical surveys has been completed for that area. The geophysical surveys must meet BOEM's minimum standards (see GGARCH), and 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. This analysis must include a determination whether any potential archaeological resources are present in the area and the geotechnical (sub-bottom) sampling activities must avoid potential archaeological resources by a minimum of 164.0 ft (50.0 m). The avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. In no case may the lessee's actions impact a potential archaeological resource without BOEM's prior approval.

Additionally, during all ground-disturbing activities, including geotechnical sampling, BOEM requires that the lessee observe the unanticipated finds requirements stipulated in 30 CFR 585.802. If the lessee, while conducting activities, discovers a potential cultural resource such as the presence of a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock), pre-contact artifacts, and/or relict landforms within the project area, then the SOCs would be followed (see Appendix B, Section B.1).

Finally, vessel traffic associated with survey activities, although indistinguishable from existing ocean vessel traffic, could at times be within the viewshed of onshore cultural resources sites and properties. These effects would be limited and temporary (see Section 4.2.3.4).

*Site Assessment*

For site assessment activities, this EA considers the impacts of construction and operation of up to five meteorological towers and up to 10 meteorological buoys. Although the construction of meteorological towers and buoys impacts the bottom, the lessee's SAP must be submitted to and approved by BOEM prior to construction. To assist BOEM in complying with the National Historic Preservation Act (NHPA) (see Section 5.2.4) and other relevant laws (30 CFR 585.611(a),(b)(6)), the SAP must contain a description of the archaeological resources that could be affected by the activities proposed in the plan. Under its Programmatic Agreement (Appendix F), BOEM will then consult to ensure potential effects to historic properties are avoided, minimized, or mitigated under Section 106 of the NHPA.

BOEM anticipates that bottom disturbance associated with the installation of meteorological towers and buoys would disturb the seafloor in a maximum radius of 1,500 ft (~450 m) or 162 acres around each bottom-founded structure. This includes all anchorages and appurtenances of the support vessels. Direct impacts on archaeological resources within 1,500 ft of each meteorological tower and buoy would be the result of direct destruction or removal of archaeological resources from their primary context. Although this would be extremely unlikely given that site characterization surveys described above would be conducted prior to the installation of any structure (see e.g., 30 CFR 585.610 and 585.611), should contact between the activities associated with Alternative A and a historic or pre-contact site occur, there may be damage or loss to archaeological resources.

Should the surveys reveal the possible presence of an archaeological resource in an area that may be affected by its planned activities, the applicant would have the option 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 (see 30 CFR 585.802(b) and the PA in Appendix G). Although site assessment activities have the potential to affect cultural resources either on or below the seabed or on land, 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 (e.g., anchoring, installation of meteorological buoys and/or towers) to damage to cultural resources very low.

Meteorological towers installed under Alternative A would likely not be visible from shore based on the narrow profile of the structure; distance from shore; and earth curvature, waves, and atmosphere (see Section 4.2.3.4 Recreation and Visual Resources). Existing ports and other onshore infrastructure are capable of supporting site assessment activities with no expansion (see Section 3.1.2). Visual impacts to onshore cultural resources would be limited and temporary in nature and would consist predominately of vessel traffic, which most likely also would not be distinguishable from existing vessel traffic. Therefore, the likelihood of impacts on onshore cultural resources from meteorological structures and from construction vessel traffic also would be very low (see Appendix G).

#### *4.2.3.1.3 Conclusion*

Bottom-disturbing activities have the potential to affect pre-contact and cultural resources. However, existing regulatory measures, information generated for a lessee's initial site characterization activities, and the unanticipated discoveries requirement make the potential for bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) to have an adverse effect (i.e., cause significant impact or damage) on cultural resources very low. Visual impacts on onshore cultural resources from meteorological structures and vessel traffic associated with surveys and structure construction is expected to be negligible and temporary in nature.

#### *4.2.3.2 Demographics and Employment*

##### *4.2.3.2.1 Description of the Affected Environment*

This section describes the socioeconomic characteristics of the counties around the ports that may be used by lessees for activities under the proposed action. The ports occur in Massachusetts, Rhode Island, Connecticut, and New York (Table 4-22).

**Table 4-22**

**Population and Economic Data by State and County**

| Ports | County | Population (2000) | Population[1] (2010) | Establishments[2,3] (2009) | Employment[2] (2009) | Annual Payroll in Thousands[2] (2009) |
|---|---|---|---|---|---|---|
| **Massachusetts** | | | | | | |
| Fall River, Fairhaven, New Bedford | Bristol County | 534,678 | 548,285 | 12,828 | 196,389 | 7,304,452 |
| Falmouth | Barnstable County | 222,230 | 215,888 | 8,301 | 70,322 | 2,686,683 |
| **Rhode Island** | | | | | | |
| Galilee, North Kingstown, Quonset Point | Washington County | 123,546 | 126,979 | 3,811 | 40,247 | 1,553,718 |
| Newport | Newport County | 85,433 | 82,888 | 2,745 | 28,620 | 1,079,131 |
| Providence | Providence County | 621,602 | 626,667 | 15,689 | 258,436 | 11,027,649 |
| **Connecticut** | | | | | | |
| New Haven Harbor | New Haven County | 824,008 | 862,477 | 19,893 | 327,054 | 14,635,332 |
| Clinton, Westbrook | Middlesex County | 155,071 | 165,676 | 4,227 | 61,152 | 2,583,955 |
| New London, Stonington, Avery Point | New London County | 259,088 | 274,055 | 5,878 | 104,745 | 4,323,019 |

| Ports | County | Population (2000) | Population[1] (2010) | Establishments[2,3] (2009) | Employment[2] (2009) | Annual Payroll in Thousands[2] (2009) |
|---|---|---|---|---|---|---|
| **New York** | | | | | | |
| Montauk, Hampton Bays, Greenport, Islip, Sag Harbor, Orient Point | Suffolk County | 1,419,369 | 1,493,350 | 47,573 | 550,192 | 25,540,186 |

[1]Source: U.S. Census Bureau, 2011a

[2]Source: U.S. Census Bureau, 2012

[3]An establishment is a single physical location where business is conducted, or where services are performed

[4]Annual payroll includes all forms of compensation, such as salaries, wages, commissions, bonuses, vacation allowances, sick-leave pay, and the value of payments inkind (e.g., free meals, lodgings) paid during the year to all employees.

Suffolk County, NY, reported the highest population in 2010. All counties in New York and Connecticut reported an increase in population between 2000 and 2010 (U.S. Census Bureau, 2011a). One county each in Massachusetts (Barnstable County) and Connecticut (Newport County) reported a slight decrease in population between 2000 and 2010.

The highest annual payroll was reported by Suffolk County at nearly $25.5 million for 2009. New Haven County, CT, and Providence County, RI, were the other two counties that reported high payroll figures during the same period. The proximity of these counties to some of the Nation's active robust labor markets such as New York City and other markets spread over New Jersey and Connecticut accounts for the high annual payroll figures. Many of the counties reported higher median household incomes and per-capita incomes when compared to the State.

Tourism and recreation are a large part of the Dukes County, MA, (Martha's Vineyard) and Nantucket County, MA, (Nantucket) economy. The arts, entertainment, and recreation, and accommodation and food services sector employed 22.1 percent of the Nantucket workforce and 8.3 of Martha's Vineyard workforce between 2006 and 2010 (U.S. Census Bureau, 2011b). The construction sector was the single largest employer between 2006–2010 in both counties with 22.5 percent of total employment in Nantucket County, and 21.5 percent of total employment in Dukes County. Some of the construction was tourism-related (e.g., hotels, restaurants) so the tourism economy is indirectly supported by the construction sector.

Based on 2012 data, Dukes County and Nantucket County reported unemployment rates of 11.8 percent and 14.5 percent respectively, which are higher when compared to the national average of 8.8 percent (BLS, 2012). The overall decline in the national economy coupled with the reduced spending on tourism and leisure could explain the higher levels of unemployment within the two counties compared to national averages.

In 2011, the average wage in Dukes County was $783 per week/$40,716 per year and in Nantucket County was $840 per week/$43,680 per year; these wages were lower than the national average wage of $891 per week/$46,332 per year in 2011 (BLS, 2011).

##### *4.2.3.2.2 Impact Analysis of Alternative A*

Temporary and minor 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 New England area, and particularly in the coastal counties of Massachusetts, Rhode Island, Connecticut, and New York. Additionally, site assessment, including operation and maintenance of the meteorological towers and buoys, would be limited and intermittent and is not expected to affect local employment numbers; therefore impact would be negligible. Spending necessary to carry out proposed action activities (e.g., ship supplies, upkeep, maintenance of ships, crew accommodations such as hotels and meals) would temporarily stimulate the local economies. Impacts on employment and demographics from the proposed action would, therefore, result in minor short-term effects and negligible long-term effects on the local economies.

##### *4.2.3.2.3 Conclusion*

BOEM anticipates that the proposed action would have minor, beneficial, short-term impacts on local communities primarily within coastal communities in Massachusetts, Rhode Island, Connecticut, and New York from site characterization and negligible impacts on local economies from site assessment activities. Minor increases in temporary employment and population associated with the proposed action would result in spending on support services for the duration of activities associated with the proposed action.

#### *4.2.3.3 Environmental Justice*

##### *4.2.3.3.1 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). If such effects are identified, appropriate mitigation measures must be implemented. The 2007 PEIS contains a complete description of the method of analysis (MMS, 2007).

Median household income and demographics data for the study area counties were reviewed to better understand the income levels of residents within the counties surrounding the ports. Table 4-23 presents demographics and income data for the study area counties.

**Table 4-23**

**Demographics and Median Household Income by State and County**

| Ports | County | Percent of White Persons | Median Household Income |
|---|---|---|---|
| **Massachusetts** | | | |
| N/A | State of MA[1] | 84.1 | $64,509 |
| N/A | Dukes | 87.6 | $62,407 |
| N/A | Nantucket | 87.6 | $83,347 |
| Fall River, Fairhaven, New Bedford | Bristol County[1] | 91.3 | $54,955 |
| Falmouth | Barnstable County | 92.7 | $60,317 |
| **Rhode Island** | | | |
| N/A | State of RI[1] | 86.3 | $54,902 |
| Galilee, North Kingstown, Quonset Point | Washington County[1] | 94.2 | $70,285 |
| Newport | Newport County[1] | 91.2 | $67,239 |
| Providence | Providence County | 73.4 | $48,500 |
| **Connecticut** | | | |
| N/A | State of CT[1] | 82.3 | $67,740 |
| New Haven Harbor | New Haven County[1] | 79.9 | $61,114 |
| Clinton, Westbrook | Middlesex County[1] | 90.3 | $74,906 |
| New London, Stonington, Avery Point | New London County[1] | 84.8 | $65,419 |
| **New York** | | | |
| N/A | State of NY[1] | 71.5 | $55,603 |
| Montauk, Hampton Bays, Greenport, Islip, Sag Harbor, Orient Point | Suffolk County[1] | 85.9 | $84,506 |

Source: 2010 data from U.S. Census Bureau, 2012a

[1]Source: 2011 data from U.S. Census Bureau, 2012b

Because White persons made up the majority of the populations in the coastal counties with potential port facilities that would be used to support the proposed action, Table 4-23 only shows the percentage of White persons. The percentage of White persons among all counties listed in Table 4-22 ranges from a low of 73.4 percent in Providence County, RI, to a high of 94.2 percent in Washington County, RI. There are four federally recognized Tribes in the project area—reasonably foreseeable impacts on these Tribes are discussed in Section 4.2.3.1 and consultation is described in Section 5.3.4. Median household income data (Table 4-23) shows that incomes for most coastal counties were higher than the state median household income, and overall were higher than the national average median household income of $49,445 (U.S. Census Bureau, 2012c).

##### 4.2.3.3.2 Impact Analysis of Alternative A

Because the WEA would be located over 10 nm miles from the nearest shoreline, site characterization and site assessment activities within the WEA are not anticipated to have disproportionately high or adverse environmental or health effects on minority or low-income populations. Work at existing fabrication sites, staging areas, and ports to support the proposed action would be short-term and is not anticipated to result in expansion of existing onshore facilities, so no residents or businesses would be displaced or adversely affected. Therefore, BOEM does not anticipate any effects on minority or low-income populations from Alternative A.

##### 4.2.3.3.3 Conclusion

BOEM does not anticipate disproportionally high or adverse environmental or health effects for minority or low-income populations from Alternative A based on the distance of the WEA from shore, the short duration of onshore and nearshore activities, and the use of existing fabrication sites, staging areas, and ports.

#### 4.2.3.4 Recreation and Visual Resources

##### 4.2.3.4.1 Description of the Affected Environment

In order to assess visual resources, a viewshed, which is the area that is visible from a fixed vantage point, must be defined. The viewsheds that may be affected—i.e., areas where meteorological towers may be seen—include the southern coastlines of Martha's Vineyard and Nantucket and the open ocean surrounding the WEA. The scenic and aesthetic values of these coastal areas play an important role in attracting visitors. Martha's Vineyard and Nantucket are both well-known tourist locations. Recreation and tourism-related industries provide almost one-quarter of the employment and wages in Nantucket and Dukes Counties, which include Nantucket and Martha's Vineyard, respectively. See Section 4.2.3.2 for a more detailed discussion of the tourism-related economy.

A mix of public, private, and residential beaches are located on Martha's Vineyard and Nantucket. Martha's Vineyard has 19 beaches: 14 are public, 4 are for town residents only, and 1 is off limits (Martha's Vineyard Chamber of Commerce, 2011). Seven of these beaches are on the south side of Martha's Vineyard looking towards the WEA (Figure 4-4). Nantucket has 10 public beaches (Nantucket Island Chamber of Commerce, 2011), 4 of which are on the south side of the island looking towards the WEA (Figure 4-5). Both Martha's Vineyard and Nantucket have walking and biking paths accessible to the public along the southern coasts of the islands. There are five lighthouses on Martha's Vineyard, but only one is on the southern side of the island, the Gay Head Lighthouse, which is open to the public. Of the three lighthouses on Nantucket, none are on the south side of the island. Resorts, a golf course (near Miacomet on Nantucket), and natural areas on the southern coast have open views to the ocean.


**Figure 4-4. Recreational areas and viewpoints on Martha's Vineyard looking toward WEA**


**Figure 4-5. Recreational areas and viewpoints on Nantucket looking toward WEA**

Several locations on Martha's Vineyard and Nantucket were selected as potentially sensitive viewsheds as a result of their popularity with tourists and/or importance to the islands' character. These locations are described in Table 4-24 and shown on Figures 4-4 and 4-5.

**Table 4-24**

**Locations on Martha's Vineyard and Nantucket Looking toward WEA**

| Viewpoint | Description |
|---|---|
| *Martha's Vineyard* | |
| Gay Head Cliffs | Cliffs are located on western-most part of island. They are designated as a National Natural Landmark (NPS, 2011). Local and Federal laws forbid touching or climbing the cliffs. |
| Gay Head Lighthouse | The Gay Head Lighthouse dates back to 1844, but today is maintained by the Martha's Vineyard Historical Society under a 30-year lease with the USCG. |
| Aquinnah Cultural Center | The Aquinnah Cultural Center is located at the top of the Gay Head Cliffs and provides a place for the Aquinnah Wampanoag Tribe of Gay Head to preserve, interpret, and document the Aquinnah Wampanoag self-defined history, culture, and contributions. |
| Aquinnah Public Beach (Moshup Beach) | Aquinnah Public Beach is at the base of the Aquinnah clay cliffs. |

| Viewpoint | Description |
| --- | --- |
| Philbin Beach | Philbin Beach is located off Moshup Trail near the clay cliffs on the western portion of Martha's Vineyard. It is open to Aquinnah residents only. |
| Squibnocket Beach | A surf beach on the western side of the island. |
| Lucy Vincent Beach | Relatively empty beach open only to Chilmark residents and guests. The tide here is calmer than in other sections of the island. There are small cliffs in the background and large boulders are scattered throughout the beach. |
| Long Point Wildlife Refuge Beach | One of the largest public beaches in Martha's Vineyard, and is part of the 632-acre Long Point Wildlife Refuge that also includes dunes, woodlands, and prairies. |
| Katama Beach/South Beach State Park | Popular and well-known public beach. A 3-mile-long (4.8-km-long) barrier beach. Home to a small community of houses and an ocean-side resort. Representative photographs from Martha's Vineyard were taken from this location and can be seen in Appendix H. |
| Norton Point Beach | The only island beach permitting oversand driving. The beach provides an important nesting area for shorebirds. |
| Wasque Point on Chappaquiddick Island | Wasque Point**,** at the southeastern end of Chappaquiddick Island, is a nature reserve with picnic tables, good surf-casting, and a beach. |
| *Nantucket* | |
| Madaket Beach | Madaket Beach is a popular tourist destination. Portions of the long beach, such as Smith's Point, the westernmost portion of Madaket, are only accessible via four-wheel-drive vehicles or boats. The beach has been heavily eroded in the past couple of years causing these access points to be closed occasionally. Consistent with the other southern beaches in Nantucket, Madaket has heavy, sometimes dangerous, surf. Representative photographs from Nantucket Island were taken from this location and can be seen in Appendix H. |
| Cisco Beach | Located at the southwest end of the island, just east of Madaket, Cisco is a relatively flat beach. It can be accessed via car or a bike trail. The surf is strong and a popular spot for surfers—Cisco Beach is the home of Nantucket Island Surf School. Houses in this community are as close as 0.8 miles (1.3 km) from the shoreline. |
| Miacomet Beach and Pond | The surf and rip currents are strong oceanside. |
| Surfside Beach | Surfside is the southernmost settlement in Massachusetts. Parts of the beach are four-wheel-drive-accessible and others have beach-accessible wheelchairs. Surf is heavy. Beach is within walking distance of communities. |
| Tom Nevers | Surf can be heavy. No lifeguard or facilities. Access onto the beach can be difficult. |
| Nobadeer | Wide beach near the airport. Parking is available, but accessing the beach is difficult. Plenty of surf. No lifeguard and no facilities. |
| Nantucket Conservation Foundation Properties: Sanford Farm, Head of the Plains, Cisco, Madequecham | The Nantucket Conservation Foundation is a nonprofit conservation organization that protects land on Nantucket. The area is divided into 210 property parcels dispersed over the island. A few of the areas (Sanford Farm/Ram Pasture/The Woods, Head of the Plains, Cisco, and Madequecham) are on the south side of Nantucket and include views of the ocean. |
| Miacomet Golf Club | The Miacomet Golf Course greens are approximately ½ mile (0.8 km) from the shore and have open views of the ocean to the south. |

Source: Martha's Vineyard Chamber of Commerce, 2011 and Nantucket Island Chamber of Commerce, 2011

The overall aesthetic character of Martha's Vineyard and Nantucket are that of a small-town landscape with little to moderate urban development. The horizon looking south towards the WEA from the coasts is typically defined by a view of the open ocean. Because of the development and infrastructure at some of the viewpoints, manmade lighting results in some light pollution, but most viewpoints are typical of beaches and natural areas without much development. Lights from boats/ships can be seen from all locations of the coastline on the ocean horizon on most nights, except in extremely foggy conditions. The intensity and size of the lights varies depending on the distance of the boat from the shore, and remains within the view different amounts of time depending on the direction and speed of the vessel. Photographs in Appendix H show typical views of the WEA from a representative location on each island.

Recreational fishing is discussed in Section 4.2.3.5 of this EA. Recreational vessels, including power boats, sailboats, and cruise ships also transit through the WEA—see Section 4.2.3.8 of this EA for further discussion.

#### *4.2.3.4.2 Impact Analysis of Alternative A*

As described in Section 5.2.21.2 of the PEIS (MMS, 2007a), a meteorological tower in a typical seascape could introduce a vertical line that would contrast with the horizon line and would introduce a geometrical manmade element into a natural landscape. However, the main concerns related to visual impacts of meteorological towers would be those presented by the deck (the widest and most substantial portion of the tower—approximate diameter between 16 and 40 ft [5 and 12 m]) rather than the relatively slender mast (approximate diameter between 3 to 10 ft [1 to 3 m] depending on height above the water) (GL Garrad Hassan, 2012). Visual impacts are contingent on the distance from shore, earth curvature, wave height, and atmospheric conditions that could screen some or all of the deck from view (MMS, 2007a).

Distances at which a meteorological tower could be seen from shore were calculated using the methodology described in Section 5.2.21.4 of the PEIS (MMS, 2007a). As described in the PEIS, a visibility table (Table 4-25) allows calculation of the maximum viewing distance of a structure for a given distance, structure height, and viewer elevation. For example, the theoretical maximum viewing distance for a 370 ft tower viewed by a person 6 ft tall standing at the shore is 25.4 miles. If the viewer was located on a 100 ft headland, the theoretical viewing distance would be 34.2 miles. However, at these maximum distances, the tips of the towers would appear just over the horizon, with the rest of the structure below the horizon. Because atmospheric haze reduces visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that even the tips of the towers may not be discernible at the maximum distances, although they theoretically would be visible.

**Table 4-25**
**Visibility Table**

| Height (feet) | Distance in Geographic or Nautical Miles | Height (feet) | Distance in Geographic or Nautical Miles | Height (feet) | Distance in Geographic or Nautical Miles | Height (feet) | Distance in Geographic or Nautical Miles | Height (feet) | Distance in Geographic or Nautical Miles | Height (feet) | Distance in Geographic or Nautical Miles |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.2 | 23 | 5.6 | 45 | 7.8 | 135 | 13.6 | 340 | 21.6 | 620 | 29.1 |
| 2 | 1.7 | 24 | 5.7 | 46 | 7.9 | 140 | 13.8 | 350 | 21.9 | 640 | 29.5 |
| 3 | 2.0 | 25 | 5.9 | 47 | 8.0 | 145 | 14.1 | 360 | 22.2 | 660 | 30.1 |
| 4 | 2.3 | 26 | 6.0 | 48 | 8.1 | 150 | 14.3 | 370 | 22.5 | 680 | 30.5 |
| 5 | 2.6 | 27 | 6.1 | 49 | 8.2 | 160 | 14.8 | 380 | 22.8 | 700 | 31.0 |
| 6 | 2.9 | 28 | 6.2 | 50 | 8.3 | 170 | 15.3 | 390 | 23.1 | 720 | 31.4 |
| 7 | 3.1 | 29 | 6.3 | 55 | 8.7 | 180 | 15.7 | 400 | 23.4 | 740 | 31.8 |
| 8 | 3.3 | 30 | 6.4 | 60 | 9.1 | 190 | 16.1 | 410 | 23.7 | 760 | 32.3 |
| 9 | 3.5 | 31 | 6.5 | 65 | 9.4 | 200 | 16.5 | 420 | 24.0 | 780 | 32.7 |
| 10 | 3.7 | 32 | 6.6 | 70 | 9.8 | 210 | 17.0 | 430 | 24.3 | 800 | 33.1 |
| 11 | 3.9 | 33 | 6.7 | 75 | 10.1 | 220 | 17.4 | 440 | 24.5 | 820 | 33.5 |
| 12 | 4.1 | 34 | 6.8 | 80 | 10.5 | 230 | 17.7 | 450 | 24.8 | 840 | 33.9 |
| 13 | 4.2 | 35 | 6.9 | 85 | 10.8 | 240 | 18.1 | 460 | 25.1 | 860 | 34.3 |
| 14 | 4.4 | 36 | 7.0 | 90 | 11.1 | 250 | 18.5 | 470 | 25.4 | 880 | 34.7 |
| 15 | 4.5 | 37 | 7.1 | 95 | 11.4 | 260 | 18.9 | 480 | 25.6 | 900 | 35.1 |
| 16 | 4.7 | 38 | 7.2 | 100 | 11.7 | 270 | 19.2 | 490 | 25.9 | 920 | 35.5 |
| 17 | 4.3 | 39 | 7.3 | 105 | 12.0 | 280 | 19.6 | 500 | 26.2 | 940 | 35.9 |
| 18 | 5.1 | 40 | 7.4 | 110 | 12.3 | 290 | 19.9 | 520 | 26.7 | 960 | 36.3 |
| 19 | 5.1 | 41 | 7.5 | 115 | 12.5 | 300 | 20.3 | 540 | 27.2 | 980 | 36.6 |
| 20 | 5.2 | 42 | 7.6 | 120 | 12.8 | 310 | 20.6 | 560 | 27.7 | 1000 | 37.0 |
| 21 | 5.4 | 43 | 7.7 | 125 | 13.1 | 320 | 20.9 | 580 | 28.2 | | |
| 22 | 5.5 | 44 | 7.8 | 130 | 13.3 | 330 | 21.3 | 600 | 28.7 | | |

Explanation: The line of sight connecting the observer and a distant object is at maximum length tangent with the spherical surface of the sea. It is from this point of tangency that the tabular distances are calculated. The table must accordingly be entered twice to obtain the actual geographic visibility of the object—first with the height of the object, and second with the height of the observer's eye—and the two figures so obtained must be added. Thus, if it is desired to find the maximum distance for which a powerful light may be seen from the bridge of a tangent vessel where the height of the eye of the observer is 55 feet above the sea, from the table: 55 feet height of observer (visible) = 8.7 nautical miles, 200 feet of light (visible) = 16.5 nautical miles, and the distance the structure is visible = 25.2 nautical miles. Modified from Seascape Energy Ltd., 2002.

To evaluate impacts on visual resources, daytime and nighttime simulations of a meteorological tower were developed from Katama Beach/South Beach on Martha's Vineyard and Madaket Beach on Nantucket. These locations were chosen to illustrate views of the WEA from representative viewpoints if the towers were installed in the closest possible location from shoreline. The photographs and simulations are included in Appendix H along with a description of the visual simulation methodology. Animations showing the FAA standard obstruction lighting (AC 70/7460-1K) on the meteorological towers were created to illustrate what the tower will look like at nighttime. This animation is available for viewing at http://www.boem.gov/Renewable-Energy-Program/State-Activities/Massachusetts.aspx. The final color, intensity, and timing of tower lights would be determined in consultation with and receiving final approval from the USCG (33 CFR 66.01–11) and FAA.

Impacts on recreational resources are not anticipated in connection with Alternative A. As discussed in Section 4.2.3.5, existing port facilities would be used to support the proposed action and expansion of these facilities is not anticipated. Vessel traffic associated with Alternative A would use established nearshore traffic lanes to the extent possible, and would not travel close to the shoreline except when leaving and entering a port or dock. Therefore, any adverse impact on tourism and recreation from the additional vessels associated with the proposed action is unlikely. Spills from vessels (typically diesel spills from collisions/allisions or during refueling) or a tower or buoy during construction, operation, or maintenance activities could have the potential for adverse impacts on recreation if the spill reached shore. If a spill were to occur, it would be expected to dissipate very rapidly and biodegrade within a few days. Therefore, because the WEA is over 12 nm from the nearest shoreline, a spill would not likely reach the shore in quantities that would result in impacts on recreation.

Additionally, given the limited nature of the proposed activities and their distance from shore, recreational beaches would not likely be affected by waterborne trash as a result of Alternative A. Any beached litter and debris as a result of Alternative A is unlikely to be perceptible to beach users or administrators given the amount of vessel traffic and debris currently traversing the coastal areas. To reduce or eliminate the risk of intentional and/or accidental introduction of debris into the marine environment, all vessel operators, employees, and contractors actively engaged in offshore operations would be required to be briefed on marine trash and debris awareness and elimination. The lessee would also be required to ensure that its 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.

#### *4.2.3.4.3 Conclusion*

As shown in the daytime visual simulations from both viewpoints, the widest portion of the meteorological tower (the deck) would be below the visual horizon and would not be visible from shore. In addition, given the width of the tower and the distance from the viewpoints, the mast of the tower would not be discernible by the naked eye in the best visibility conditions (a clear, low humidity day). Overall, visual impacts to onshore viewers of meteorological towers in daylight would be expected to be negligible to minor.

Although the lights on the tower can be seen by the naked eye in the nighttime simulations, there are multiple lights on the horizon in the Nantucket simulation, so it is difficult to know which of the lights can be attributed to the tower. Only the lit tower can be seen in the Martha's Vineyard nighttime simulation, indicating that no boats/ships were within view when the photography was taken. Lighting markers at the top of the tower would likely be visible on clear nights from the shoreline. However, boats/ships frequently appear on the horizon, making it difficult to distinguish the tower from the other lights. Weather conditions such as fog, haze, clouds, or rough seas would also greatly limit the visibility of the towers and lighting from the shore. Therefore, the presence of a flashing light or lights on a meteorological tower at night would result in minor impacts when no other lights could be seen on the horizon and negligible impacts if other lights were present. Because meteorological buoys would be at the same approximate height of the meteorological towers' decks, the visual impacts from the buoys are anticipated to be negligible.

A meteorological tower or buoy could dominate views from vessels traveling within and around the WEA, but because boats/ships are generally moving, the close-up views, and any associated impacts, would be brief. Therefore, visual impacts from vessels would likely be negligible.

Given the distance of the proposed lease areas from shore, the fact that no new coastal infrastructure would be necessary, and the small amount of vessel traffic associated with the proposed action that would be present in any given recreational area, no impacts on coastal recreational resources from the proposed action are anticipated. While adverse impacts could occur from marine trash and debris, with implementation of the mitigation discussed under the impacts analysis above, impacts would be short-term and negligible. Impacts on recreational fishing are discussed in Section 4.2.3.5.2.

#### *4.2.3.5 Commercial and Recreational Fisheries*

##### *4.2.3.5.1 Description of the Affected Environment*

The area encompassed by the Massachusetts WEA is used for both commercial and recreational fishing. The following section discusses fishing activities in the context of the proposed action in the WEA, focusing on the economic value of these fisheries to the ports where they originate.

### *Recreational Fishing*

Much recreational fishing takes place in the waters of southern New England. Anglers go out in search of recreationally permitted species from shore, via personal vessels, and on “party” and charter vessels. Fishing occurs onshore from piers and beaches to Federal waters greater than 3 miles offshore. In 2011, Massachusetts had more than 2.8 million estimated angler trips across all fishing modes (Table 4-26). Of these, 203,299 (7 percent) were greater than 3 miles offshore in Federal waters (Table 4-27). The large majority of Massachusetts recreational effort is characterized as “inland,” or “ocean (<=3 miles [4.8 km])” (NMFS OST, 2012a). The charter and party boat trips that occurred in the WEA during recent years were confined to the extreme western portion of the WEA (Figures 4-6 and 4-7). The last 10 years have shown a decline in recreational angler trips in the Federal Exclusive Economic Zones (Figure 4-8).

The top recreational fish species caught by weight in Massachusetts in 2011 was striped bass, followed by Atlantic cod, pollock, and bluefish (Table 4-28; NMFS OST, 2012a).

**Table 4-26**

**Recreational Effort by State and Fishing Mode for the Year 2011**

| State | Fishing Mode | Angler Trips |
|---|---|---|
| Connecticut | Shore | 399,213 |
| | Party Boat | 16,533 |
| | Charter Boat | 29,477 |
| | Private/Rental Boat | 863,429 |
| Massachusetts | Shore | 1,305,475 |
| | Party Boat | 75,418 |
| | Charter Boat | 113,990 |
| | Private/Rental Boat | 1,318,589 |
| Rhode Island | Shore | 539,012 |
| | Party Boat | 16,864 |
| | Charter Boat | 22,215 |
| | Private/Rental Boat | 535,703 |

Source: NMFS OST, 2012a

**Table 4-27**

**Massachusetts Fishing Effort in 2011 by Mode and Area**

| Fishing Mode | Fishing Area | Angler Trips |
|---|---|---:|
| Shore | Ocean (<= 3 MI) | 164,114 |
| | Inland | 1,141,361 |
| Party Boat | Ocean (<= 3 MI) | 10,466 |
| | Ocean (> 3 MI) | 25,408 |
| | Inland | 38,995 |
| | Unknown | 549 |
| Charter Boat | Ocean (<= 3 MI) | 34,743 |
| | Ocean (> 3 MI) | 27,593 |
| | Inland | 48,844 |
| | Unknown | 2,809 |
| Private/Rental Boat | Ocean (<= 3 MI) | 295,295 |
| | Ocean (> 3 MI) | 150,298 |
| | Inland | 872,995 |

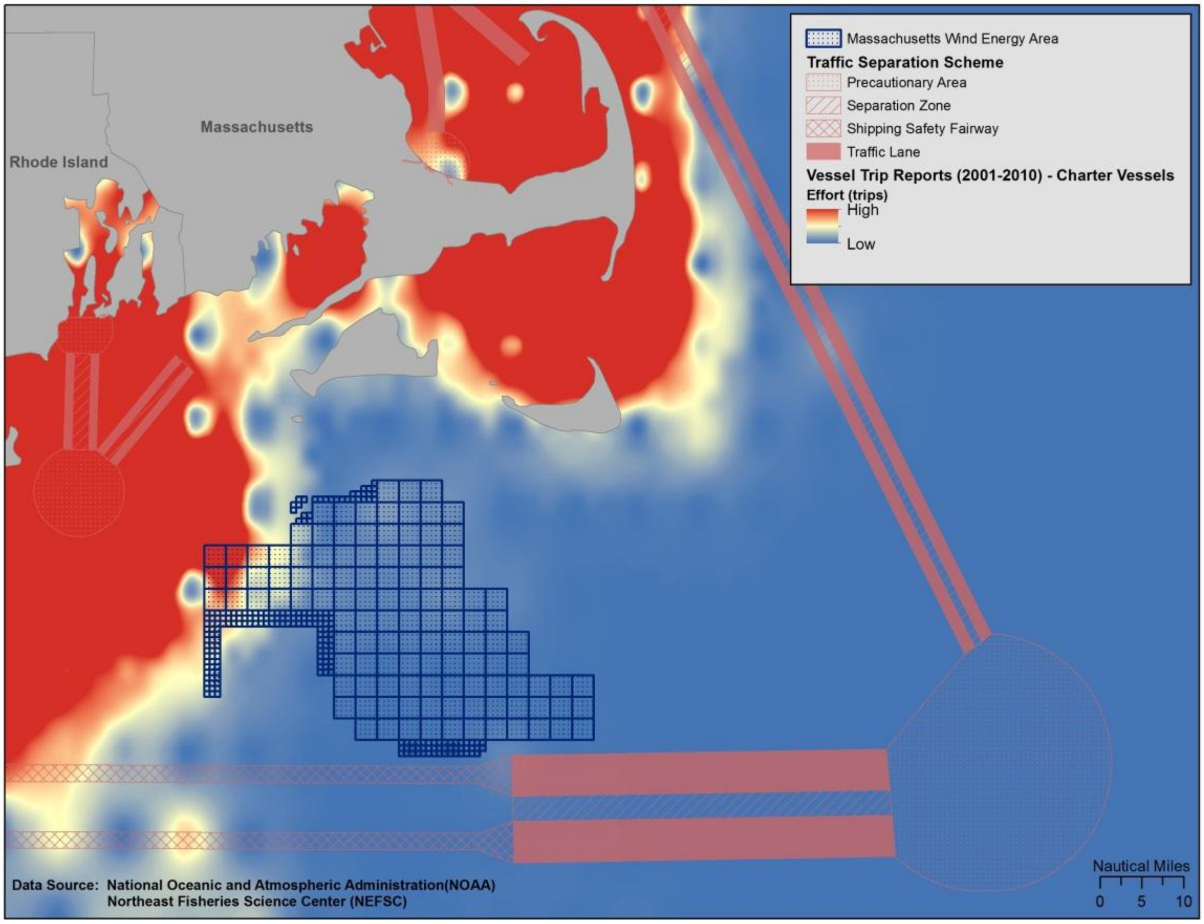
Source: NMFS OST, 2012a

**Table 4-28**

**Recreational Fishery Landings by Species in 2011 for Massachusetts**

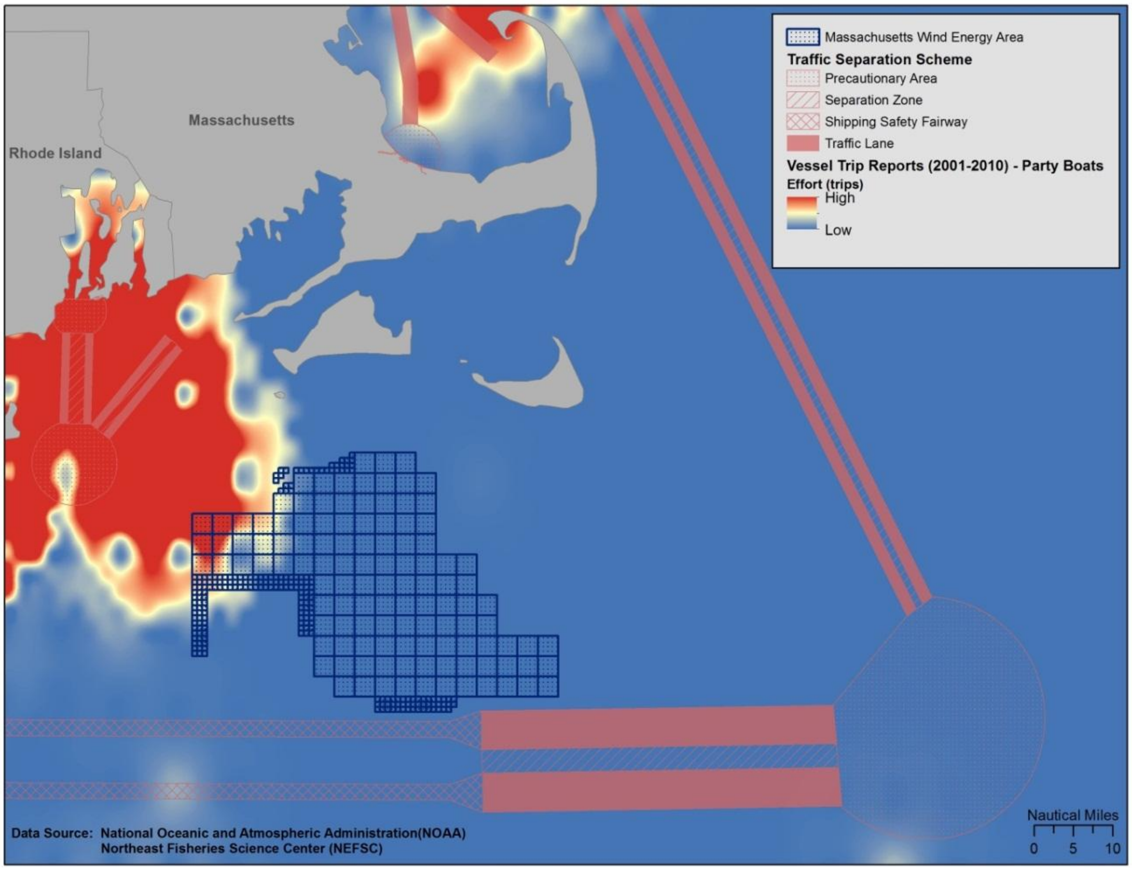
| Species | 2011 Massachusetts landings |
|---|---:|
| Striped bass | 3,504,522 |
| Atlantic cod | 2,519,244 |
| Pollock | 2,191,463 |
| Bluefish | 1,175,610 |
| Scup | 836,156 |
| Atlantic mackerel | 607,619 |
| Black sea bass | 318,379 |
| Haddock | 217,112 |
| Summer flounder | 202,665 |
| Tautog | 129,669 |
| Winter flounder | 66,728 |

Source: NMFS OST, 2012a



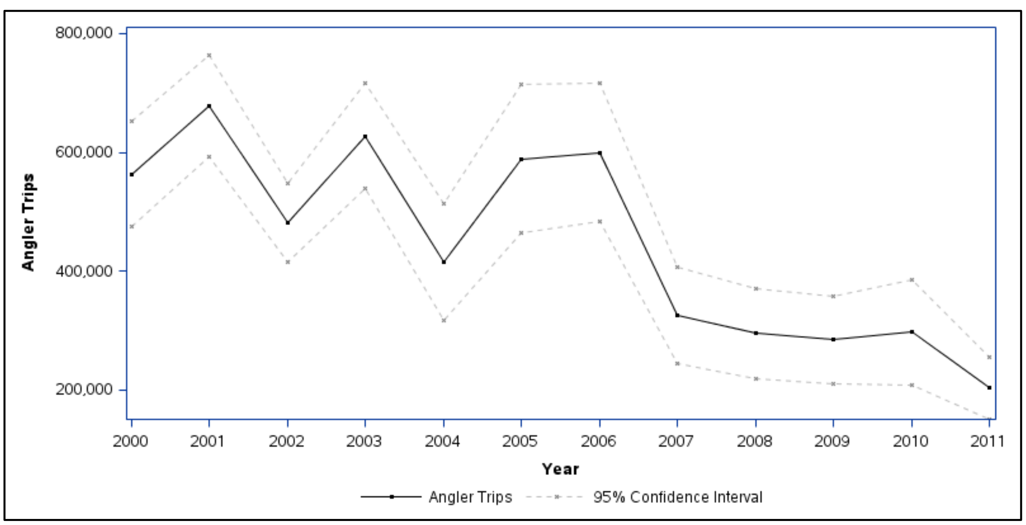

*Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010*

**Figure 4-6. Vessel trip report data for charter vessels in the area of the Massachusetts WEA between 2001 and 2010**




*Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010*

**Figure 4-7. Vessel trip report data for party boats in the area of the Massachusetts WEA between 2001 and 2010**




*Source: NMFS OST, 2012a*

**Figure 4-8. Angler effort for recreational fisheries in Federal waters based out of Massachusetts between 2000 and 2011**

### *Commercial Fishing*

The fisheries resources in the Federal waters off the New England States provide a significant amount of revenue to the United States (Table 4-29). Some species are available in great quantities and sold for low prices (i.e., menhaden), and others are harvested more sparingly and fetch high prices (i.e., Atlantic sea scallops). A majority of fisheries in Federal waters off Massachusetts are managed by the NEFMC, though some are managed jointly between the NEFMC and the Mid-Atlantic Fishery Management Council. Other stocks and species are managed by the Atlantic States Marine Fisheries Commission, international fishery organizations, or a combination of bodies.

**Table 4-29**

**Total Commercial Fishery Landed Weight and Value by State for the 2010 Fishing Year**

| State | Metric Tons | Pounds | Dollar Value |
|---|---|---|---|
| Connecticut | 3,004.4 | 6,623,416 | $18,099,048 |
| Maine | 90,294.4 | 199,063,136 | $377,820,918 |
| Massachusetts | 128,293.1 | 282,834,896 | $478,626,525 |
| New Hampshire | 5,361.4 | 11,819,834 | $20,653,033 |
| Rhode Island | 35,143.2 | 77,476,759 | $62,676,828 |
| Total | 262,096.5 | 577,818,041 | $957,876,352 |

Source: NMFS OST, 2012b

The most important species by dollar value present in and around the Massachusetts WEA is the sea scallop (Table 4-30; NMFS OST, 2012b). In 2010, more than 14,000 metric tons of scallops were landed in the State of Massachusetts, totaling more than $252 million. However, the State where the catch is landed may not reflect the area from which the fishery is prosecuted. The major sea scallop port is located in New Bedford, MA (Table 4-31). The location of this port suggests transit to fishing grounds on Georges Bank may occur via the WEA. Several other high ranking ports in terms of seafood landings in dollar value are located in New England (Table 4-31).

**Table 4-30**

**Commercial Landings by Weight and Value for All Species Contributing over $1 million in Massachusetts in 2010**

| Species | Metric Tons | Pounds | $ Dollars |
|---|---|---|---|
| Sea scallop | 14,132.80 | 31,157,184 | 252,290,172 |
| American lobster | 5,791.70 | 12,768,448 | 50,367,166 |
| Atlantic cod | 6,972.70 | 15,372,052 | 23,999,317 |

| Species | Metric Tons | Pounds | $ Dollars |
|---|---|---|---|
| Haddock | 9,566.00 | 21,089,109 | 21,210,502 |
| Atlantic herring | 32,623.60 | 71,921,943 | 10,253,258 |
| Goosefish | 3,964.30 | 8,739,767 | 9,921,759 |
| Ocean quahog clam | 7,096.90 | 15,645,782 | 8,980,750 |
| Eastern oyster | 96.9 | 213,640 | 8,170,872 |
| Polluck | 3,939.30 | 8,684,636 | 7,184,355 |
| Atlantic surf clam | 3,669.60 | 8,089,978 | 6,799,284 |
| Winter flounder | 1,515.90 | 3,341,962 | 6,658,838 |
| Bluefin tuna | 424.4 | 935,665 | 6,367,903 |
| Softshell clam | 503.4 | 1,109,795 | 5,960,731 |
| Northern quahog clam | 406.7 | 896,711 | 4,640,279 |
| Skates | 8,337.40 | 18,380,689 | 4,630,028 |
| Silver hake | 3,198.10 | 7,050,457 | 4,253,500 |
| Atlantic plaice flounder | 1,302.30 | 2,870,974 | 4,150,050 |
| Channeled whelk | 362 | 798,042 | 3,831,335 |
| Yellowtail flounder | 1,177.90 | 2,596,816 | 3,695,384 |
| Striped bass | 555.4 | 1,224,520 | 3,578,533 |
| Witch flounder | 678.4 | 1,495,548 | 3,373,564 |
| White hake | 1,468.00 | 3,236,332 | 3,342,984 |
| Jonah crab | 2,580.70 | 5,689,436 | 3,211,326 |
| Crabs | 1,412.20 | 3,113,307 | 3,055,361 |
| Swordfish | 278.8 | 614,552 | 2,118,249 |
| Summer flounder | 386.4 | 851,889 | 2,096,791 |
| Acadian redfish | 1,573.40 | 3,468,814 | 1,838,796 |
| Longfin squid | 701.5 | 1,546,492 | 1,719,475 |
| Bay scallop | 57.7 | 127,174 | 1,523,114 |
| Atlantic mackerel | 5,514.00 | 12,156,111 | 1,486,986 |
| Spiny dogfish shark | 2,922.40 | 6,442,713 | 1,357,162 |

Source: NMFS OST, 2012b

**Table 4-31**

**2010 Commercial Fishery Landings by Port Ranked by Dollars for All Ports in the New England States**

| Rank* | Port | Millions of Pounds | Millions of Dollars |
|---|---|---|---|
| 1 | New Bedford, MA | 133.4 | $306.0 |
| 2 | Gloucester, MA | 88.8 | $56.6 |
| 18 | Stonington, ME | 17 | $45.3 |
| 26 | Point Judith, RI | 35.6 | $32.2 |
| 43 | Provincetown-Chatham, MA | 15.9 | $19.9 |
| 44 | Portland, ME | 38.2 | $18.8 |
| 45 | Stonington, CT | 6 | $18.5 |
| 52 | Boston, MA | 12 | $15.1 |
| 63 | Rockland, ME | 22.6 | $10.6 |
| 64 | New London, CT | 3.2 | $10.6 |
| 79 | Newport, RI | 7.5 | $6.9 |

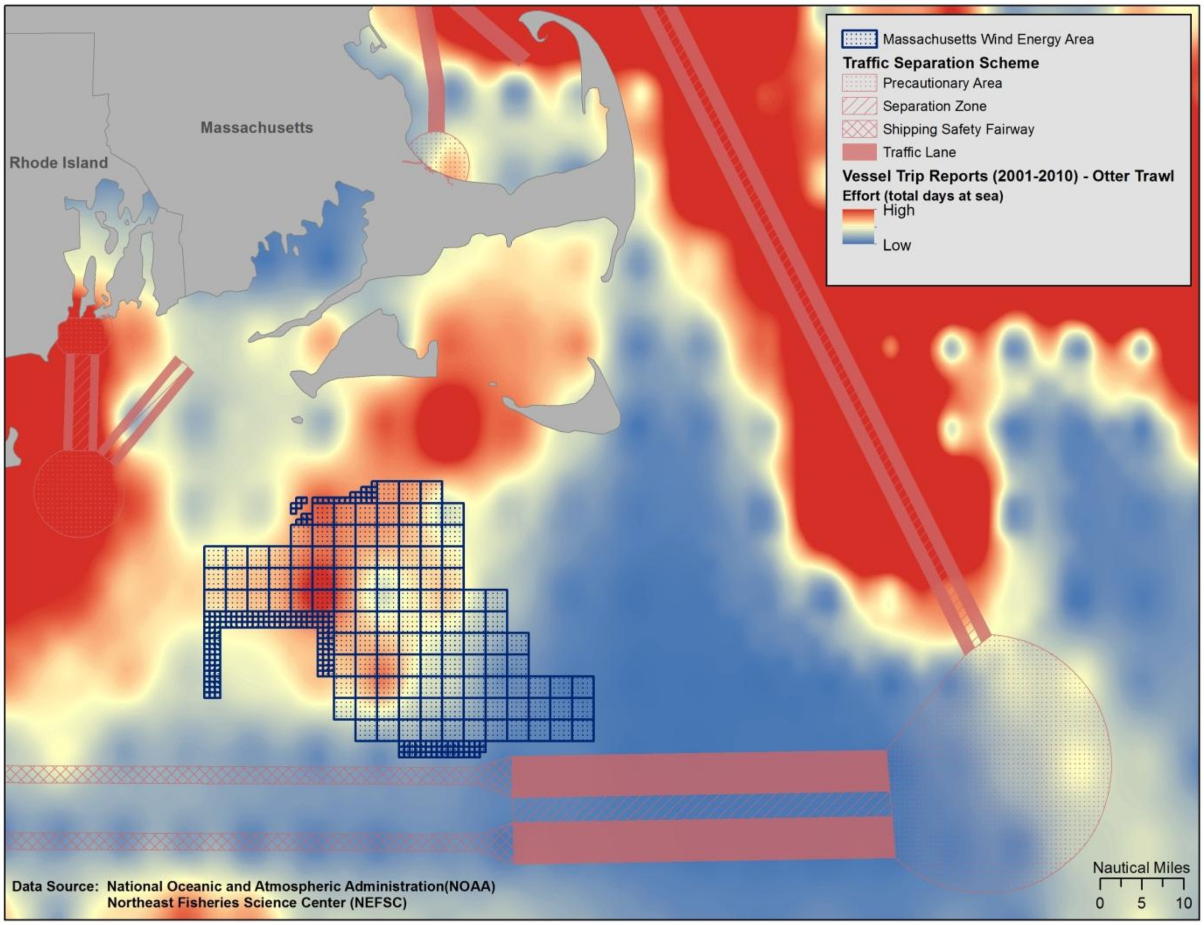
*Ports are ranked out of 94 based on all ports reporting $1 million or more in landings.
Source: NMFS OST, 2012b

Within the State waters of Massachusetts, the commercial effort and landings data for various statistical areas, including those closest to the WEA, are presented in the Ocean Planning Work Group Reports associated with the Massachusetts Ocean Management Plan (EOEEA, 2009). State commercial fishing effort is considered “low” to “medium” in State waters south of Martha’s Vineyard, adjacent to the location of the WEA. Species considered most important from this area are striped bass, fluke (summer flounder), black sea bass, and scup. The same areas are considered of “medium” and “high” importance to Massachusetts fisheries resources based on State survey data.

Commercial fishing in federal waters brings in a large amount of money for the state of Massachusetts, and the port of New Bedford has been the most valuable in the United States for much of the 2000s (NMFS, 2010c). Species with more than $5 million in annual landings in Massachusetts from federal waters in 2007 included sea scallop, lobster, monkfish, cod, haddock, winter flounder, Atlantic sea herring, yellowtail flounder, skates, and witch flounder (MA DMF, 2009 as cited in MA EOEEA, 2009).

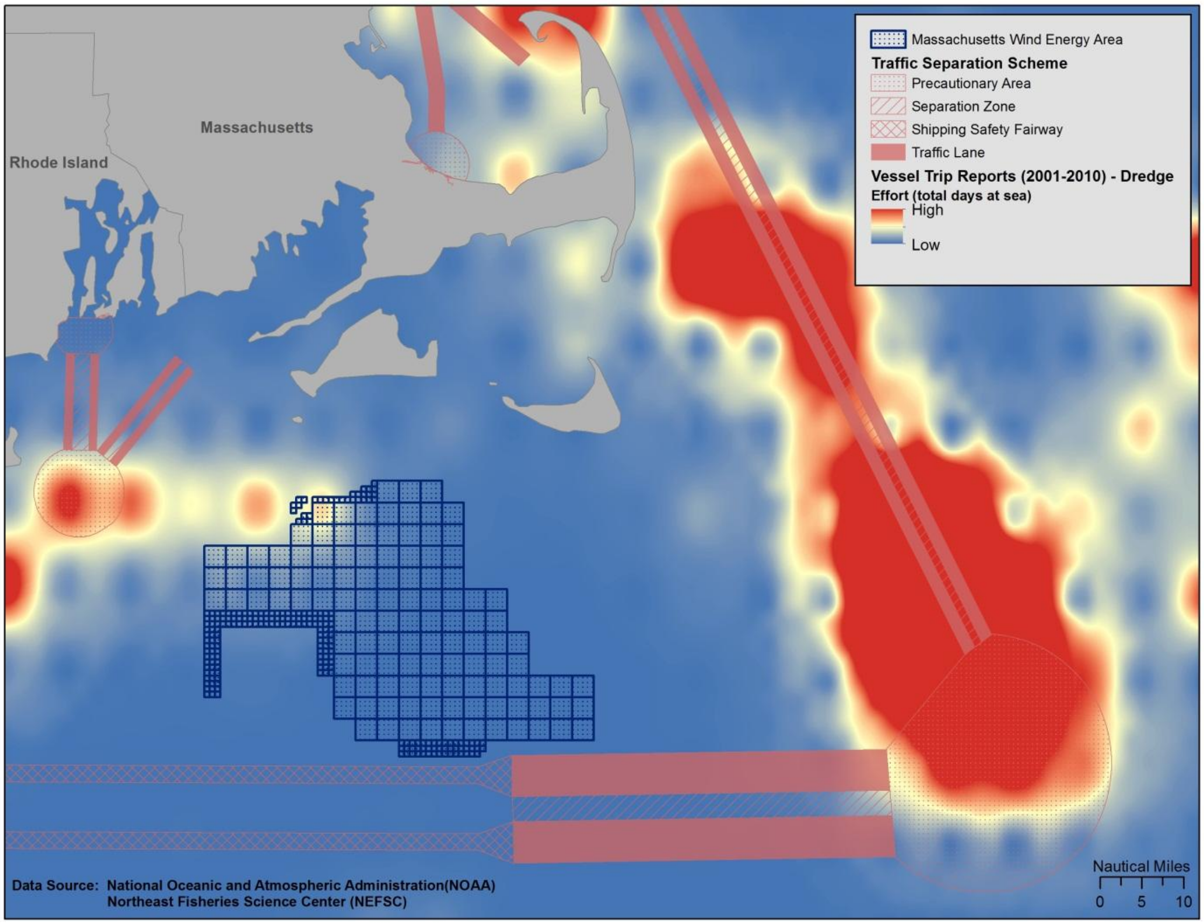
Commercial otter trawl trips reported from federally mandated vessel trip reports show the fishing effort inside the WEA to be concentrated in the central and western portions (Figure 4-9). This effort is small compared to that in the regional fishing grounds located outside the WEA. In addition, relatively little commercial trawl effort occurs to the south or east of the WEA.

Commercial scallop dredge vessel trip reports show very little effort in the WEA (Figure 4-10). A small amount of effort occurs in the northwest corner of the WEA compared to the effort on other fishing grounds outside the WEA.




*Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010*

**Figure 4-9. Vessel trip report data for commercial otter trawl effort in the area of the WEA between 2001 and 2010**




*Source: NOAA Fisheries Northeast Fisheries Science Center Fishing Vessel Trip Reports 2001-2010*

**Figure 4-10. Vessel trip report data from scallop dredge vessels in the area of the WEA between 2001 and 2010**

#### *4.2.3.5.2 Impact Analysis of Alternative A*

Potential effects on commercial and recreational fishing include two broad categories: (1) displacement of fishing activities, and (2) alteration of target species availability. Impacts on fish or fish habitat could affect the availability of target species. There is also the possibility that installation of meteorological towers or buoys will create additional habitat for species that use structures as habitat, which could have an indirect beneficial effect on fisheries for those species. Higher abundances of target species around meteorological towers or buoys could attract fishermen to these areas as a result of higher catch likelihood and catch rates. This could impact both commercial and recreational fisheries positively, but is more likely to impact hook-and-line fisheries.

Fisheries impacts are discussed below for both routine and non-routine (unexpected) activities associated with Alternative A. Fisheries impacts are evaluated with a focus on displacement of fishing activities; additional discussion of impacts that could affect the availability of target species is provided in Section 4.2.2.5. Section 5.2.23.2 of the PEIS (MMS, 2007a) provides additional analysis of impacts from site characterization and assessment activities on commercial and recreational fishing.

### *Routine Activities*

The proposed site characterization and assessment activities involve installation of meteorological towers and buoys inside the WEA and surveys for site characterization. These activities would result in increased boat traffic in the area and the temporary exclusion/displacement of vessels during activities on the leasehold to prevent conflicts and collisions with survey vessels and gear. Alternative A includes installation of a maximum of five meteorological towers or 10 meteorological buoys, which take approximately 1 to 10 weeks and 1 to 3 days, respectively, to complete, and would close a circular area 3,000 ft in diameter around each tower or buoy to vessel traffic during that time (see Section 3.1.4.4). Exclusion/displacement as a result of survey activities involving sub-bottom samples, etc. is expected to be on a scale of hours and confined to the immediate area around the survey ship. Site characterization and assessment activities are expected to take place in the spring and summer months, which would overlap with commercial and recreational fishing seasons. Commercial and recreational fishing will not be precluded from the areas inside the WEA but outside the immediate footprint of characterization and assessment activities.

Prior to selection of the final WEA, major areas of fishing interest were removed to minimize potential conflict between activities. Commercial fishing vessels may transit the WEA en route to historical fishing grounds, but survey activities or construction activities (projected to temporarily occupy less than one percent of the WEA) would not likely interfere with access to active fishing grounds beyond the WEA outside of the need to change transit routes slightly to avoid survey and construction vessels and installed equipment. Once meteorological towers and buoys are decommissioned and removed, the proposed sites would pose no obstacle to commercial or recreational fishing.

There are numerous port and marina locations shoreward of the WEA that may be used by commercial fishing vessels, recreational vessels, and project vessels. The projected number of vessel trips for site characterization and site assessment activities at any of these ports or marinas would be up to approximately 6,500 (see Sections 3.1.3.4 and 3.1.4.4). These trips are expected to bring revenue to some businesses in fishing ports without interfering in the day-to-day operations of the fishing fleet, resulting in a small beneficial impact.

### *Non-Routine Events*

The impacts of non-routine events on water quality are discussed in Section 4.2.1.5. Diesel fuel would be present in vessels, generators, and pile-driving hammers, all of which have the potential to be damaged in non-routine events such as collisions, allisions, and storms. Based on data from 2000 to 2009, the average spill size for vessels other than tank ships and tank barges was 88 gallons (USCG, 2011), so BOEM anticipates that the average volume of any potential spill caused by Alternative A would be similar. If such a diesel spill occurred, the fuel would be expected to dissipate rapidly, evaporate, and biodegrade within a few days because of physical oceanographic features, resulting in negligible impact to the ecosystem and, therefore, the fishing resource and fisheries.

##### *4.2.3.5.3 Conclusion*

The proposed action would consist of vessel traffic and activities related to the installation/operation of the meteorological towers and buoys that would not measurably impact commercial or recreational fishing activities. Areas in which commercial and recreational fishermen would be excluded are small in relation to the fishing grounds, and changes to navigation necessary to reach fishing areas beyond the WEA would be minimal. Localized fishing displacement and/or target species availability within the immediate area of proposed activities may occur during the initial stages of Alternative A, but these would be temporary and confined to a limited area, resulting in a negligible, if detectible, impact to fishing. Observational equipment that would be installed under Alternative A could provide habitat for some target fish species in the area, which may have a small beneficial impact on fisheries.

#### *4.2.3.6 Aviation*

##### *4.2.3.6.1 Description of the Affected Environment*

### *Airport Facilities*

The closest public airports to the WEA are Nantucket Memorial Airport on Nantucket Island, and Katama Airfield and Martha’s Vineyard Airport, both located on Martha’s Vineyard. Private airports nearby include Tuckernuck and Muskeget Island Airport (located on islands between Nantucket and Martha’s Vineyard). Major airports located on the mainland include Logan International Airport in Boston, MA, Providence T.F. Green Airport in Providence, RI, and Long Island near New York, NY. In addition, there is military air traffic associated with Otis Air National Guard Base on Cape Cod, MA.

Nantucket Memorial Airport and Martha’s Vineyard Airport are included in the ten system airports in Massachusetts with air traffic control towers and support both general aviation and commercial service/charter activities. Martha’s Vineyard Airport is a municipal airport that serves as a vital transportation link to the mainland and to Nantucket. Because Nantucket Memorial Airport can accommodate single and multi-engine aircraft as well as corporate jets and helicopters, it is busier than Martha’s Vineyard Airport, and is the second busiest airport in

Massachusetts after Logan International Airport. Eight airlines currently provide service at Nantucket Memorial Airport, five of which provide seasonal service only (June–September). Approaches to these airports are over the WEA (FAA, 2012).

### *Aviation Corridors and Air Traffic*

General aviation (not commercial airlines or freight) traffic varies throughout the year but increases during the summer season along with the tourism season on Martha's Vineyard and Nantucket. High Altitude Jetways occur at 18,000 ft above mean sea level. Air traffic at lower altitudes is managed by the FAA with Low Altitude Instrument Flight Rules (IFR) routes, and with Visual Flight Rules (VFR), which generally don't have designated routes. High performance jet and turbo prop aircraft generally follow IFR routes, with planes in the proposed action area typically flying at altitudes between 3,000 to 7,000 ft. General aviation often uses VFR. Pilots flying under VFR assume responsibility for their separation from all other aircraft and obstructions; low flying aircraft operating under VFR are required to maintain a minimum 500 ft (152.5 m) clearance from any structure or vessel (14 CFR 91.119). There are no minimum altitude restrictions over water in the absence of any structures or vessels.

The FAA designates air space for military activities, including training routes, operating areas (OPAREAs), restricted airspace, and warning areas. There are no military OPAREAs or training routes in the airspace over the WEA (FAA, 2012). The majority of the WEA is within a U.S. Navy Aviation Warning Area, which is a type of Special Use Airspace where flight operation may be restricted at times. Warning areas extend from 3 nm outward from the coast over international waters and in international airspace, but because they occur over international waters, there are no restrictions on nonmilitary aircraft. The purpose of designating such areas is to warn nonparticipating pilots of the potential danger. When in use for military exercises, the controlling agency notifies civil, general, and other military aviation organizations through notice-to-airmen and notice-to-mariner advisories, which specify the current and scheduled status of the area and warn other aircraft. Aircraft operations conducted in warning areas primarily involve air-to-air combat training and are rarely conducted at altitudes below 5,000 ft (1,524 m). The closest restricted airspace occurs around a small island that is approximately 2.8 nm south of the western end of Martha's Vineyard and approximately 6.5 nm north of the WEA (U.S. Navy, 2007).

Additionally, the airspace above the WEA may be used by USCG or other government and private aircraft for data collection (such as the avian surveys associated with this proposed action) and search and rescue operations.

#### 4.2.3.6.2 Impact Analysis of Alternative A

### Routine Activities

Meteorological towers and buoys would be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66. Marking and lighting of meteorological towers and buoys in accordance with USCG and FAA regulations would mitigate risks to commercial, private, and government aircraft using the airspace above the WEA. If the anticipated meteorological towers are taller than 199 ft (61 m), as BOEM anticipates, each lessee would be required to file a "Notice of Proposed Construction or Alteration" with the FAA (14 CFR 77.13). Any meteorological tower more than 199 ft (61 m) tall also would require an obstruction evaluation analysis by the FAA to determine whether a meteorological tower would pose a hazard to air traffic and a Determination of Hazard/No Hazard issued by the FAA if within 12 nm of shore. Should BOEM receive a SAP for a meteorological tower outside of FAA jurisdiction (i.e., further than 12 nm from shore), BOEM would determine whether the proposed meteorological tower would pose a threat to air navigation. With implementation of mitigation measures and appropriate FAA review and approvals, BOEM anticipates that impacts on aviation under Alternative A would be negligible.

*Radar*

Meteorological towers could affect nearby radar use and accuracy because radar devices, such as avian detection/tracking radar, shipping vessel traffic-monitoring radar, and lightning detection sensors, are often on the towers themselves. Radar interference effects would depend on the type of radar, specific characteristics of meteorological towers, and the distribution of the meteorological towers. BOEM would conduct evaluations of impacts on radar systems during the COP phase, once details about where towers would be placed within the WEA and what devices would be on the towers are known. Evaluation of impacts of meteorological towers on military and civilian radar systems would be included in any Determination of Hazard/No Hazard by the FAA (if within 12 nm of shore). BOEM would consult with DOD on any meteorological towers outside of FAA jurisdictional authority to determine impacts of meteorological towers greater than 12 nm from shore on military and civilian radar systems. Any meteorological tower more than 199 ft (61 m) tall and within 12 nm of shore would require an Obstruction Evaluation and a Determination of Hazard/No Hazard by the FAA and each lessee would be required to file a "Notice of Proposed Construction or Alteration" with the FAA in accordance with Federal aviation regulations (14 CFR 77.13). According to the FAA, specific lighting requirements or recommendations, a radar impact analysis (including any existing windshear detection radar(s)), and recommendations for potential mitigation measures would be applied on a case-by-case basis (Page, personal communication, 2012).

### Non-Routine Events

An aircraft (associated with survey activities, commercial airplane, or other) colliding with the meteorological structures could result in adverse impacts from the spillage of diesel fuel, oil-based lubricants, or hydraulic oil, and present a risk to the health and safety of pilot(s) and passengers.

#### 4.2.3.6.3 Conclusion

Installation/operation of the meteorological towers and buoys would not measurably impact current or projected future military or aviation activities for several reasons. An aircraft colliding with meteorological towers is unlikely because the towers would be constructed following USCG and FAA requirements relating to marking and lighting of towers. BOEM would consult on impacts on military and civilian radar systems once project specific details are known.

### 4.2.3.7 Military Use Areas

#### 4.2.3.7.1 Description of the Affected Environment

Military Use Areas, established in numerous areas off all U.S. coastlines, are required by the U.S. Air Force, Navy, Marine Corps, and Special Operations Forces to conduct various testing and training missions. Military OPAREAs define where the U.S. Navy conducts surface and subsurface training and operations. The WEA is within the Narragansett Bay OPAREA. The Navy conducts various training activities at sea, such as sinking exercises of surface targets and mine warfare exercises. The Navy also conducts shakedown cruises for newly built ships, and for ships completing overhaul or extensive repairs in shipyards located along the coasts.

The USACE has established surface danger zones and restricted areas in many areas adjacent to U.S. coastlines. These danger zones and restricted areas are typically shown on nautical charts. Danger zones are defined as water areas used for a variety of hazardous operations and may be closed to the public on a fulltime or intermittent basis. A restricted area is a defined water area for the purpose of prohibiting or limiting public access. Restricted areas generally provide security for Government property and/or protection to the public from the risks of damage or injury arising from the Government’s use of that area. The regulations pertaining to the identification and use of these areas are found at 33 CFR Part 334. There are no danger zones or restricted areas within the WEA; the closest danger zone/restricted area to the WEA under Alternative A is the restricted air space over Nomans Land Island that is approximately 10 nm north of the WEA. Nomans Land Island is also designated as a danger zone for naval operations (33 CFR 334.70) because unexploded ordnance is suspected to be present (NOAA Office of Coast Survey, 2009) and public access is not permitted.

Two OCS blocks within the WEA do contain unexploded ordnance (Martin, personal communication)–Blocks 6070 and 6284.

The FAA also designates military training routes, military OPAREAs, restricted airspace, and warning areas. There are no military training routes or restricted airspaces directly over the WEA. However, as discussed above, the Narragansett Bay OPAREA occurs over the WEA. In addition, a U.S. Navy aviation warning area occurs over the majority of the WEA. See Section 4.2.3.6 under "Air Corridors and Air Traffic" for a more detailed discussion of this warning area.

Numerous military and civilian radar systems provide radar coverage along the coast of New England. The FAA evaluates structures for their potential hazard to radar when a "Notice of Proposed Construction or Alteration" is filed for a specific action (in this case, a lessee's plans to construct a meteorological tower greater than 199 ft (61 m) tall within FAA jurisdiction [up to 12 nm offshore]). The FAA would then conduct an obstruction evaluation analysis to determine whether a meteorological tower would pose a hazard to air traffic radar, and would issue a Determination of Hazard/No Hazard.

#### *4.2.3.7.2 Impact Analysis of Alternative A*

### *Routine Activities*

Impacts on military radar from the proposed action and future consultation with DOD and FAA are discussed under impacts on aviation in Section 4.2.3.7.2 above.

Vessel traffic in the area of the WEA, in the area of grid transmission cable routes, and ports used to support Alternative A would increase compared to existing conditions; this increase in traffic could conflict with military uses of the OCS. Direct impacts on military activities, including vessels and aircraft in the designated OPAREA from routine activities may occur as a result of increased vessel traffic. BOEM would consult with DOD on any activities that may affect military activities to determine the extent of impacts. Specific DOD requirements or recommendations for SOCs or further mitigation measures may be necessary to eliminate or reduce impacts on military activities and would also be applied on a case-by-case basis.

Prior to starting any surveying activities in OCS Blocks 6070 and 6284, where UXO are documented, BOEM would coordinate with DOD to determine the specific locations that should be avoided to mitigate the potential for encountering UXO.

### *Non-Routine Events*

A military aircraft colliding with the meteorological structures could result in adverse impacts from the spillage of diesel fuel, oil-based lubricants, or hydraulic oil, and present a risk to the health and safety of pilot(s) and passengers.

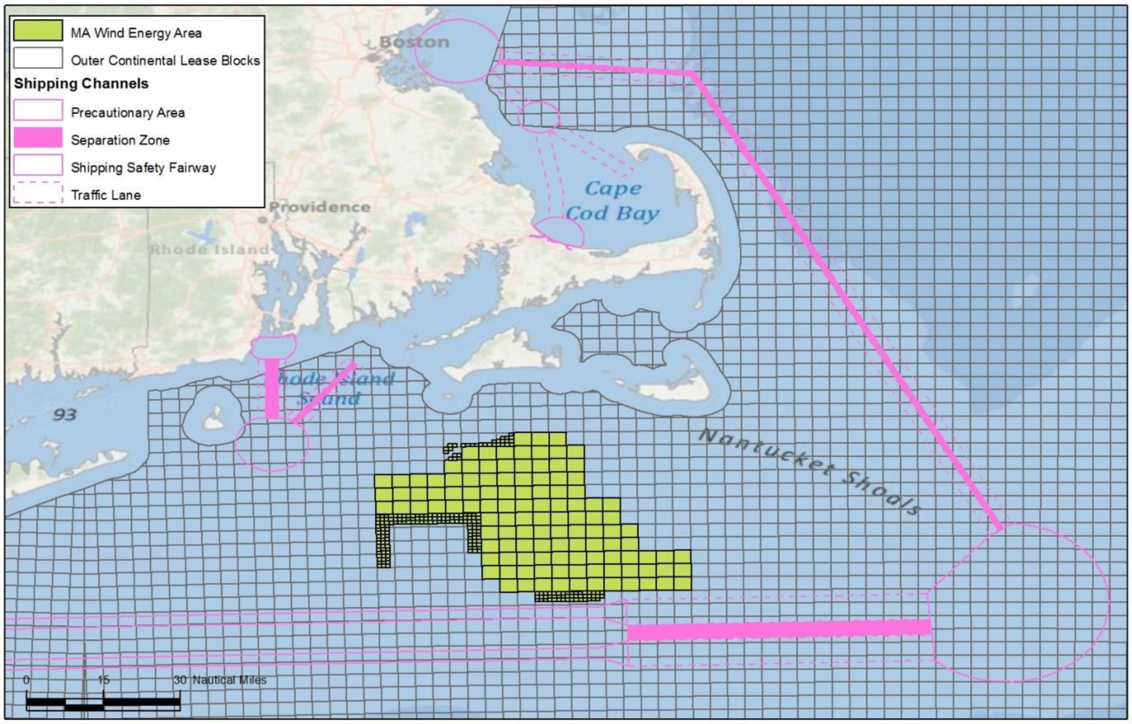
#### 4.2.3.7.3 Conclusion

BOEM consulted with DOD on Alternative A of this EA. DOD responded that the impact on the Navy's training areas and other DOD activities from site characterization surveys and installation, operation, and decommissioning of meteorological towers/buoys offshore Massachusetts could be mitigated, given site-specific stipulations in consultation with the DOD. Therefore, impacts would be negligible and avoidable when coordinated with DOD.

### 4.2.3.8 Navigation/Vessel Traffic

#### 4.2.3.8.1 Description of the Affected Environment

This section describes navigation/vessel traffic in the vicinity of the WEA. As shown in Figure 4-11, the WEA is surrounded by Routing Measures (IMO, 2010; TSS, i.e., shipping lanes) on the west, east, and south. To the north, the area is bounded by Martha's Vineyard and Nantucket. The WEA represents a crossroads between multiple heavily used waterways, including Narragansett Bay, Long Island Sound, Buzzards Bay, Vineyard and Nantucket Sounds, and offshore shipping lanes. Vessels using these ports and navigation routes include cargo ships such as tankers, bulk carries, and tug and barge units; passenger ferries; naval vessels; government research, enforcement, and search and rescue vessels; pilot boats; and fishing and recreational crafts.




*Source: Modified from Northeast Ocean Data Portal Working Group, 2011*

**Figure 4-11. Location of shipping channels and the WEA**

Vessel traffic in the vicinity of the WEA is supported by a network of navigation features, including shipping lanes, TSS, and navigational aids. Based on the navigation chart, there are four major TSSs near the WEA; two are at the Buzzards Bay entrance, one is east of the lease area (the Nantucket to Boston TSS), and one is south of the lease area (the Nantucket to Ambrose TSS). These TSSs consist of a north/south or east/west approach and inbound and outbound lanes, marked by precautionary areas (see Figure 4-11). The Nantucket to Ambrose TSS is an offshore shipping lane that serves the New York harbor between the latitudes of 40°22' and 40°36' N. The southern boundary of the WEA is located about 1 nm north of this shipping lane. The Nantucket to Boston TSS serves Boston Harbor. Designed to enhance safety for commercial shipping entering/exiting ports, these Routing Measures are not mandatory.

The USCG is expected to provide additional navigational safety recommendations when the Atlantic Coast Port Access Route Study (ACPARS) is complete. The main purpose of the ACPARS is to enhance navigational safety by examining existing shipping routes and waterway uses and, to the extent practicable, reconcile the paramount right of navigation within designated port access routes. The ACPARS will include information about current vessel traffic density, fishing vessel traffic, and agency and stakeholder experience in vessel traffic management, navigation, ship handling, and effects of weather.

Shipping densities and vessel types vary with the highest vessel density levels associated with access routes to the 10 major and 21 minor ports listed in Section 3.1.2. Commercial shipping involves the transport of goods such as petroleum products, coals, and cars, while pilot boats and government enforcement and search and rescue vessels provide critical support to commercial vessel operation. Recreational and fishing vessels are also common in the vicinity of the WEA and use the same navigational features. According to a USACE report on traffic at the entrance to Narragansett Bay during the calendar year of 2009 (USACE, 2009), a total of 2,588 vessel transits were headed to and from Providence, out of which 1,334 transits were for dry cargos, 235 transits were for tankers, 310 transits were for tow boats, and 709 transits were for barges. The majority of shipping traffic consists of vessels delivering coal and petroleum products (USACE, 2009). The number of cargo vessels has declined over the past two decades, although the total cargo tonnage has remained relatively constant, indicating that the size of cargo vessels have increased. The data gathered during the ACPARS and its analysis results may suggest that the USCG modify the existing routing measures, create one or more precautionary areas, and/or identify area(s) to be avoided.

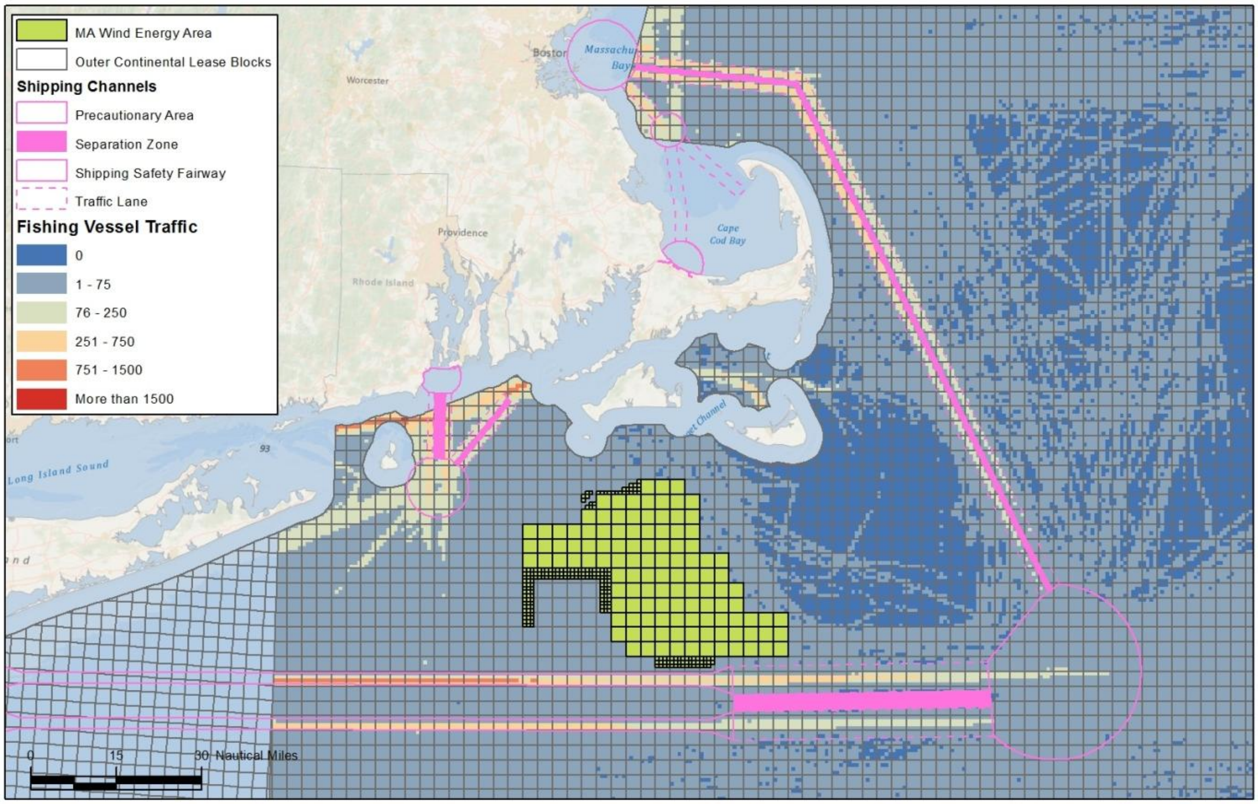
According to the Newport and Bristol Convention and Visitors Bureau (2009), 58 cruise ships from 11 cruise lines were scheduled to stop in Newport, RI, during April to November 2009. Most cruise ships transiting into/out of Narragansett Bay use the Recommended Vessel Route (i.e., the Bay entrance TSS).

Naval ships heading to the Naval Station Newport also enter Narragansett Bay via the Bay entrance TSS. Northeast Marine Pilots provided pilots for Navy vessels 7 times in 2006, 6 times in 2007, 10 times in 2008, and 5 times in 2009, indicating an annual average of about 7 port visits or 14 total transits (RICRMC, 2010).

Maritime commercial ship traffic is an important component of U.S. commerce. However, according to the U.S. Department of Transportation Maritime Administration, none of the 10 major ports listed in Section 3.1.2 was included in the top ten United States ports in 2010 (USDOT MARAD, 2011a). U.S. freight tonnage is expected to grow 73 percent from 2008 levels by 2035 (USDOT MARAD, 2011b).

The Northeast Ocean Data Portal Working Group, a partnership of government agencies, non-government organizations, and academic entities, is developing and maintaining the Northeast Ocean Data Portal (Northeast Ocean Data Portal Working Group, 2011). This is a decision support information system for the region from the Gulf of Maine to Long Island Sound, which includes vessel traffic information based on Automatic Identification Systems[2] (AIS) data. Figure 4-12 shows the vessel traffic density analyzed from AIS data, which indicates shipping traffic was concentrated on areas near the shipping lanes in the vicinity of the entrance to Narragansett Bay and offshore shipping lanes located south of the WEA. A two-way traffic route is visible at the entrance of the Narragansett Bay, which is more than 10 nm from the WEA. The other major high-vessel-density area is the offshore shipping lane that serves the New York harbor. This shipping lane also consists of an inbound and outbound route. Some traffic approaches or departs this lane to the entrance of the Narragansett Bay; therefore, crossing the WEA.

[2] AIS is a maritime safety communications system standardized by the International Telecommunications Union and adopted by the International Maritime Organization (IMO) that provides vessel information, including type, position, course, speed, and other safety-related information automatically to appropriately equipped shore stations, other ships, and aircraft (USCG Navigation Center, 2011). It is required equipment on all vessels greater than 300 gross tons. Since AIS transponders are not required on vessels <300 gross tons, its usefulness in analysis is limited and reflects only a portion of total vessel traffic.

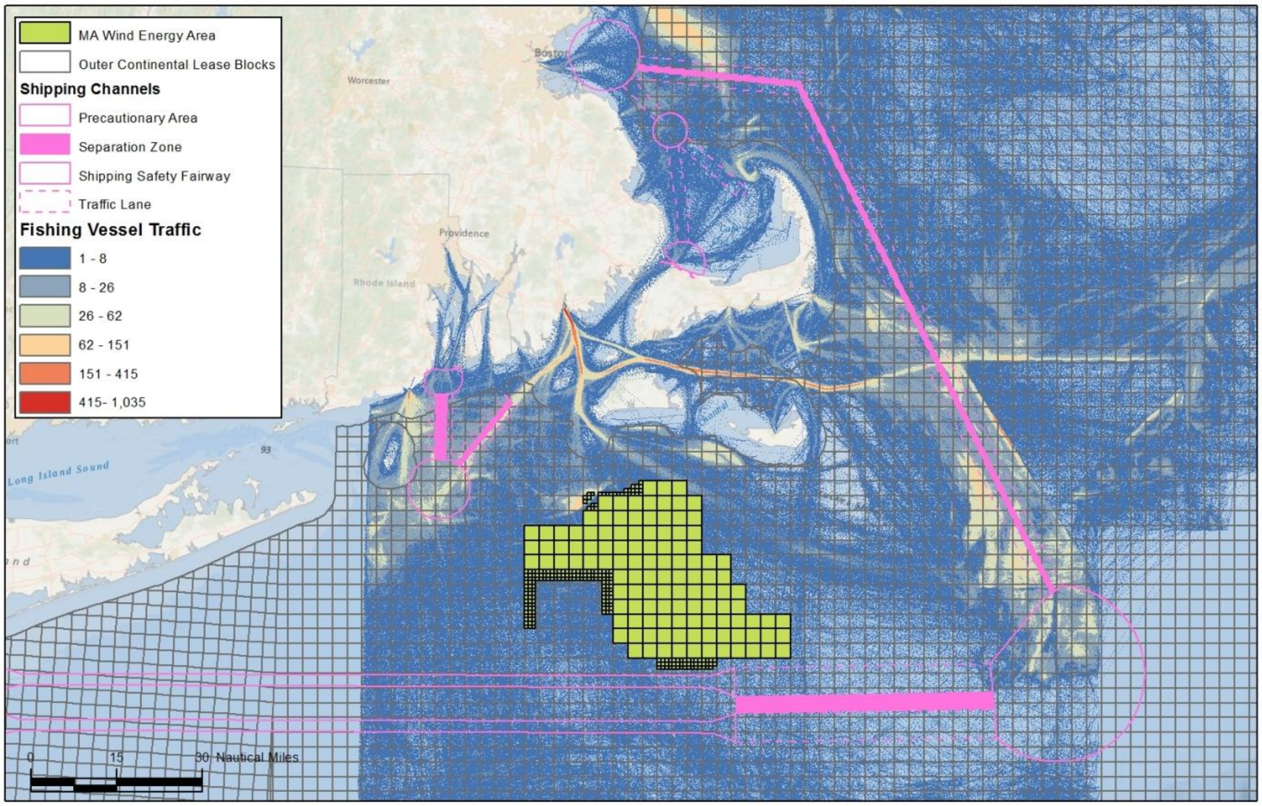



*Source: Modified from Northeast Ocean Data Portal Working Group, 2011*

**Figure 4-12. Vessel traffic density derived from AIS data, shipping channels, and the WEA**

Because Figure 4-12 represents the traffic density based only on AIS data, traffic information from vessels that weigh less than 300 tons is lacking. On the contrary, Vessel Monitoring Systems[3] (VMS) provide complementary data from fishing vessels. Figure 4-13 shows the traffic density from VMS in the vicinity of the WEA (Northeast Ocean Data Portal Working Group, 2011). Compared to the AIS-derived traffic density, VMS data shows generally higher traffic density within and around the WEA, in particular in the northwest portion. The higher traffic density line is connected to the port of New Bedford, MA, indicating that it supports higher fishing activities. Additionally, fishing traffic from the New Bedford port to offshore areas passes the northeast corner of the WEA.

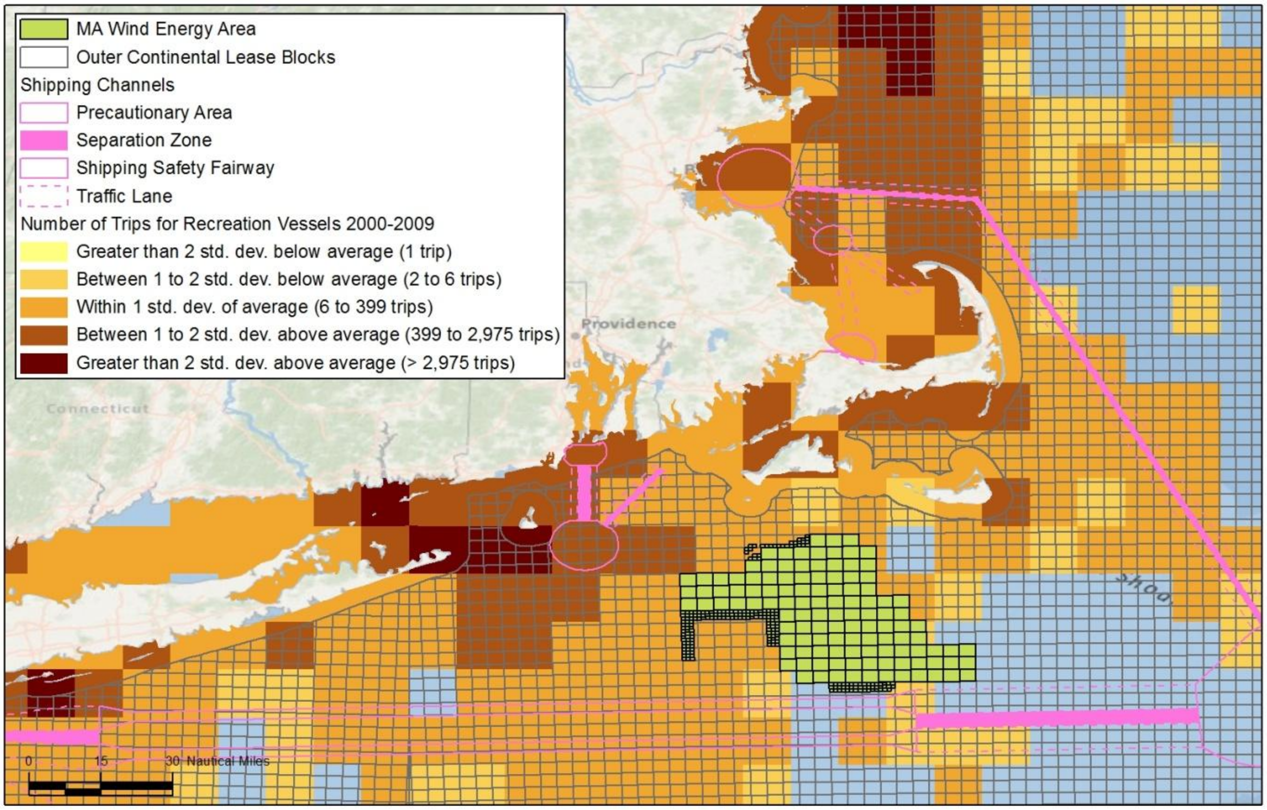
[3] Vessel Monitoring Systems (VMS) are used in commercial fishing to allow environmental and fisheries regulatory organizations to monitor minimally, the position, time at a position, and course and speed of fishing vessels. VMS may be used to monitor vessels in the territorial waters of a country or a subdivision of a country, or in the Exclusive Economic Zones that extend 200 nautical miles from the coasts of many countries.




*Source: Modified from Northeast Ocean Data Portal Working Group, 2011*

**Figure 4-13. Fishing vessel traffic density derived from VMS data, shipping channels, and the WEA**

Figure 4-14 shows the average number of trips for recreational vessels during the years of 2000 to 2009 (Northeast Ocean Data Portal Working Group, 2011). The areas with the highest vessel traffic—an average of greater than 2,975 trips—are not located in the vicinity of the WEA. The areas with the next highest level of vessel traffic—representing an average of 399 to 2,975 trips over 10 years—include one area located northwest of the WEA. Roughly, one-third of the WEA had an average of 6 to 399 trips and the other one-third had an average of 2 to 6 trips over the 10 years sampled (see Figure 4-14). The remainder of WEA had less than 1 visit by recreational vessels, on average, based on the 10 years of records (see Figure 4-14).




*Source: Modified from Northeast Ocean Data Portal Working Group, 2011*

**Figure 4-14. Number of recreational vessel trips, shipping channels, and the WEA**

#### *4.2.3.8.2 Impact Analysis of Alternative A*

Alternative A has two primary activities that could impact navigation/vessel traffic. These activities are routine activities (e.g., deployment and operation of a meteorological buoy or construction of a meteorological tower, vessel traffic from survey) and non-routine activities (e.g., collision between vessels, allision with structures, accidental fuel discharge). Increased vessel traffic from these routine and non-routine activities would increase vessel traffic within the WEA and between the WEA and shore. This increase in traffic has the potential to directly impact coastal and offshore vessel traffic.

### *Routine Activities*

Increased vessel traffic associated with site characterization surveys, and the construction, operation, and decommissioning of meteorological tower/buoys would be anticipated as a result of Alternative A. BOEM assumes that one or two survey vessels would be active in the WEA at any given time to conduct site characterization activities. During the time when meteorological tower/buoy construction, operations, and decommissioning are being conducted, more activities would be expected, such as a vessel to tow and assist in buoy placement, a specialized jack-up vessel for installing foundation pilings for a tower, or during routine maintenance, which results in two to three vessels at any given time. These trips could occur within and nearby the heavily trafficked areas, such as the entrance of the Narragansett Bay during the time period of the proposed action. These heavily trafficked areas are already expecting additional increases in traffic density (USDOT, 2011b).

Because the additional vessel activity associated with the proposed action within the WEA is expected to be relatively small (one to two additional survey vessels during characterization and two to three vessels during the site assessment activities in a given time/space over a period of 5.5 years), BOEM does not anticipate that the number of vessels passing through the WEA for these activities would significantly increase vessel traffic density levels when compared with the existing and projected future vessel traffic in the WEA. In addition, ferry operations should not be affected by the proposed action as the ferries come no closer than 10 nm from the lease area.

Although the WEA is not located within designated routing measures, meteorological towers/buoys may still pose an obstruction to navigation. The lease blocks are located within 1 nm of the heavily trafficked offshore shipping lane to New York Harbor. However, any placement of meteorological towers/buoys would be mitigated by USCG-required marking and lighting, including avoidance of heavily trafficked areas within the WEA. Meteorological towers/buoys would also be considered Private Aids to Navigation, which are regulated by the USCG under 33 CFR 66. A Private Aid to Navigation is a buoy, light, or day beacon owned and maintained by any individual or organization other than the USCG. These aids are designed to allow individuals or organizations to mark privately owned marine obstructions or other similar hazards to navigation. Therefore, through the use of these aids, impacts on navigation from the placement of meteorological towers and buoys are expected to be minor.

#### *Non-Routine Events*

The AIS data in Figure 4-12 indicates that the majority of large commercial vessels including cargo vessels, container vessels, and oil tankers operate within and near the TSS lanes, and follow distinct patterns to approach/depart these lanes. The WEA was designed to avoid the major shipping lanes and the heavier trafficked 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/buoy placement would reduce the already small likelihood of vessel collision or allision with structures. In addition, a fuel/oil spill resulting from a collision or allision between a vessel/tanker and a meteorological tower/buoy is not reasonably foreseeable as a result of the proposed action because of the strong likelihood that a meteorological tower/buoy would collapse or become destroyed without serious damage to an oil tanker.

According to the U.S. Department of Transportation (USDOT) Maritime Administration (MARAD) (2011a), 97 percent of the oil and gas tanker calls in the United States were by double-hulled vessels, which are much less likely to release oil from collision and/or allision than single-hulled tankers. In addition, the vessel traffic associated with site characterization surveys, and the construction, operation, and decommissioning of meteorological towers/buoys in very close proximity to the major shipping lanes and ports would not substantially increase the probability of a vessel collision(s) and/or allision(s). However, vessels servicing or decommissioning towers/buoys could collide with a tower, buoy, or other vessels. The water quality effects of non-routine events such as allisions/collisions and spills are described in Sections 3.2.2 and 3.2.3, respectively.

#### *4.2.3.8.3 Conclusion*

Impacts on vessel traffic and navigation as a result of site characterization surveys and the construction, operation, and decommissioning of meteorological and oceanographic data collection towers and buoys associated with Alternative A will be negligible and minor. Because the additional vessel activity associated with the proposed action is expected to be relatively small, the number of vessels passing through the WEA is not expected to significantly increase vessel traffic density when compared to existing and projected future vessel traffic in the WEA. Based on the use of aids, such as Private Aids to Navigation, impacts on navigation from the placement of meteorological towers and buoys are expected to be minor. In addition, because the WEA was designed to avoid the major shipping lanes, the risk of allisions with structures causing oil spills is low; in the event of an allision, a meteorological tower/buoy would likely collapse or  become destroyed without serious damage to an oil tanker.

## 4.3 ALTERNATIVE B – NORTH ATLANTIC RIGHT WHALE AREA EXCLUSION

### 4.3.1 Summary of Alternative B

Alternative B would exclude approximately 233 square nm of the north-eastern portion of the WEA. This alternative was developed to reduce the likelihood of impacts on right whales by excluding an area of the WEA that has a relatively high known historical occurrence for right whales in the spring (see Section 4.2.2.6.1). As shown below in Table 4-32, Alternative B would result in a 35 percent reduction in vessel traffic when compared to Alternative A. The description of the affected environment under Alternative A for all resources remains the same under Alternative B.

**Table 4-32**

**Vessel Round Trips Anticipated under Alternative B**

| Activity | Number of round trips (minimum–maximum) | Percent of Trips Compared to Alternative A |
|---|---|---|
| Site characterization surveys | 1,616–3,196 | 67 |
| Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment) | 132–1,020 | 60 |
| Total | 1,748–4,216 | 65 |

### 4.3.2 Impact Analysis of Alternative B

As described in Section 4.2.2.6.2, significant impacts on right whales as a result of Alternative A are not expected due to SOCs. However, reasonably foreseeable adverse impacts on right whales under Alternative A may still exist for the following activities under certain circumstances: 1) acoustic effects from pile-driving activities and HRG surveys for whales present and not detected, and 2) increased potential for vessel strike especially during transit to and from the WEA as a result of potential speeds above 10 knots and/or transits at night or when visual sight detection is impaired.

Although the seasonal limitation on pile driving would reduce the risk of related noise impacts on right whales, right whales could be potentially present in the WEA during a time of year when they are not known to occur in the area (May 1 through October 31). BOEM anticipates that under Alternative B there would be three total leaseholds, which is two fewer leaseholds than the five anticipated under Alternative A. This would result in fewer meteorological towers and/or meteorological buoys under Alternative B (three meteorological towers, six buoys, or a combination of towers and buoys). Pile driving for construction of towers, which is anticipated to occur for approximately 32 hours (4 days) per tower (see Section 4.2.2.6.2), also has the potential to produce acoustic effects that may result in impacts on right whales. Therefore, because construction of three towers under Alternative B would result in 12 days of pile driving compared to 20 days of pile driving for construction of five towers under Alternative A, the risk of acoustic impacts to right whales from pile driving under Alternative B would be reduced when compared to Alternative A.

Alternative B would result in another substantial reduction in risk for impacts on right whales compared to Alternative A because of a 35 percent reduction in vessel traffic as shown in Table 4-32. As with Alternative A, the amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. This substantial reduction of vessel traffic, coupled with SOCs such as vessel strike avoidance measures, would reduce the risk of vessel collisions with right whales when compared to Alternative A.

The risk from all of the activities is even further reduced because BOEM would remove areas of known right whale occurrences from leasing consideration under Alternative B, thus eliminating areas where project activities are more likely to interact with right whales. However, while there would be no project-specific investigations within the right whale exclusion area under Alternative B, support vessels en route to or from the southern portion of the WEA may pass through the excluded area if it is the most direct route to their port of origin.

For several resources, although the type (beneficial or adverse) and duration (short- or long-term) of impacts would be similar to Alternative A, the context (site-specific, local, or regional) and/or intensity (negligible, minor, moderate, or substantial) of impacts would be reduced when compared to Alternative A. Those resources are discussed below.

#### *Air Quality*

Section 4.2.1.1, which describes the reasonably foreseeable impacts of Alternative A on air quality, concludes that adverse effects on ambient air quality could be reasonably expected from routine activities anticipated under Alternative A due to the large size and relative remoteness of the WEA. The reduced amount of activities under Alternative B would result in fewer emissions (primarily as a result of approximately 35 percent fewer vessel trips) in the vicinity of the lease area compared with Alternative A. Once SAPs have been submitted, BOEM would determine if a General Conformity evaluation is necessary.

#### *Geology*

The disturbance of small areas of the seafloor as a result of sub-bottom sampling and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. During the deployment and operation of towers and buoys, scour of sediment adjacent to tower support piles embedded in the seabed is expected to occur. However, BOEM assumes that scour prevention methods would be deployed to prevent scour occurrence at all tower foundations; thus, causing these impacts to be minimal. Given the reduced amount of activities anticipated under Alternative B as compared to Alternative A, the associated impacts on geological resources are anticipated to be minor.

#### *Water Quality*

Activities associated with Alternative B that would affect coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), tower/buoy installation and removal, and spills from non-routine events such as allisions/collisions. However, because the total amount of vessel activity under Alternative B would be approximately 65 percent of that under Alternative A, the amount and intensity of these impacts would be less than Alternative A.

### *Birds*

Fewer site characterization and site assessment activities would occur in the Alternative B lease area compared to Alternative A, resulting in less impacts on birds. Although birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, adverse impacts on the population are not anticipated. The risk of collision with towers would be minor given the smaller number of meteorological towers proposed compared to Alternative A, the size of the towers, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) would be less than Alternative A and is expected to be negligible.

### *Bats*

Should migratory bats occur in the lease area, they would likely display avoidance or attraction responses to the meteorological towers and meteorological buoys, or research vessels present during site characterization activities. These avoidance or attraction effects would only occur during the night when bats are active, and are expected to be negligible to bats that may occur in the lease area. Because fewer site characterization and site assessment activities are anticipated under Alternative B compared to Alternative A, no adverse impacts on bats are anticipated.

### *Benthic Resources*

The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. BOEM anticipates that that the bottom disturbance associated with installation of three towers under Alternative B would result in approximately 486 acres of impacted seafloor in the lease area, which is about 320 acres less impact than anticipated under Alternative A. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would be approximately twice that of the towers, resulting in approximately 970 acres of impacted seafloor, compared to 1,620 acres under Alternative A. If the proposed maximum of three meteorological towers under Alternative B were built, the total area expected to be impacted by scour control systems or actual scour would be approximately 6,000 square ft (0.14 acres) (2,000 square ft x three meteorological towers), compared to approximately 10,000 square ft under Alternative A. Impacts on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and negligible in extent. These impacts would be localized, given the extent of the benthic habitat types on the continental shelf. The data collected during HRG surveys would indicate the presence of any potential benthic resources, so that sensitive habitat types, such as hard-bottom and live-bottom habitats, could be avoided by the lessee during sub-bottom sampling and when the meteorological facility siting decisions are made.

#### *Coastal Habitat*

Because the size of the WEA under Alternative B would be reduced, less vessel traffic would be associated with site assessment and site characterization activities. Therefore, the potential for impacts on coastal habitats such as wake-induced erosion and associated sediment suspension in the port areas, or an incidental diesel fuel spill, would be less than the "negligible, localized, and temporary" impacts described under Alternative A.

#### *Sea Turtles*

SPUE data indicate that the potential risk to leatherback sea turtles would likely be reduced compared to Alternative A in the fall, when this species is historically known to occur in relatively large numbers in the portion of the WEA excluded in Alternative B. Loggerhead, green, Kemp's ridley, and hawksbill sea turtles are uncommon in the portion of the WEA excluded in Alternative B (Right Whale Consortium, 2012), and, therefore, a decrease in potential risk within the exclusion area is not expected for these species.

Mitigation measures of exclusionary zones and surveillance by trained observers during vessel transit, survey work, and pile driving would further minimize impacts on sea turtles. There may be a small potential for acoustic impacts from HRG surveys, sub-bottom sampling, and pile driving if turtles are present but undetected in the lease area. Overall under Alternative B, the short term and minimal to negligible risk of harassment of sea turtles within the lease area and surrounding waters would be slightly reduced when compared to Alternative A.

#### *Other Marine Mammals*

Historical sightings data suggest that Alternative B may result in a small decrease in potential risk for fin whales in the winter, humpback whales in the spring and summer, short-beaked common dolphins in the winter and fall, harbor porpoise in the summer, and for seals in the spring (see Section 4.2.2.6.1). A decrease in potential risk within the Alternative B exclusion area is not expected for sei whales or sperm whales, because these species are not historically known to occur in that area of the WEA. Whale and dolphin species travelling to and from the northeast sector (i.e., Alternative B exclusion area) may be impacted by site characterization and site assessment activities.

Marine mammals, including right whales, occurring in the southwest portion of the lease area would be subject to the same impacts under Alternative B as they would under Alternative A.

#### *Cultural, Historic, and Archaeological Resources*

Because Alternative B reduces the size of the WEA, bottom-disturbing activities associated with the proposed action (e.g., coring, anchoring, installation of meteorological towers and buoys) that would have the potential to affect pre-contact and cultural resources, would be reduced compared to Alternative A. Existing regulatory measures, information generated for a lessee's initial site characterization activities, and the unanticipated discoveries requirement (30 CFR

585.802) make the potential for bottom-disturbing activities to have an adverse effect on cultural resources very low, and less for Alternative B than Alternative A. Similarly, because the reduced WEA under Alternative B would result in fewer meteorological structures and less surveying traffic compared to Alternative A, visual impacts under Alternative B on onshore cultural resources from meteorological structures and vessel traffic associated with surveys and structure construction would be reduced when compared to Alternative A.

#### *Recreation and Visual Resources*

Alternative B reduces the size of the WEA and, thus, the impacts on visual resources. In particular, the excluded area under Alternative B effectively eliminates any daytime view of meteorological towers in the lease area from Nantucket when compared to Alternative A. Although a viewer could theoretically see a tower from Martha's Vineyard during the daytime under clear, sunny conditions, BOEM anticipates that the average viewer under normal conditions (i.e., with some haze) would not be able to discern the structure. Nighttime views of a tower from Martha's Vineyard would also be more difficult under Alternative B compared to Alternative A because a tower would be located farther from the shoreline as a result of the extent and location of the excluded OCS blocks.

#### *Navigation/Vessel Traffic*

Section 4.2.3.8, which describes the reasonably foreseeable impacts of Alternative A on navigation and vessel traffic, concludes that the increase in vessel traffic associated with the proposed action would not measurably impact current or projected future shipping or navigation. Because the offshore area associated with Alternative B is smaller than the WEA under Alternative A and there would only be three meteorological towers constructed or six buoys deployed (compared with five towers and 10 buoys under Alternative A), Alternative B would have approximately 65 percent of the vessel traffic associated with Alternative A, and the intensity of impacts on vessel traffic under Alternative B would be less than the impacts described for Alternative A.

#### *Resources with No Substantial Difference Compared to Alternative A*

For the resources listed below, there is no substantial difference between the anticipated impacts of Alternative B and Alternative A, thus no additional discussion is provided:

- Physical Oceanography;
- Finfish, Shellfish, and Essential Fish Habitat;
- Demographics and Employment;
- Environmental Justice;
- Commercial and Recreational Fisheries;
- Aviation; and

- Military Use Areas.

***Conclusion***

Alternative B would result in a substantial reduction in risk for impacts on right whales compared to Alternative A. When compared to Alternative A, impacts on the following resources would also be reduced as a result of Alternative B: Air Quality, Water Quality, Geology, Birds, Bats, Benthic Resources, Coastal Habitat, Sea Turtles, Other Marine Mammals, Cultural, Historical, and Archeological Resources, Visual and Recreational Resources, and Navigation/Vessel Traffic. There is no substantial difference between the anticipated impacts of Alternative B and Alternative A for the following resources: Physical Oceanography, Finfish, Shellfish, and Essential Fish Habitat, Demographics and Employment, Environmental Justice, Commercial and Recreational Fisheries, Aviation, and Military Uses.

## 4.4 ALTERNATIVE C – AREAS WITHIN 15 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

### 4.4.1 Summary of Alternative C

Under Alternative C, any OCS blocks within 15 nm of the inhabited coastline are excluded from leasing to reduce potential visual impacts to cultural resources.

As with Alternative A, BOEM anticipates that Alternative C would result in the issuance of up to five leaseholds and, therefore, the installation of five meteorological towers, 10 buoys, or a combination of towers and buoys. Alternative C would result in the vessel round trips shown in Table 4-33 in connection with site characterization and assessment activities over 5 years.

**Table 4-33**

**Vessel Round Trips Anticipated under Alternative C**

| Activity | Number of round trips (minimum–maximum) | Percent of Trips Compared to Alternative A |
|---|---|---|
| Site characterization surveys | 2,520–4,588 | 96 |
| Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment) | 220–1700 | 100 |
| Total | 2,740–6,288 | 97 |

The amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. Alternative C would result in approximately 97 percent of the trips anticipated under Alternative A. The description of the affected environment under Alternative A for all resources is the same for Alternative C.

### 4.4.2 Impact Analysis of Alternative C

Because the size of the WEA under Alternative C is similar to the WEA under Alternative A, the same number of towers/buoys would be constructed/deployed (five towers, 10 buoys, or a combination). As such, the type (beneficial or adverse), duration (short- or long-term), context (site-specific, local, or regional), and/or intensity (negligible, minor, moderate, or substantial) of impacts under Alternative C would be near identical to Alternative A with the exception of Recreation and Visual and Cultural Historic Resources, which are discussed below.

Although the same number of towers could be constructed under Alternative C as for Alternative A, the exclusion of OCS blocks within 15 nm of the shoreline from the WEA would result in towers being constructed farther from the Martha's Vineyard and Nantucket shores. Even though a viewer could theoretically see a tower beyond 15 nm from the shoreline during the daytime under clear, sunny conditions (see Section 4.2.3.4), BOEM anticipates that the average viewer under normal conditions (i.e., with some haze) would not be able to discern the structure. Nighttime views of a tower from the shoreline would also be more difficult under Alternative C compared to Alternative A because towers would be located farther from the shoreline as a result of the extent and location of the excluded OCS blocks. Because the reduced WEA under Alternative C would result in meteorological towers being constructed farther offshore than under Alternative A, visual impacts on onshore cultural resources from meteorological structures are expected to be less than compared to Alternative A. Visual impacts from Alternative C are expected to be slightly reduced from the minor anticipated impacts under Alternative A.

## 4.5 ALTERNATIVE D – AREAS WITHIN 21 NAUTICAL MILES OF THE INHABITED COAST EXCLUDED

### 4.5.1 Summary of Alternative D

Under Alternative D, any OCS blocks within 21 nm of the inhabited coastline are excluded from leasing. Alternative D was developed to reduce possible visual impacts on cultural resources. As discussed below in the Impacts Analysis of Alternative D (Section 4.5.2), the exclusion OCS blocks within 21 nm of the inhabited shoreline, and therefore construction of towers farther offshore than under Alternative A, substantially reduces impacts on visual and therefore cultural and recreational resources compared to Alternative A.

BOEM anticipates that Alternative D would result in the issuance of up to three leaseholds and, therefore, the installation of three meteorological towers, six buoys, or a combination of towers and buoys, compared to five towers/10 buoys under Alternative A. Alternative D would result in the vessel round trips shown in Table 4-34 in connection with site characterization and assessment activities over 5 years.

**Table 4-34**

**Vessel Round Trips Anticipated under Alternative D**

| Activity | Number of round trips (minimum–maximum) | Percent of Trips Compared to Alternative A |
|---|---|---|
| Site characterization surveys | 1,624–3,236 | 67 |
| Construction, operation and decommissioning of meteorological towers and/or buoys (i.e., site assessment) | 132–1,020 | 60 |
| Total | 1,756–4,256 | 65 |

As with Alternative A, the amount of vessel traffic is based on the assumption that the entire lease area would be leased and the maximum amount of site characterization surveys would be conducted. Alternative D would result in approximately 65 percent of the trips anticipated under Alternative A. The description of the affected environment under Alternative A for all resources is the same for Alternative D.

### 4.5.2 Impact Analysis of Alternative D

Because the reduced WEA under Alternative D would result in meteorological towers being constructed farther offshore compared to Alternative A, visual impacts on onshore cultural resources from meteorological structures are expected to be negligible, which is less than the anticipated minor impacts under Alternative A. Additionally, impacts from bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) that would have the potential to affect pre-contact and cultural resources, would also be less than the potential impacts under Alternative A because of fewer samples being taken and fewer towers/buoys being installed. Existing regulatory measures, information generated for a lessee’s initial site characterization activities, and the unanticipated discoveries requirement (30 CFR 585.802) further reduce the potential for bottom-disturbing activities to have an adverse effect on cultural resources under both Alternative D and Alternative A.

Alternative D excludes any OCS blocks within 21 nm of the inhabited shoreline from the WEA and, thus, substantially reduces impacts on visual and therefore cultural and recreational resources when compared to Alternative A. As described in Section 4.2.3.4, the theoretical maximum viewing distance of a tower would be 25.4 nm from the shoreline under clear, sunny conditions. However, at that distance, the tips of the towers would appear just over the horizon, with the rest of the structure below the horizon. Because atmospheric haze reduces visibility, sometimes significantly, and the presence of waves obscure objects very low on the horizon, maximum theoretical viewing distances typically exceed what is experienced in reality. Furthermore, limits to human visual acuity reduce the ability to discern objects at great distances, suggesting that even the tips of the towers may not be discernible at the maximum distances. Under Alternative D, the blinking light on the top of a tower may be faintly discernible at nighttime under clear skies; however, the lights of vessels would be seen much more readily. Although meteorological towers could theoretically be seen under Alternative D during daytime and nighttime, atmospheric conditions on most days would make the towers difficult if not impossible to discern. In addition, the 35 percent reduction in vessel traffic under Alternative D would result in less visual impacts from vessels transiting through and to and from the WEA when compared to Alternative A. Therefore, an unencumbered view from the shoreline would occur on most days and impacts on visual resources under Alternative D are anticipated to be negligible and reduced compared to impacts under Alternative A.

#### *Resources with Different Impacts than Alternative A*

For several resources, although the type (beneficial or adverse) and duration (short- or long-term) of impacts would be similar to Alternative A, the context (site-specific, local, or regional) and/or intensity (negligible, minor, moderate, or substantial) of impacts would be different than described under Alternative A. Those resources are discussed in this section.

#### *Air Quality*

Section 4.2.1.1, which describes the reasonably foreseeable impacts of Alternative A on air quality, concludes that adverse effects on ambient air quality could be reasonably expected from routine activities anticipated under Alternative A due to the large size and relative remoteness of the WEA. The reduced amount of activities under Alternative D would result in fewer emissions (primarily as a result of approximately 35 percent fewer vessel trips) in the vicinity of the lease area compared with Alternative A. Once SAPs have been submitted, BOEM would determine if a General Conformity evaluation is necessary.

#### *Geology*

The disturbance of small areas of the seafloor as a result of sub-bottom sampling and the construction and deployment of meteorological towers and buoys is expected to result in a localized disturbance similar to that caused by commercial fishing, such as bottom trawls. During the deployment and operation of towers and buoys, scour of sediment adjacent to tower support piles embedded in the seabed is expected to occur. However, BOEM assumes that scour prevention methods would be deployed to prevent scour occurrence at all tower foundations; thus, causing these impacts to be minimal. Given the reduced amount of activities anticipated under Alternative D as compared to Alternative A, the associated impacts on geological resources are anticipated to be minor.

### *Water Quality*

Activities associated with Alternative D that would affect coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), tower/buoy installation and removal, and spills from non-routine events such as allisions/collisions. However, because the total amount of vessel activity under Alternative D would be approximately 65 percent of that under Alternative A, the amount and intensity of these impacts would be less than Alternative A.

### *Birds*

Fewer site characterization and site assessment activities would occur in the Alternative D lease area compared to Alternative A, resulting in fewer impacts on birds. While birds could be affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases, adverse impacts on the population are not anticipated. The risk of collision with towers would be minor given the smaller number of meteorological towers proposed compared to Alternative A, the size of the towers, and their distance from shore and each other. The impact of meteorological buoys on ESA-listed and non-ESA-listed migratory birds (including pelagic species) would be less than Alternative A and is expected to be negligible

### *Bats*

Should migratory bats occur in the lease area, they would likely display avoidance or attraction responses to the meteorological towers and meteorological buoys, or research vessels present during site characterization activities. These avoidance or attraction effects would only occur during the night when bats are active, and are expected to be negligible to bats that may occur in the lease area. Because fewer site characterization and site assessment activities are anticipated under Alternative D impacts to bats would be reduced when compared to potential impacts under Alternative A.

### *Benthic Resources*

The primary reasonably foreseeable impacts resulting from routine activities on benthic communities would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. BOEM anticipates that that the bottom disturbance associated with installation of three towers under Alternative D would result in approximately 486 acres of impacted seafloor in the lease area, which is about 320 acres less impact than anticipated under Alternative A. Should all lessees decide to install two meteorological buoys on their leases instead, the maximum area of disturbance would be approximately twice that of the towers, resulting in approximately 970 acres of impacted seafloor, compared to 1,620 acres under Alternative A. If the proposed maximum of three meteorological towers under Alternative D were built, the total area expected to be impacted by scour control systems or actual scour would be approximately 6,000 square ft (0.14 acres) (2,000 square ft x three meteorological towers), compared to approximately 10,000 square ft under Alternative A. Impacts on benthic communities would be short term (likely less than a year [Continental Shelf Associates, Inc., 2004]), and negligible in extent. These impacts would be localized, given the extent of the benthic habitat types on the continental shelf. The data collected during HRG surveys would indicate the presence of any potential benthic resources, so that sensitive habitat types, such as hard-bottom and live-bottom habitats, could be avoided by the lessee during sub-bottom sampling and when the meteorological facility siting decisions are made. Under Alternative D, fewers acres would be impacted when compared to Alternative A, therefor potential impacts to benthic resources under Alternative D would be reduced when compared to Alternative A.

#### *Coastal Habitat*

Because the size of the WEA under Alternative D would be reduced, less vessel traffic would be associated with site assessment and site characterization activities. Therefore, the potential for impacts on coastal habitats such as wake-induced erosion and associated sediment suspension in the port areas, or an incidental diesel fuel spill, would be less than the "negligible, localized, and temporary" impacts described under Alternative A.

#### *Marine Mammals*

The lease area under Alternative D is smaller than the WEA under Alternative A, therefore, the impacts on marine mammals would likely be less compared to Alternative A. Some of the OCS blocks excluded under Alternative D are in an area of relatively high known historical occurrence for right whales in the spring (see Section 4.2.2.6.1). Consequently, the elimination of this area is likely to result in a decrease in potential risks from site characterization activities for right whales. Historical sightings data also suggest that Alternative D may result in a small decrease in potential risk for fin whales in the winter, humpback whales in the spring and summer, short-beaked common dolphins in the winter and fall, harbor porpoise in the summer, and for seals in the spring (see Section 4.2.2.6.1). A decrease in potential risk is not expected for sei whales or sperm whales, because these species are not historically known to occur in the area of the WEA excluded from Alternative D. Whale and dolphin species travelling to and from the north-northeast sector (i.e., the Alternative A OCS blocks excluded from Alternative D) may be impacted by site characterization and site assessment activities. Marine mammals, including right whales, occurring in the southwest portion of the lease area would be subject to the same impacts under Alternative D as they would under Alternative A.

#### *Sea Turtles*

SPUE data indicate that the potential risk to leatherback sea turtles would likely be reduced compared to Alternative A in the fall, when this species is historically known to occur in relatively large numbers in the portion of the WEA excluded in Alternative D. Loggerhead, green, Kemp's ridley, and hawksbill sea turtles are uncommon in the portion of the WEA excluded in Alternative D (Right Whale Consortium, 2012), and, therefore, a decrease in potential risk within the exclusion area is not expected for these species.

Mitigation measures of exclusionary zones and surveillance by trained observers during vessel transit, survey work, and pile driving would further minimize impacts on sea turtles. There may be a small potential for acoustic impacts from HRG surveys, sub-bottom sampling, and pile driving if turtles are present but undetected in the lease area. Overall, under Alternative D, the short term and minimal to negligible risk of harassment of sea turtles within the lease area and surrounding waters would be slightly reduced when compared to Alternative A.

Section 4.2.3.8, which describes the reasonably foreseeable impacts of Alternative A on navigation and vessel traffic, concludes that the increase in vessel traffic associated with the proposed action would not measurably impact current or projected future shipping or navigation. Because the offshore area associated with Alternative D is smaller than the WEA under Alternative A and there would only be three meteorological towers constructed or six buoys deployed (compared with five towers and 10 buoys under Alternative A), Alternative D would have approximately 65 percent of the vessel traffic associated with Alternative A, and the intensity of impacts on vessel traffic under Alternative D would be less than the impacts described for Alternative A.

#### *Resources with No Substantial Difference Compared to Alternative A*

For the resources listed below, there is also no substantial difference in between the anticipated impacts of Alternative D and Alternative A, thus no additional discussion is provided:

- Physical Oceanography,
- Finfish, Shellfish, and Essential Fish Habitat,
- Demographics and Employment,
- Environmental Justice,
- Commercial and Recreational Fisheries,
- Aviation, and
- Military Use Areas.

#### *Conclusion*

Alternative D would result in reduced visual impacts to onshore historical, cultural and recreational resources from meteorological structures and vessel traffic compared to Alternative A. Under Alternative D, impacts on these resources are expected to be negligible, which is less than the anticipated minor impacts under Alternative A. In addition, impacts from bottom-disturbing activities (e.g., coring, anchoring, installation of meteorological towers and buoys) that would have the potential to affect pre-contact and cultural resources would also be less than the potential impacts under Alternative A because of fewer samples being taken and fewer towers/buoys being installed. Compared to Alternative A, impacts on the following resources would be reduced under Alternative D; Air Quality, Water Quality, Geology, Birds, Bats, Benthic Resources, Coastal Habitat, Sea Turtles, Marine Mammals, and Navigation/Vessel Traffic. There is no substantial difference between the anticipated impacts of Alternative D and Alternative A for the following resources; Physical Oceanography, Finfish, Shellfish, and Essential Fish Habitat, Demographics and Employment, Environmental Justice, Commercial and Recreational Fisheries, Aviation, and Military Uses.

## 4.6 ALTERNATIVE E – NO ACTION

Under the No Action Alternative, no commercial leases to develop wind energy would be issued and there would be no approval of site assessment activities within the WEA offshore Massachusetts at this time. Opportunities for the collection of meteorological, oceanographic, and biological data offshore Massachusetts would not occur or would be postponed. Site characterization surveys would also not occur. Therefore, the potential environmental and socioeconomic impacts described in Section 4.2 of this EA would not occur or would be postponed.

## 4.7 CUMULATIVE IMPACTS

### 4.7.1 Overview

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 what 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 section summarizes the cumulative impacts over the 5-year life of the proposed action (2014–2019), focusing on the incremental impact of Alternative A when added to other current and reasonably foreseeable future actions.

The spatial boundary of the cumulative impacts assessment focuses primarily on the Southern New England region where existing and planned projects/activities have the most potential for resulting in incremental impacts on resources described in this EA. The Southern New England region comprises the OCS area south of Cape Cod, MA to the northern border of New Jersey; this region is a sub-area of the Northeast U.S. Continental Shelf Large Marine Ecosystem (Link et al., 2002). However, the geographic scope of the cumulative analysis varies depending on the resources being evaluated; for example, water quality is only likely to be affected locally within the Southern New England region, but migratory species such as sea turtles would be affected by other cumulative actions at much greater distances (e.g., the entire Atlantic coast).

## 4.7.2 Existing and Future Reasonably Foreseeable Activities and Projects

### *4.7.2.1 Activities/Projects within the Atlantic OCS Southern New England Region*

#### *Block Island Wind Farm*

Deepwater Wind, LLC is proposing to construct a 30 MW wind farm approximately 3 miles offshore of Block Island, RI, in State waters (Deepwater Wind LLC, 2012a). See Figure 4-15. The Block Island Wind Farm would consist of five wind turbines that would produce more than 100,000 MW-hours annually. This demonstration-scale wind farm would provide power primarily to Block Island, supplying most of its electricity needs, and exporting excess electricity to the Rhode Island mainland via a subsea transmission cable traversing both State and Federal waters. Construction of the project is estimated to begin in 2013 (Deepwater Wind LLC, 2012a).

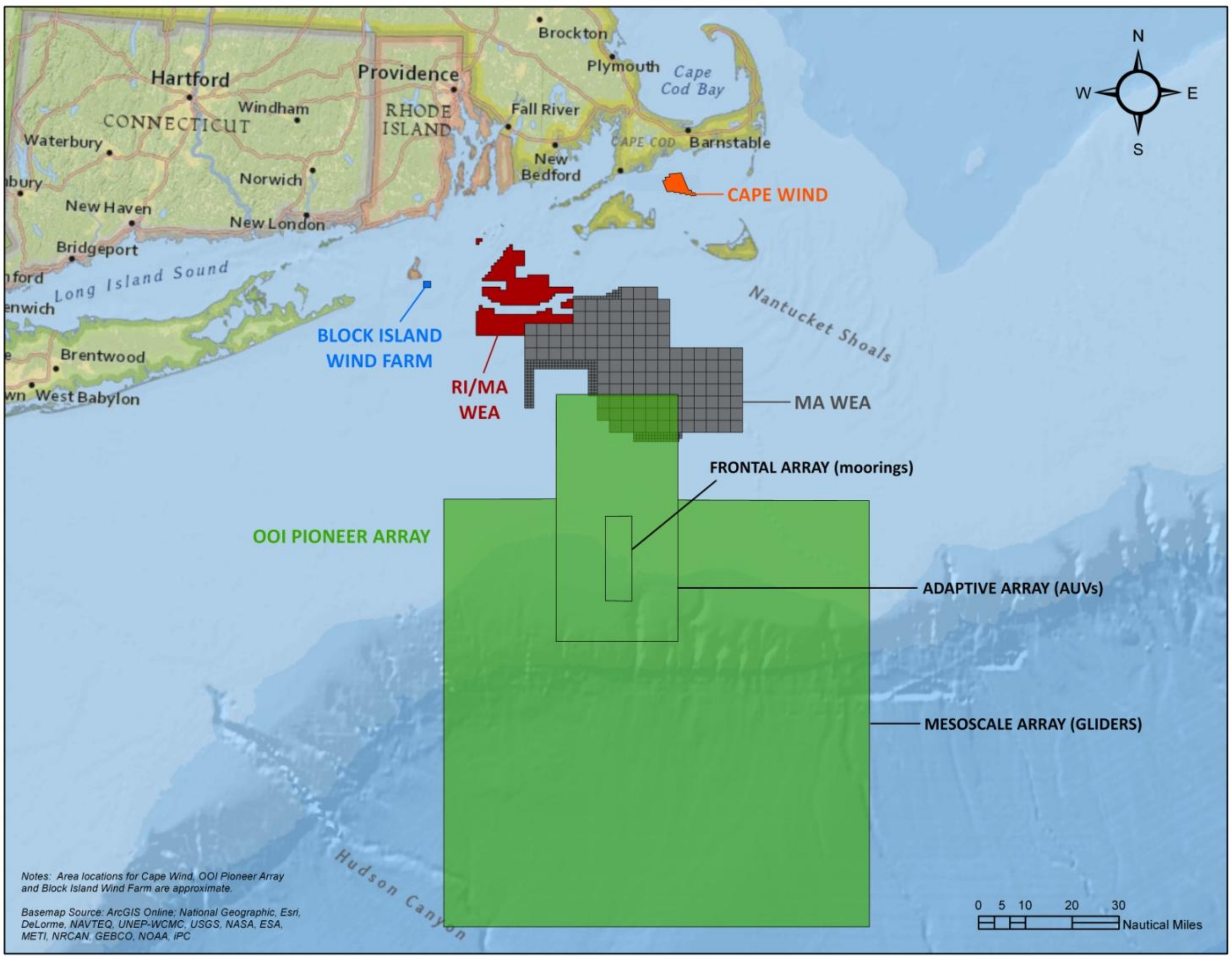



**Figure 4-15. Projects considered under cumulative impacts**

Deepwater Wind, LLC is collecting wind, avian, and bat data from the radar systems and meteorological mast located on Block Island and conducting terrestrial surveys for the onshore route of the cables on both Block Island and the Rhode Island mainland. In September 2011, marine surveys involving several vessels equipped with sonar, depth finders, and magnetometers were conducted; further offshore avian and bat surveys related to the Block Island Wind Farm project are not anticipated be conducted (Deepwater Wind LLC, 2012b).

Vessel traffic in both Rhode Island and Block Island Sounds will increase once construction of the Block Island Wind Farm commences. Because the Port of Quonset Point is the proposed staging area, as well as the entrance and exit site for construction and operation activities, there will also be increased vessel traffic in Narragansett Bay.

#### *Existing Vessel Traffic and Offshore Structures*

Offshore waters from the shoreline to the WEA are trafficked by commercial, private, and military vessels (see Section 4.2.3.8). According to a USACE report on traffic at the entrance to Narragansett Bay during the calendar year of 2009 (USACE, 2009), a total of 2,588 vessel transits were headed to and from Providence, of which 1,334 transits were for dry cargos, 235 transits were for tankers, 310 transits were for tow boats, and 709 transits were for barges. The majority of shipping traffic consists of vessels delivering coal and petroleum products (USACE, 2009). Therefore, assuming a similar rate of vessel traffic per year, approximately 13,000 military, commercial, and recreational vessel trips are projected to occur during the 5-year period (Section 4.2.3.8). AIS data (see Section 4.2.3.8) indicate that the majority of vessel traffic traveling to/from the ports within the New England States operates within and near TSS lanes and follows distinct patterns to approach/depart these lanes. There are no meteorological towers or buoys currently located in the WEA, but meteorological, oceanographic, and navigational buoys are located in the waters between the WEA and shore.

#### *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic OCS Offshore Rhode Island and Massachusetts*

BOEM is considering issuing leases and approving site assessment and site characterization activities in a WEA on the OCS offshore Rhode Island and Massachusetts (BOEM, 2012b). The Rhode Island/Massachusetts WEA is adjacent to the western side of the offshore Massachusetts WEA (Figure 4-15). The proposed action covers the same activities discussed in this EA. The Rhode Island/Massachusetts WEA contains 13 whole OCS lease blocks and 29 partial OCS lease blocks that cover 164,750 acres. BOEM assumes that the entire Rhode Island/Massachusetts WEA would be leased, resulting in up to four leaseholds. As assumed for this EA, BOEM also assumes that for each Rhode Island/Massachusetts WEA lease, zero to one meteorological tower, one to two buoys, or a combination, would be constructed, resulting in up to four meteorological towers or eight meteorological buoys. The Rhode Island/Massachusetts WEA would be leased for site assessment and site characterization activities for a 5-year period from 2013 to 2018.

### *Cape Wind Energy Project*

The Cape Wind Energy Project would produce 420 MW from 130 wind turbines that are proposed for construction in the center of Nantucket Sound on Horseshoe Shoal (see Figure 4-15) by the developer Energy Management Inc. Project construction, including additional surveys, is expected to begin in 2014 and end in 2016. Cape Wind Associates, LLC (the developer) will conduct pre- and post-construction avian and bat monitoring studies. Other types of studies have been/will be conducted for the following resources/environments: avian resources, marine mammals, benthic infauna and shellfish, EFH, commercial and recreational fisheries, air and water quality, visual resources, noise, alternative site analysis, marina archaeological and cultural resources, air and sea navigation, local meteorological conditions, sediment transport patterns, local geological conditions, and economics.

The four phases of construction include: manufacturing turbines, installing upland (land) cable, installing offshore electric cabling, and constructing the wind farm in Nantucket Sound (Cape Wind Associates, LLC, 2012b). Two phases of construction would contribute to increased vessel traffic: installing offshore electric cabling and constructing the wind farm. Cables from individual turbines would connect to an electrical service platform, which would connect to the Northeast electrical grid via two undersea cables. The service platform would also serve as an offshore maintenance facility.

### *Ocean Observatories Initiative Pioneer Array*

The Ocean Observatories Initiative is a long-term, National Science Foundation-funded program to provide 25 to 30 years of sustained ocean measurements to study climate variability, ocean circulation and ecosystem dynamics, air-sea exchange, seafloor processes, and plate-scale geodynamics. The Pioneer Array, operated by the Woods Hole Oceanographic Institution, is a network of platforms and sensors that will be centered approximately 70 nm south of Martha’s Vineyard, MA, at the shelf break in the Middle-Atlantic Bight (see Figure 4-15). The array will include a network of 10 moorings and autonomous, robotic vehicles that can be programmed to monitor waters of the continental shelf and slope (Woods Hole Oceanographic Institution, 2011). The array will be located at seven sites in a rectangular pattern in water depths from about 100 m to 500 m. Some of the moorings will incorporate a surface buoy with multiple sources of power generation and multiple surface and subsurface communications systems (Woods Hole Oceanographic Institution, 2012). The Pioneer Array is currently under construction and is expected to be fully operational by 2015.

### *Panamax Project and Expansion of Port Facilities*

The “Panamax” project is the expansion of the Panama Canal. Canal expansion will allow larger vessels to travel through the canal, which will result in an increase in vessel traffic and the size of vessels on the East Coast. 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. Several East Coast ports have been deepening harbors and expanding cargo-handling facilities to accommodate and attract the larger vessels.

#### *4.7.2.2 Activities/Projects Outside of the Atlantic OCS Southern New England Region*

Because some resources, primarily migratory species, travel outside of the Southern New England region, they would be affected by impacts from a variety of projects and activities occurring all along the Atlantic Coast. The types of projects that could result in incremental impacts when combined with the proposed action include but would not be limited to the following:

- Undersea cables and transmission lines;
- Liquid Natural Gas facilities and operations;
- Water degradation/pollution from coastal discharges and offshore activities;
- Sand and gravel mining;
- BOEM's commercial lease issuance for site assessment and site characterization activities in Maine, New Jersey, Delaware, Maryland, and Virginia; and
- Renewable energy projects.

### 4.7.3 Reasonably Foreseeable Cumulative Impacts

The following section addresses only those resources that have the potential to be affected from the incremental effects of the proposed action in combination with existing and future reasonably foreseeable projects and activities during the 5-year proposed action period (2014–2019). BOEM does not anticipate cumulative impacts on the following resources, and therefore they are not discussed in this section: physical oceanography, environmental justice, recreation and visual resources, and military use areas.

Some of the potential impact-producing factors of the proposed action include discharges; bottom disturbance during surveying, anchoring, and structure placement; disturbance and collision risk from an increase in vessel traffic (including noise from vessels and HRG surveys); and disturbance, space-use conflicts, and collision risk due to the presence of meteorological towers.

#### 4.7.3.1 Physical Resources

### Air Quality

Comparatively, the additional air emissions from the 2,808 to 6,500 vessel round trips associated with Alternative A would be relatively small (see Section 3.1.3.8) compared with the existing and projected future vessel traffic in the vicinity's heavily used waterways and ports.

### Global Climate Change

Cumulative activities, which include Alternative A, could impact global climate change. Section 7.6.1.4 of the PEIS (MMS, 2007a) describes global climate change with respect to renewable energy development. The following is a summary of that information and incorporates new information specific to Alternative A.

The temperature of the earth's atmosphere is regulated by a balance between the radiation received from the sun, the amount reflected by the earth's surface and clouds, the amount of radiation absorbed by the earth, and the amount re-emitted to space as long-wave radiation. Greenhouse gases (GHGs) keep the earth's surface warmer than it would otherwise be because they absorb infrared radiation from the earth and, in turn, radiate this energy back down to the surface. Although these gases occur naturally in the atmosphere, there has been a rapid increase in concentrations of GHGs in the earth's atmosphere from human sources since the start of industrialization, which has caused concerns over potential changes in the global climate. The primary GHGs produced by human activities are carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and halocarbons (MMS, 2007a).

The surveying, construction, and decommissioning activities associated with Alternative A would produce GHG emissions. As GHGs are relatively stable in the atmosphere and are essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional climate impacts are likely a function of global emissions. The causes and effects of climate change can be summarized as follows. First, GHGs are emitted into the atmosphere, causing global warming (i.e., an aggregate average increase in the temperature of the earth's atmosphere). Second, global warming induces the climate to change in disparate ways at various places around the globe, altering global precipitation regimes, decreasing the salinity of the oceans, and altering the seasons. Finally, climate change leads to direct impacts on the environment, such as changes in the structure of an ecosystem, changes in air quality, a reduced supply and increased cost of food, warming polar regions, higher precipitation totals, sea level rise, extreme temperatures, and severe weather events (EPA, 2011 as cited in BOEM, 2012c). Additionally, uptake of $CO_2$ in marine waters decreases the pH buffering capacity of the ocean.

In general, the GHG emissions associated with the site characterization surveys and site assessment activities under Alternative A can be assumed to contribute to climate change; however, these contributions would be so small (i.e., 6,990 metric tonnes) compared with the aggregate global emissions of GHGs that they cannot be deemed significant, if their impact could even be detected. The additional GHG emissions anticipated from Alternative A, over the 5-year period, would have a negligible incremental contribution to existing GHG emissions and, therefore, would have an exceedingly minor effect on the environment via contributions to climate change.

### *Geology*

The WEA area on the continental shelf is dominated by sand, silt, and clay-sized unconsolidated sediment that responds to currents generated by tides and winds. Currents generated during tropical storms, hurricanes, and nor'easters can result in significant transport of these sediments. Construction and deployment of meteorological towers and buoys in the WEA combined with construction and deployments of other reasonably foreseeable actions in the region, would not have a significant cumulative impact on geology. Impacts from buoy or tower deployment are small in scale (a few meters square to a few tens of meters square) and are similar to effects occurring during storms or by commercial fish trawls.

### *Water Quality*

The cumulative increase in military, commercial, and recreational vessel traffic would collectively contribute to discharges adversely affecting water quality.

The ports used by activities under Alternative A (Section 3.1.2) would be accessed by the Atlantic Ocean, Narragansett Bay, and Buzzards Bay. The two bays are part of the Atlantic Intracoastal Waterway system and are ecologically and commercially important to the region. The Narragansett Bay National Estuarine Research Reserve, in the heart of Narragansett Bay, protects approximately 4,400 acres of land and water (NBNERR Reserve, n.d.). Like Narragansett Bay, Buzzards Bay and its watershed is in one of the 28 national estuary programs in the United States created for the protection and restoration of water quality and living resources (Buzzards Bay National Estuary Program, 1997). Although Alternative A would result in additional vessel traffic in the coastal waters and bays, the increase in traffic would be negligible compared to existing/future commercial, private, and military traffic. Therefore, cumulative impacts on water quality from Alternative A would be negligible.

### *4.7.3.2 Biological Resources*

### *Birds*

Birds could be adversely affected by vessel discharges, the presence of meteorological towers and buoys, and accidental fuel releases. The risk of allision with towers or buoys would be minor given the small numbers proposed, their size, and their distance from shore and each other. Adherence to BOEM's SOCs (Appendix B) regarding tower lighting would reduce impacts. Thus, Section 4.2.2.1.2 concludes that any impacts from Alternative A on birds, including ESA-listed species, are expected to be negligible.

Birds within the Southern New England region have historically been, and will continue to be, subject to a variety of anthropogenic stressors, including allisions with manmade structures, commercial and recreational boating activity, pollution, disturbance of marine and coastal environments, hunting, habitat loss of breeding and wintering grounds, and climate change (NABCI, 2011). Migratory birds are affected by similar factors over much broader geographical scales. Impacts on birds (e.g., birds striking towers, accidental spills) that may result from Alternative A would add to the cumulative effects from past, present, and foreseeable anthropogenic activities in the region. Based on the low level of impacts on birds anticipated from Alternative A, BOEM expects that any incremental contributions to cumulative impacts would be negligible to minor.

### *Bats*

Impacts on bats include avoidance or attraction to meteorological towers or buoys, or allisions with these structures, especially during storms. Although migratory tree bats are the most likely species to be found in the WEA, all bats would be considered rare in this offshore environment, and measureable impacts on bats are unlikely. Section 4.2.2.2.2 concludes that any impacts from Alternative A on bats are expected to be negligible.

Bats that may occur in the Southern New England region are subject to a variety of anthropogenic stressors including allisions with manmade structures. Hibernating bat species (considered much less likely to be found offshore than migratory species) have experienced high mortality rates from White Nose Syndrome. Impacts on bats (e.g., allisions with towers) that may result from Alternative A would add to the cumulative effects from past, present, and foreseeable anthropogenic activities in the region. Based on the low level of impacts on bats anticipated from Alternative A, BOEM expects that any incremental contributions to cumulative impacts would be negligible to minor.

### *Benthic Resources*

As described in Section 4.2.2.3, the primary reasonably foreseeable impacts from site Alternative A would be direct contact by anchors, driven piles, and scour protection that could cause crushing and smothering. However, these impacts would be 1) short term with recovery likely occurring within a year; 2) take place primarily during meteorological tower/buoy installation and decommissioning; and 3) be localized in space (in approximately 0.1 to 0.2 percent of the WEA) given the extent of the benthic habitat types on the continental shelf. Therefore, impacts on benthic resources from Alternative A are expected to be negligible in extent. Similarly, for the other activities and projects within the Southern New England region (e.g., Block Island Wind Farm, Alternative A for the Rhode Island/Massachusetts WEA), the effects are expected to be short term and localized to the area of the specific activity. Therefore, anticipated deployment of meteorological towers and buoys in the WEA and future such deployments in the surrounding area would not have a significant cumulative impact on benthic resources.

#### *Coastal Habitats*

As discussed in Section 4.2.2.6, although the coastal areas of New England have a range of diverse coastal habitats, much of the Atlantic shoreline in these States has been altered in some degree, and most of the coastal habitats have been impacted by human activities. Much of this alteration has been from development, agriculture, maritime activities, beach replenishment, or shore-protection structures such as groins and jetties (MMS, 2007a). Because Alternative A would be supported by several existing port facilities , the proposed action would add a relatively minor amount of additional vessel traffic over a 5-year period, and as a result the cumulative impacts on coastal habitats from onshore activities associated with Alternative A is expected to be negligible.

#### *Finfish, Shellfish, and Essential Fish Habitat*

Marine fish and shellfish could be affected by Alternative A by noise generated by HRG surveys, geotechnical surveys, and pile driving and cutting during meteorological tower/buoy installation and decommissioning. Marine fish would generally experience short-term behavioral changes and avoid the sound source. Individuals that do not leave the area could be exposed to potentially lethal SPLs. However, the implementation of a "soft start" procedure would minimize the possibility of exposure to lethal sound levels. BOEM anticipates that the impacts per activity would be localized.

Because of the small, localized sub-bottom sampling footprints occurring from the activities associated with the existing and proposed projects in the Southern New England region, benthic effects impacting fish species and their habitat, including EFH, when combined with Alternative A are expected to be negligible. Therefore, cumulative impacts are expected to be minor and would not result in changes in local fish community assemblage and diversity.

The existing and proposed meteorological structures in the area, including those proposed for Alternative A in this WEA, would form new habitat complexes that would attract certain fish species such as tautog and black sea bass. This would likely result in a cumulative increase in fish population numbers closer to the structures in multiple locations.

Although vessel traffic in the area would cumulatively increase as a result of activities associated with Alternative A and the other existing and proposed projects, the risk of discharge of waste materials or the accidental release of fuels is still expected to be low given the relatively limited number of structures and vessels that would be involved. Impacts on fish and their habitat, including EFH, from the discharge of waste materials or the accidental release of fuels are also expected to be minor because they would be temporary in nature and would occur in a limited area. If a diesel spill occurred (the most likely pollutant to be discharged), the diesel would dissipate very rapidly in the water column, and then evaporate and biodegrade within a few days. Therefore, the cumulative effect of spills as a result of activities from Alternative A and the other existing and proposed projects is expected to be minor.

Other stresses that could cause cumulative impacts on fish, shellfish, and fisheries are fisheries harvest levels and harvest methods. There is some indication that Atlantic fisheries are already experiencing impacts of climate change. For instance, Nye et al. (2009) examined whether recent oceanographic changes associated with climate change in the Northeast U.S. continental shelf ecosystem had caused changes in spatial distribution of marine fish over time. In the analysis of temporal trends of fish stocks from 1968 to 2007, Nye et al. (2009) found stocks (especially in the southern extent of the survey area) exhibited poleward shifts in center of biomass and some occupied habitats in increasingly deeper waters.

In summary, the overall cumulative effects on finfish, shellfish, and EFH from Alternative A and the other existing and proposed projects in the area are expected to be minor because they would be short term and localized.

### *Marine Mammals*

Marie mammals could be adversely affected by noise from HRG surveys, sub-bottom reconnaissance, pile driving for meteorological tower installation, and vessel traffic. Currently, quantifying the incremental increase in noise produced from Alternative A, or the direct effects such an increase would produce in marine mammals, is not possible. In addition to acoustic impacts, the potential for vessel collisions is an important concern for marine mammals. Other impacts on marine mammals include effects on benthic habitat, waste discharge, and accidental fuel leaks or spills. 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 marine mammals, including ESA-listed species.

Marine mammals within the Southern New England region have historically been, and will continue to be, subject to a variety of anthropogenic impacts including collisions with vessels (ship strikes), entanglement with fishing gear, anthropogenic noise, pollution, disturbance of marine and coastal environments, hunting, and climate change. Many marine mammal species migrate long distances and are affected by similar factors over broad geographical scales. For example, the critically endangered North Atlantic right whale migrates annually between calving areas off the southeastern coast of the United States and primary feeding areas off the coast of

Canada and in the Gulf of Maine.

Impacts on marine mammals (e.g., vessel strikes, acoustic impacts) that may result from Alternative A would add to the cumulative effects from past, present and foreseeable anthropogenic activities in the region. Based on the mitigation measures outlined in BOEM's SOCs for Protected Species (Appendix B), the incremental contributions from Alternative A to cumulative impacts are expected to be minor, and mostly resulting from noise associated with site characterization and site assessment activities. The potential for higher-level cumulative impacts exists, especially for right whales. Although large numbers of right whales are generally not thought to spend considerable amounts of time in the WEA region, in April of 2010, 98 right whales were reported feeding in the waters near the WEA (Kahn et al., 2011). This represents around one-quarter to one-third of the estimated population of right whales. Cumulative impacts on right whales from a potential ship strike, or from noise levels that may alter feeding behavior, could be higher than for other marine mammals because of the low population levels of this endangered species.

### *Sea Turtles*

All sea turtle species are ESA-listed, and the following four are most likely to occur in the WEA: Loggerhead, leatherback, green, and Kemp's ridley. These sea turtles could be adversely affected by noise from HRG surveys, sub-bottom reconnaissance, pile driving for meteorological tower installation, and vessel traffic. In addition to acoustic impacts, other impacts on sea turtles include vessel strike, entanglement with towed acoustic gear, discharge of waste, accidental fuel leaks or spills, and effects to benthic foraging habitat. 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.

Sea turtles that may occur within the Southern New England region are all highly migratory. These turtles have long been subject to a variety of anthropogenic impacts throughout their range. Human impacts on sea turtles include collisions with vessels (ship strikes), entanglement with fishing gear, anthropogenic noise, pollution, disturbance of marine and coastal environments, disturbance of nesting habitat, hunting, and climate change. Impacts on sea turtles (e.g., vessel strikes, acoustic impacts) that may result from Alternative A would add to the cumulative effects from past, present and foreseeable anthropogenic activities in the region, and throughout the range of these species. Based on the mitigation measures outlined in BOEM's SOCs for Protected Species (Appendix B), the incremental contributions from Alternative A on cumulative impacts are expected to be minor, and mostly resulting from vessel traffic associated with site characterization and site assessment activities.

#### 4.7.3.3 Socioeconomic Resources

### Cultural Historic and Archaeological Resources

The projects discussed in Section 4.6.2 would collectively contribute to bottom disturbances from anchoring and construction that could impact offshore cultural resources. However, surveying and avoidance of any resources would mitigate impacts.

### Demographics and Employment

Although the beneficial impacts on employment from Alternative A would be negligible compared with the other projects/activities in the Southern New England region, all the actions combined would result in substantial beneficial impacts on employment from the creation of new jobs to support the actions and from retaining staff in existing companies/industries. The impacts would be temporary, but would result in benefits to local coastal economies and the industries supporting offshore development and actions (e.g., surveying, design and installation/construction of structures and instrumentation, vessel maintenance, vessel fueling). No impacts on demographics are expected from Alternative A; therefore, Alternative A would not contribute to cumulative impacts.

### Commercial and Recreational Fisheries

BOEM anticipates that commercial and recreational fishing activities and recreational boating would continue to use the area surrounding the proposed meteorological towers. Therefore, because commercial and recreational fisheries would not be adversely affected or restricted from the proposed action, there would be no adverse cumulative impacts. Fishing vessels with a home port in southern New England and the mid-Atlantic often have a fishing range well beyond their home port and thus use much of the U.S. exclusive economic zone from Maine to North Carolina. These vessels could be impacted by site assessment and site characterization activities throughout their fishing range. However, the total increase in vessel traffic from renewable energy leasing, as well as other sources, is not likely to impede fishing as a whole along the Atlantic coast.

### Aviation

Construction of towers and wind turbines associated with the Block Island Wind Farm and Cape Wind Energy Project, when combined with Alternative A would have the potential to adversely affect aviation, including risk of allisions with the structures or interference with radar. However, adherence to USCG and FAA lighting (33 CFR 66.01–11) and marking requirements along with FAA and DOD consultations regarding effects on radar for each of these projects would substantially reduce impacts. Therefore, BOEM anticipates cumulative impacts on aviation would be negligible.

### *Navigation/Vessel Traffic*

The military, commercial, and recreational vessel traffic associated with the activities and projects discussed in Section 4.2.3.8, when combined with Alternative A, would collectively contribute to increases in vessel traffic in the region of the WEA and port facilities used to support the site characterization and site assessment activities. The WEA represents a crossroads between multiple heavily used waterways, including Narragansett Bay, Long Island Sound, Vineyard and Nantucket Sounds, and offshore shipping lanes. However, the WEA was designed to avoid the major shipping lanes and the heavier trafficked approach/departure areas associated with those lanes.

The number of trips associated with site characterization and assessment activities in this EA (up to 6,500 vessel round trips over 5 years) would be relatively minor compared with the vessel trips from the projects discussed in Section 4.2.3.8 and the existing military, commercial, and recreational traffic over the same 5-year period. Because only a few towers/buoys that would be constructed/deployed under Alternative A and they would be spread out across the WEA, no adverse impacts on navigation are anticipated when added to the existing structures in the Southern New England region. USCG marking and lighting requirements for these structures, based on 33 CFR 66.01–11, would minimize impacts on safety and navigation.

## 4.7.4 Conclusion

BOEM anticipates that the incremental contribution of Alternative A when combined with other reasonably foreseeable projects and activities during the 5-year site assessment period from 2014 to 2019 would result in cumulative impacts on the environment. However, with implementation of SOCs (Appendix B), following USCG and FAA lighting and marking requirements, and consultations with appropriate agencies (e.g., DOD, USFWS, NMFS, FAA), BOEM anticipates that cumulative impacts would be negligible to minor. The proposed action and alternatives would facilitate the collection of meteorological, oceanographic, and biological data for the environment offshore Massachusetts, which would lead to a better understanding of the wind resources and allow for better planning of wind energy development in that area.

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# 5 CONSULTATION AND COORDINATION

BOEM conducted early coordination with appropriate Federal and State agencies and other concerned parties to discuss and coordinate the identification of the WEA under the Secretary's "Smart from the Start" initiative (see Sections 1.1.1 and 1.5 of this EA). Formal consultations and cooperating agency exchanges are detailed below. In addition, BOEM regularly coordinated with the Federal and State agencies noted on an informal basis through dialogue, teleconferences, and in-person meetings. Key agencies included the EOEEA, the Rhode Island Coastal Resources Management Council (RICRMC), the State Historic Preservation Offices (SHPOs) of Rhode Island and Massachusetts, the Advisory Council on Historic Preservation (ACHP), the Mashpee Wampanoag Tribe, the Wampanoag Tribe of Gayhead (Aquinnah), Shinnecock Indian Nation, the Narragansett Indian Tribe, NMFS, USFWS, DOD, FAA, USACE, USCG, EPA, and NPS.

## 5.1 PUBLIC INVOLVEMENT

### 5.1.1 Notice of Intent

On February 6, 2012, BOEM announced the NOI to prepare this EA in the *Federal Register* (77 FR 5830). The NOI solicited public input on issues and alternatives to be considered and analyzed in the EA. BOEM accepted comments until March 22, 2012. A total of 32 comments were received during the 45-day comment period. Issues identified to be analyzed included integration of CMSP tools into the EA; seasonal prohibitions on some or all survey and site characterization activities; mitigation measures to reduce or eliminate the chance of vessels striking North Atlantic right whales; evaluation/timing of alternative project locations, configurations/scales, and energy-generation technology scenarios; proper characterization of environmental impacts of activities proposed by developers in SAPs; implementation of best management practices, adaptive management, and monitoring programs; analysis of conflicts with vessel traffic; EFH assessment; impacts on current and future fishing activities; and analysis of noise impacts and collision risk. The comments can be viewed at regulations.gov by searching for docket ID BOEM-2011-0116.

### 5.1.2 Notice of Availability

The Notice of Availability for review of this EA is being published in the *Federal Register*. Comments on this EA will be solicited for 30 days following publication of the Notice of Availability. Comments may be submitted to regulations.gov in docket ID BOEM-2012-0086. The EA is posted on BOEM's Web site at http://www.boem.gov/Renewable-Energy-Program/Smartfrom-the-Start/Index.aspx.

Intergovernmental Renewable Energy Task Force members are notified by email. During the comment period, BOEM conducts public information meetings to give stakeholders an overview of the EA. Attendees likely include Intergovernmental Renewable Energy Task Force members, nongovernmental organizations, and entities that respond to planning notices for the WEA offshore of Massachusetts.

## 5.2 COOPERATING AGENCIES

Section 1500.5(b) of the CEQ implementing regulations (40 CFR 1500.5(b)) 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 is one that has jurisdiction by law or special expertise with respect to any environmental issue and that participates in the NEPA process upon the request of the lead agency. The NOI included an invitation to other Federal agencies and State, tribal, and local governments to consider becoming cooperating agencies in the preparation of this EA. Nine cooperating agencies were invited (see Table 5-1) and three participated in the development and review of this EA. The agencies' or Tribe's jurisdiction and/or expertise are described in the table below.

**Table 5-1**

**Agencies and Tribes Invited to Participate as a Cooperating Agency in the Preparation of the EA**

| Agency or Tribe Invited | Authority or Expertise of Invitee | Date Invited | Response |
|---|---|---|---|
| MA EOEEA | Special expertise with the environmental and socioeconomic issues considered in the EA. | 5/31/12 | Accepted on 6/6/12 |
| RICRMC | Special expertise in biological and socioeconomic resources and local issues as identified in the Rhode Island OSAMP. | 5/31/12 | Accepted on 5/31/12 |
| NOAA | NMFS' data-rich resources concerning habitat, benthos, protected resource species, fishery and impact metrics, and expertise concerning fishing activity and associated fishery resources and protected species and habitat. | 5/16/12 | Declined on 5/18/12[1] |
| USCG | The USCG has jurisdiction and expertise with port usage, vessel traffic, lighting requirements/mitigation measures for meteorological towers and buoys, and spill risk and response. | 5/16/12 | Accepted on 7/27/12 |
| USACE | Section 4(e) of the OCSLA extends the USACE's authority to prevent the obstruction to navigation in the navigable waters of the United States to OCS facilities. This includes the proposed site assessment activities (construction of meteorological towers and buoys) addressed in this EA. The USACE is also a co-consulting agency on Section 106, EFH, and ESA consultations for this proposed action. | 5/16/12 | Accepted on 10/05/12 |

| Agency or Tribe Invited | Authority or Expertise of Invitee | Date Invited | Response |
|---|---|---|---|
| Mashpee Wampanoag Tribe | Special expertise with respect to environmental impacts and effects on historic properties, including traditional cultural properties. | 5/31/12 | Accepted on 6/19/12 |
| Wampanoag Tribe of Gayhead (Aquinnah) | Special expertise with respect to environmental impacts and effects on historic properties, including traditional cultural properties. | 5/31/12 | No response to date. |
| Narragansett Indian Tribe | Special expertise with respect to environmental impacts and effects on historic properties, including traditional cultural properties. | 5/31/12 | No response to date. |
| Shinnecock Indian Nation | Special expertise with respect to environmental impacts and effects on historic properties, including traditional cultural properties. | 5/31/12 | No response to date. |

[1]NMFS respectfully declined because the Memorandum of Understanding in place between BOEM and NMFS already governs and encourages an exchange of information between the agencies.

BOEM continues to discuss the EA in government-to-government consultation with the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Wampanoag Tribe of Gay Head (Aquinnah).

## 5.3 CONSULTATIONS

### 5.3.1 Endangered Species Act

As required by Section 7 of the ESA, BOEM is consulting with the NMFS and USFWS on assessing the impacts of the proposed action on endangered/threatened species and designated critical habitat under their jurisdiction. BOEM sent letters initiating consultations with the NMFS and the USFWS on July 9, 2012. The Biological Assessments, prepared by BOEM for the consultations, conclude that the proposed lease issuance, associated site characterization, and subsequent site assessment activities are expected to be discountable[4] and insignificant[5] and, thus, not likely to adversely affect ESA-listed bats, birds, and fish. BOEM anticipates that temporary adverse impacts equivalent to Level B harassment from noise will affect ESA-listed marine mammals and sea turtles during HRG survey and pile driving activity. Potential adverse impacts are greatly reduced when activities are implemented according to the SOCs outlined in this assessment (see Appendix B). These requirements will be included as a condition on any leases and/or SAPs issued or approved under this decision. BOEM expects that the ESA-consultations will be concluded prior to any agency findings regarding this EA.

Those entities applying to BOEM for leases will be responsible for applying for other applicable permits, such as an incidental harassment authorization under the MMPA. Information regarding

[4] USFWS and NMFS define "discountable" as those effects that are extremely unlikely to occur (USFWS and NMFS, 1998).

[5] USFWS and NMFS define "insignificant" as effects related to the size of the impact and should never reach the scale where take occurs (USFWS and NMFS, 1998).

NMFS permitting can be found at http://www.nmfs.noaa.gov/pr/permits/.

### 5.3.2 Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, Federal agencies are required to consult with the 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 the NMFS.

BOEM is initiating consultation with the NMFS concurrent with this EA as required by the Magnuson-Stevens Fishery Conservation and Management Act. BOEM has determined that the proposed action will not significantly affect the quality and quantity of EFH in the action area. There are no EFH HAPCs in the proposed action area. BOEM will consider the results of this consultation prior to making any findings regarding the proposed action.

### 5.3.3 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) 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 the 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. A consistency review was performed and a single Consistency Determination (CD) was prepared for the Commonwealth of Massachusetts and the State of Rhode Island.

BOEM has determined that Rhode Island and Massachusetts share common coastal management issues and have similar enforceable policies as identified by their respective coastal zone management plans (CMPs). 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 has prepared a single CD under 15 CFR 930.36(a) to determine whether issuing leases and approving site assessment activities (including the installation, operation, and decommissioning of meteorological towers and buoys) in the WEA offshore of Rhode Island and Massachusetts is consistent to the maximum extent practicable with the provisions identified as enforceable by the Coastal Management Programs of the State of Rhode Island and the Commonwealth of Massachusetts.

This CD will be sent to both the State of Rhode Island and the Commonwealth of Massachusetts for their review. The EA provides the comprehensive data and information required under 30 CFR 939.39 to support BOEM's CD. BOEM has determined that the activities described in this

EA are consistent to the maximum extent practicable with the enforceable policies of the CMPs of Rhode Island and Massachusetts. When the affected States receive the CD, they will have 60 days to review it (which provides the supporting information required under 30 CFR 930.39(a)); the State agency has 14 days after receiving this information to identify missing information required by 930.39(a).

Pursuant to 30 CFR 585.611(b), if a lessee submits a SAP that shows changes in impacts from those identified in the CD prepared for this proposed action, BOEM may determine that the SAP is subject to a consistency certification. In that case, the lessee would submit a consistency certification under 15 CFR Part 930, Subpart E. BOEM would then submit the SAP and consistency certification to the affected States for CZMA review.

### 5.3.4 National Historic Preservation Act

Section 106 of the NHPA (16 U.S.C. 470f), and implementing regulations (36 CFR Part 800) require Federal agencies to consider the effects of their actions on historic properties and afford the ACHP a reasonable opportunity to comment. BOEM has determined that lease issuance and approval of SAPs constitute undertakings subject to Section 106 of NHPA. Therefore, the reasonably foreseeable consequences of the BOEM actions include:

1. Shallow hazards, geological, geotechnical, and archaeological resource surveys (associated with lease issuance); and

2. Installation and operation of meteorological tower(s), meteorological buoy(s), or a combination of the two (associated with SAP approval).

On February 9, 2011, BOEM formally notified the public through the *Federal Register* (pages 7226–7228), that it was initiating the “Smart from the Start” wind energy initiative and that it would involve Federal agencies, States, Tribes, local governments, wind power developers and the public as BOEM conducted the NEPA process and engaged in consultation. In August 2011, BOEM identified and initiated a request for NHPA Section 106 consultation through correspondence with the appropriate SHPOs and potentially affected federally recognized Tribes, local governments, and other individuals and organizations with a potential interest in the undertaking to obtain further information and to learn their concerns regarding the proposed undertakings’ potential effects on historic properties. The entities contacted by BOEM are listed in Table 5-2. In June and July 2011, September 2011, and April and May 2012, BOEM consulted with the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah). BOEM will continue to consult with these federally recognized Tribes on a government-to-government basis, in accordance with EO 13175.

On October 27, 2011, BOEM requested public input on the impacts on historic properties from commercial wind lease issuance and site characterization and site assessment activities on the Atlantic OCS. The comment period on the proposed undertaking as it pertained to historic properties closed on November 10, 2011. BOEM received three comments in response to this solicitation. These comments from the Alliance to Protect Nantucket Sound, Mainstream Renewable Power, and Offshore Wind Development Coalition can be viewed at regulations.gov by searching for Docket ID BOEM-2011-0115.

BOEM has prepared a PA to guide its Section 106 activities for these undertakings pursuant to 36 CFR 800.14(b) (see Appendix F). Consulting parties invited to be signatories to the PA included the SHPOs of Rhode Island and Massachusetts, the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Wampanoag Tribe of Gay Head (Aquinnah), and the ACHP. The PA provides for Section 106 consultation to continue through both the leasing process and BOEM's decision making process regarding the approval, approval with modification, or disapproval of lessees' SAPs and allows a phased identification and evaluation of historic properties. The PA also establishes a process for determining and documenting the areas of potential effect for each undertaking to further identify historic properties located within these areas. If a historic property is found to be listed in, or is eligible for listing in, the National Register of Historic Places this established process assesses potential adverse effects and helps to avoid, reduce, or resolve any potential adverse effects.

On December 14, 2011, and February 21, 2012, BOEM held Section 106 consultation webinars to discuss the proposed undertakings and BOEM's intention to prepare a PA. BOEM provided a draft of the PA to the consulting parties on March 26, 2012, and on May 8, 2012, BOEM held another webinar to review comments on the draft Agreement, discuss changes, and prepare a revised draft in preparation for signing. The final PA includes changes and edits resulting from comments BOEM received from all signatories. Although all consulting parties invited to participate in the PA did not sign, the PA has been executed and is in effect.

**Table 5-2**

**Entities Solicited for Information and Concerns Regarding Historic Properties and the Proposed Undertakings**

| Consulting Party Type | Organization |
|---|---|
| Advisory Council on Historic Preservation | Advisory Council on Historic Preservation |
| Federally Recognized Tribal Government | Catawba Indian Nation |
| | Mashpee Wampanoag Tribe |
| | Narragansett Indian Tribe |
| | Saint Regis Mohawk Tribe |
| | Shinnecock Indian Nation |
| | Wampanoag Tribe of Gay Head (Aquinnah) |
| Local Government | Barnstable County |
| | Cape Cod Commission |
| | City of Cranston |
| | City of East Providence |
| | City of New Bedford |
| | City of Pawtucket |
| | City of Providence |
| | City of Warwick |
| | Dukes County Commission |
| | Martha's Vineyard Commission |
| | Nantucket Planning and Economic Development Commission |
| | Nantucket Planning Board |
| | Town of Aquinnah |
| | Town of Barrington |
| | Town of Bristol |
| | Town of Charlestown |
| | Town of Chilmark |
| | Town of Dartmouth |
| | Town of East Greenwich |
| | Town of Edgartown |
| | Town of Gosnold |
| | Town of Jamestown |
| | Town of Little Compton |
| | Town of Middleton |

| Consulting Party Type | Organization |
|---|---|
| | Town of Nantucket |
| | Town of Narragansett |
| | Town of New Shoreham |
| | Town of North Kingstown |
| | Town of Oak Bluffs |
| | Town of Portsmouth |
| | Town of South Kingstown |
| | Town of Tisbury |
| | Town of Tiverton |
| | Town of Warren |
| | Town of West Tisbury |
| | Town of Westerly |
| | Town of Westport |
| Other Tribal Government | Mashantucket Pequot Tribal Nation |
| | Mohegan Indian Tribe of Connecticut |
| | Oneida Indian Nation |
| State Historic Preservation Office(r) (SHPO) | Connecticut SHPO |
| | Massachusetts SHPO |
| | New York SHPO |
| | Rhode Island SHPO |

### 5.3.5 Federal Aviation Administration

BOEM consulted with the FAA regarding the activities in the WEA. Typically, any structure higher than 200 ft above ground level at its site and within 12 nm of shore would require an evaluation by the FAA under 14 CFR 77. The FAA will determine whether a notice is required and the applicant would need to file "Notice of Proposed Construction or Alteration" with the FAA in accordance with 14 CFR 77.9 for an appropriate aeronautical study. The FAA would determine any impacts on aviation operations, including military and civilian radar systems, and potential mitigation measures would be evaluated and discussed on a case-by-case basis. An aeronautical study, if required, would conclude with a final agency determination of No Hazard to Air Navigation or a Determination of Hazard to Air Navigation. Any Determinations of No Hazard to Air Navigation will include marking and lighting recommendations, if appropriate.

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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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# Appendix A
# Announcement of Area Identification for Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore Massachusetts

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**ANNOUNCEMENT OF AREA IDENTIFICATION**

**Commercial Wind Energy Leasing on the Outer Continental Shelf Offshore Massachusetts**

**May 30, 2012**

The Bureau of Ocean Energy Management (BOEM) is proceeding with competitive commercial wind energy leasing on the Outer Continental Shelf (OCS) offshore Massachusetts, as set forth by 30 CFR 585.211 through 585.225. The next step in the competitive leasing process, and the purpose of this announcement, is Area Identification. BOEM defined a Wind Energy Area (WEA) offshore Massachusetts pursuant to the Secretary of the Interior's *Smart from the Start* Atlantic Offshore Wind Initiative. This entire area will be considered for leasing and approval of site assessment plans as the proposed action under the National Environmental Policy Act (NEPA) (42 U.S.C. §§ 4321-4370f). BOEM also has identified alternatives to the proposed action that consider the exclusion of certain portions of the WEA and the issuance of leases and approval of site assessment in the remainder of the WEA. This announcement also identifies mitigation measures and other issues to be considered further in the NEPA document.

On February 6, 2012, BOEM published in the *Federal Register* the *Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore Massachusetts—Call for Information and Nominations* (Call) (77 FR 5820-5830) and *Notice of Intent to Prepare an Environmental Assessment* (NOI) (77 FR 5830-5832).

Figure 1 depicts the "Excluded Area" that will not be considered for leasing or approval of site assessment plans in the NEPA document. The Call included certain areas that overlapped with an area of high sea duck occurrence. BOEM has excluded this "high value" habitat from the WEA, to avoid impacts to this valuable habitat. In addition, the Call included an area that, if ultimately developed with commercial wind energy facilities, would likely cause substantial conflict with "high value" fisheries. This area is a continuation of an area excluded from leasing consideration in the Rhode Island/Massachusetts WEA announced on February 24, 2012. The remainder of the Call Area will be considered for leasing and approval of site assessment plans in an environmental assessment (EA) (see Figure 1, Alternative A).

Alternatives to the proposed action (Alternative A) were defined by excluding certain areas of the WEA because of the following considerations:

- Areas identified as having occurrences of North Atlantic right whales, which are of concern due to potential impacts to this species (see Figure 2, Alternative B);
- All areas within 15 nautical miles of the inhabited coastline of Massachusetts, which are of concern due to potential visual impacts (see Figure 3, Alternative C); and
- All areas within 21 nautical miles of the inhabited coastline of Massachusetts, which are of concern due to potential visual impacts (see Figure 4, Alternative D).

The agency is currently only considering the issuance of leases and approval of site assessment plans in this area. BOEM is not considering, and the EA does not support, any decision(s) regarding the construction and operation of wind energy facilities on leases which will potentially be issued in this WEA. If, after leases are issued, a lessee proposes to construct a commercial wind energy facility, it would submit a construction and operations plan. If and when BOEM receives such a plan, it would prepare a site-specific NEPA document for the project proposed, which would include the lessee's proposed transmission line(s) to shore. These cable routes would underlie areas outside of the WEA, and may include areas beneath the "high value" sea duck habitat and fishing grounds.

BOEM has also identified mitigation measures that may reduce the potential for adverse impacts to North Atlantic right whales. Such measures include seasonal vessel restrictions, vessel speed restrictions, and enhanced monitoring. These measures, and possibly others, will be analyzed in the EA, and if adopted, could be imposed as binding requirements in the form of stipulations in the lease instrument and/or conditions of approval of a site assessment plan. Based upon staff recommendations; consultations with Federal agencies, states, local governments, and affected Indian tribes; and public comments received, BOEM will continue to consider additional measures that may reduce the potential for adverse environmental consequences, and may identify other issues to be considered in the EA.

**Figure 1. Wind Energy Area identified offshore Massachusetts for analysis as the Proposed Action (Alternative A) in the EA.**

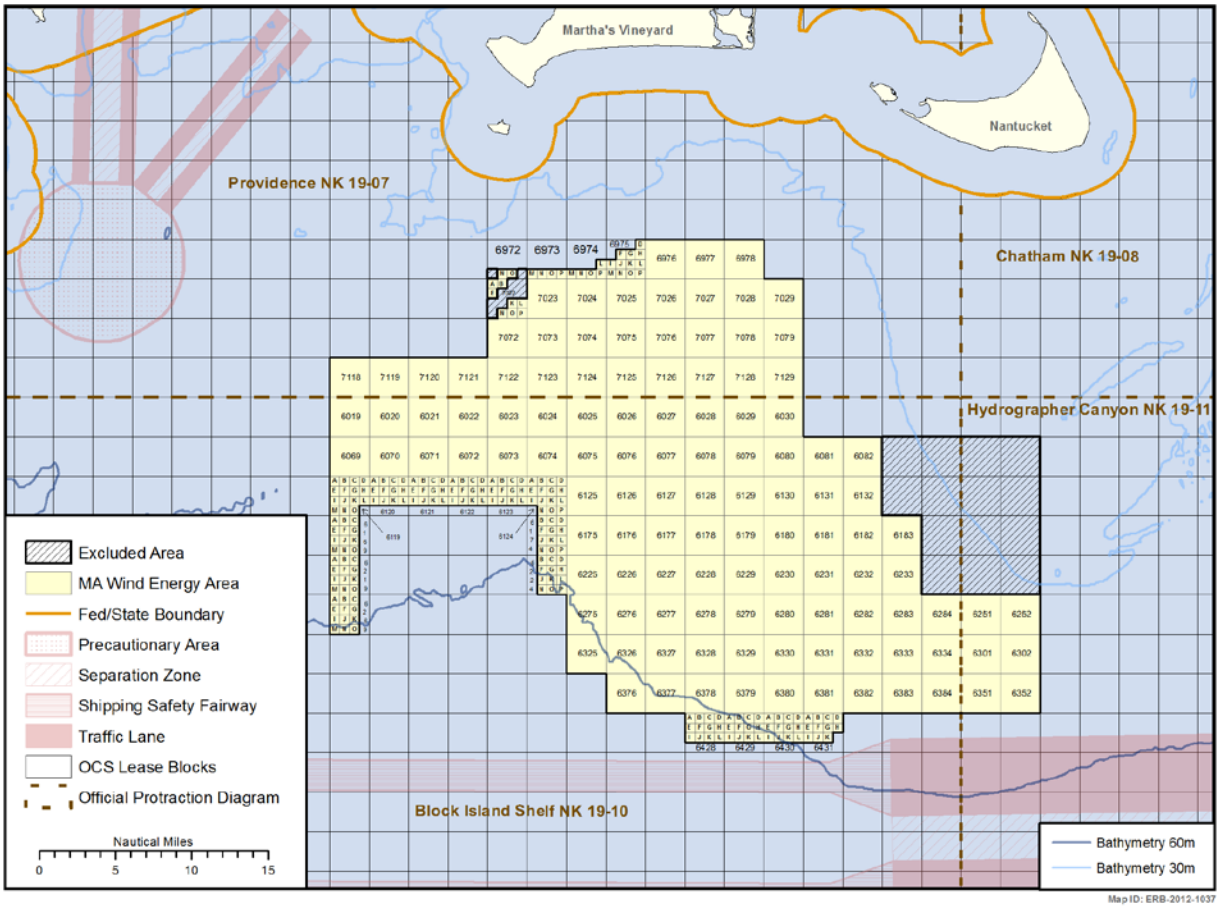


**Figure 2. Areas identified as having occurrences of North Atlantic right whales for analysis as Alternative B in the EA.**

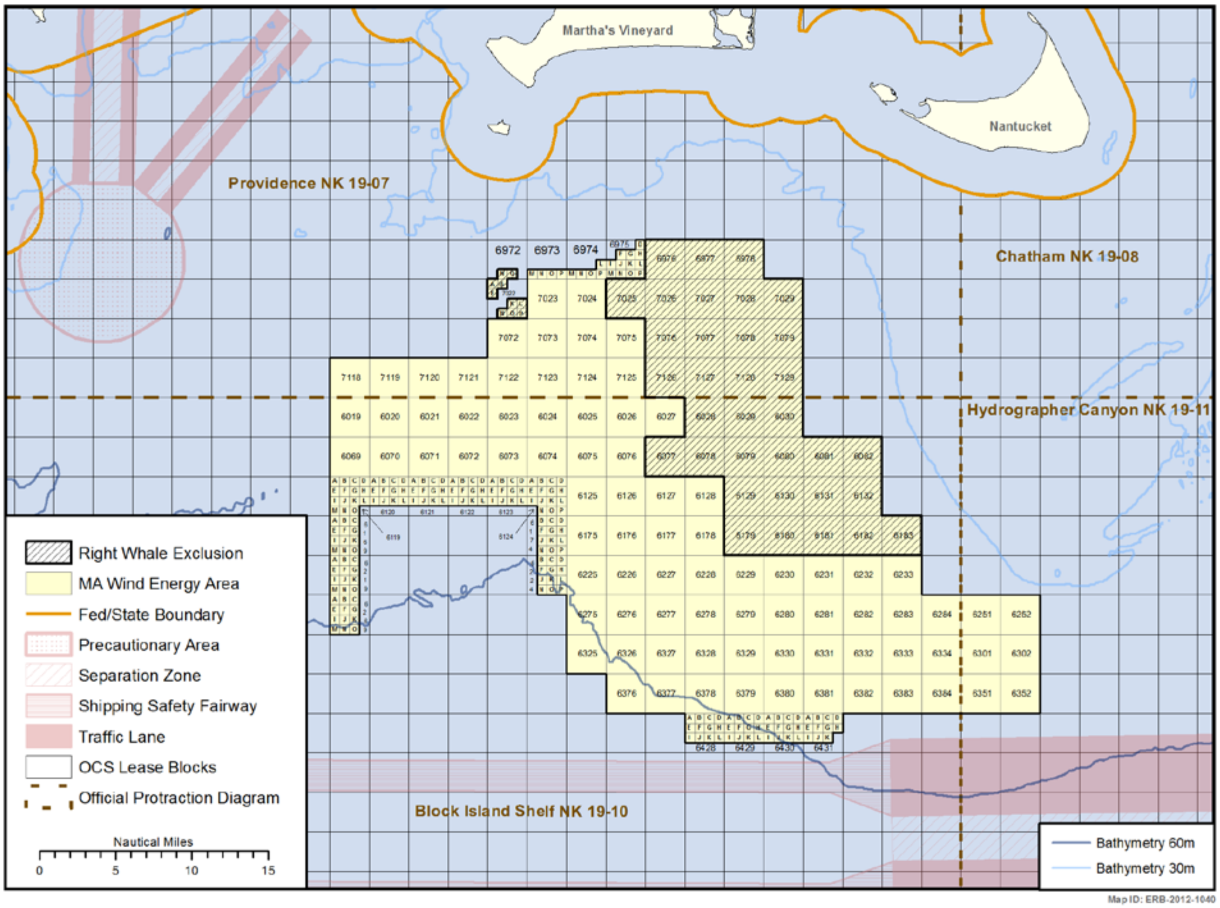


**Figure 3. Areas within 15 nautical miles of the inhabited coastline of Massachusetts identified for analysis as Alternative C in the EA.**

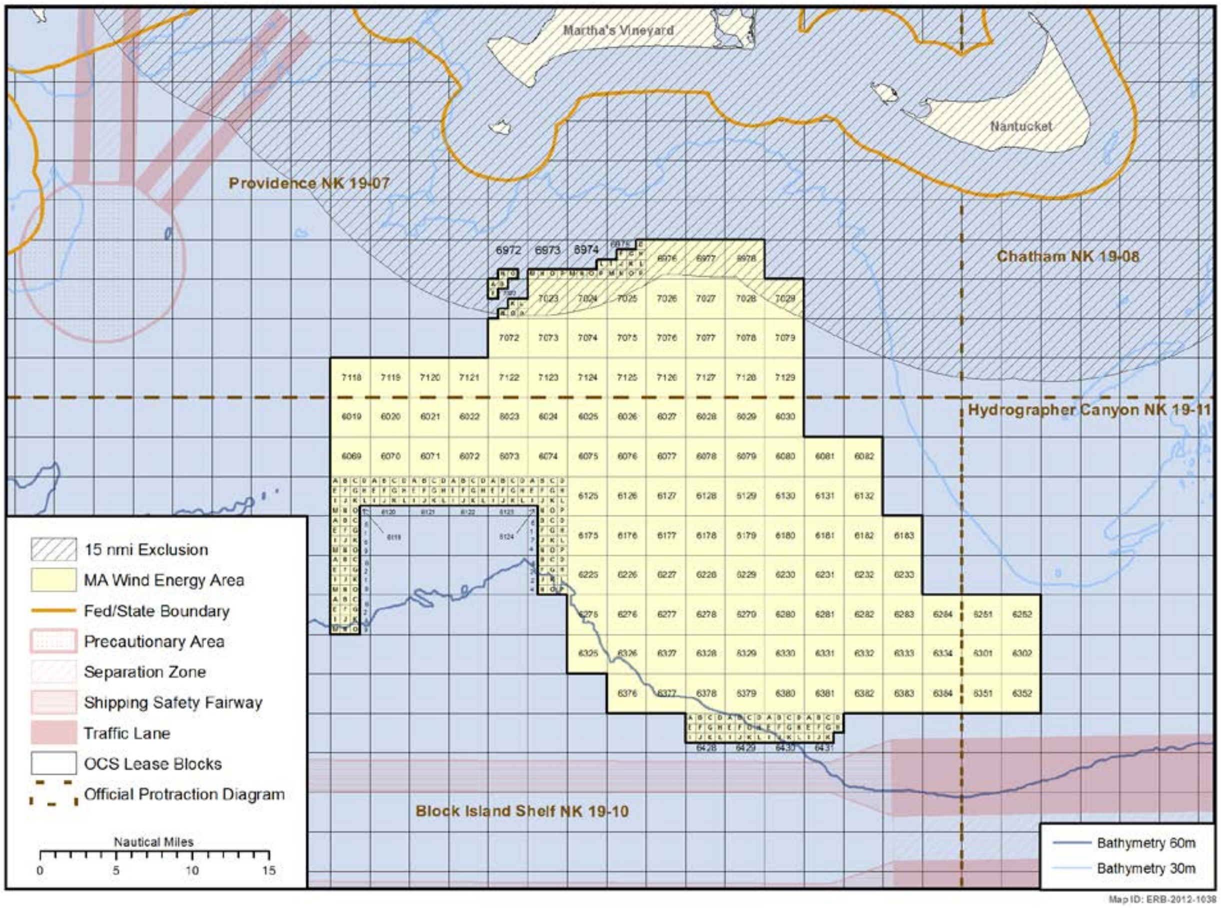
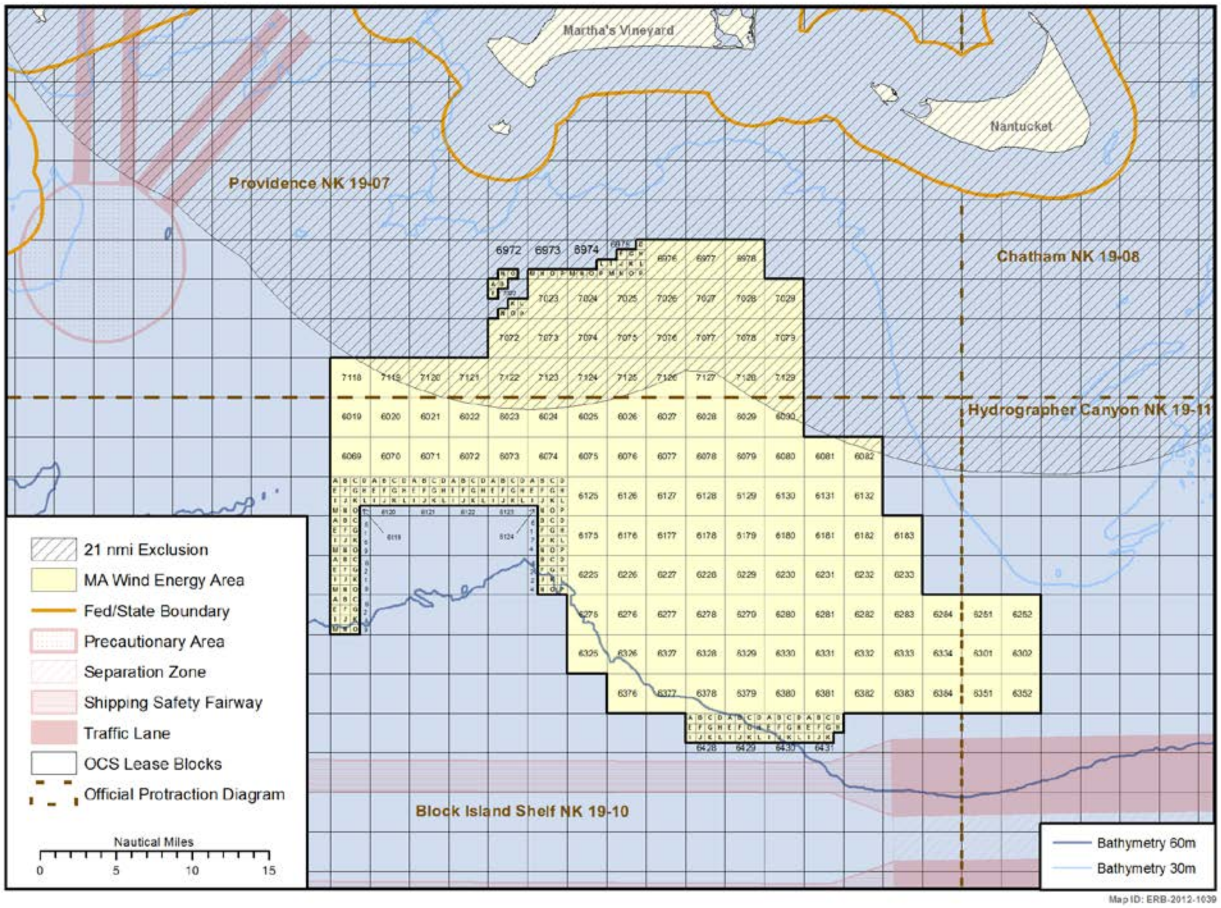


**Figure 4. Areas within 21 nautical miles of the inhabited coastline of Massachusetts identified for analysis as Alternative D in the EA.**



# 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 and which minimize or eliminate potential impacts to protected species including Endangered Species Act (ESA)-listed species of whales, sea turtles, fish and birds.

Additional conditions, including mitigation, monitoring or reporting measures, may be included in any BOEM issued lease or other authorization, including those that may be developed during Federal ESA Section 7 consultations. These conditions are divided into five sections: (1) those required during all project activity associated with Site Assessment Plan (SAP) and/or Construction and Operation Plan (COP) submittal or activity under a SAP; (2) those required during geological and geophysical (G&G) survey activity in support of plan (i.e., SAP and/or COP) submittal; (3) those required during pile driving of a meteorological tower foundation; (4) reporting requirements; and (5) other requirements.

## B.1. GENERAL REQUIREMENTS

### B.1.1. Vessel Strike Avoidance Measures

The Lessee must ensure that all vessels conducting activity in support of a plan (i.e., SAP and/or COP) comply with the vessel strike avoidance measures specified below except under extraordinary circumstances when the safety of the vessel or crew are in doubt or the safety of life at sea is in question:

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. North Atlantic right whales.
   a. The lessee must ensure all vessels maintain a separation distance of 457 meter (m) (1,500 ft) or greater from any sighted North Atlantic right whale (50 CFR 224.103).
   b. The lessee must ensure that any vessel underway remain parallel to a sighted right whale's course whenever possible, and avoid excessive speed or abrupt changes in direction until the right whale has left the exclusion zone.
   c. When a right whale is sighted in a moving vessel's path or in close proximity to the vessel, the lessee must reduce the vessel's speed and shift the engine to neutral, and must not engage the engines until the right whale has left the exclusion zone.

d. The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of right whales are observed near an underway vessel.

3. Non-delphinoid cetaceans other than the North Atlantic right whale.

   a. The lessee must ensure all vessels maintain a separation distance of 91 m (300 ft) or greater from any sighted non-delphinoid cetacean other than a North Atlantic right whale.

   b. The lessee must ensure that any vessel underway remain parallel to a sighted nondelphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction until the non-delphinoid cetacean has left the exclusion zone.

   c. When a non-delphinoid cetacean is sighted in a moving vessel's path or in close proximity to the vessel, the lessee must reduce the vessel's speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has left the exclusion zone.

   d. The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near an underway vessel.

4. Delphinoid cetaceans.

   a. The lessee must ensure that all vessels maintain a separation distance of 45 m (150 ft) or greater from any sighted delphinoid cetacean.

   b. The lessee must ensure that any vessel underway remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction until the delphinoid cetacean has left the exclusion zone.

   c. The lessee must reduce vessel speed to 10 knots (18.5 km/h) or less when mother/calf pairs, pods, or large assemblages of delphinoid cetaceans are observed near an underway vessel.

5. Sea Turtles. The lessee must ensure all vessels maintain a separation distance of 45 m (150 ft) or greater from any sighted sea turtle.

6. The lessee must ensure that all vessels 65 feet in length or greater, operating from Novemer 1 through April 30, operate at speeds less than 10 knots.

7. The lessee must ensure that vessel operators are briefed to ensure they are familiar with the above requirements.

### B.1.2. Marine Debris Awareness

The lessee must ensure that vessel operators, employees and contractors engaged in activity in support of a plan (i.e., SAP and/or COP) are briefed on marine trash and debris awareness elimination as described in the BSEE NTL No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination"). BOEM (the Lessor) will not require the lessee to undergo formal training or post placards, as described under this NTL. Instead, the lessee must ensure that its 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.2. GEOLOGICAL AND GEOPHYSICAL (G&G) SURVEY REQUIREMENTS

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) prevents visual monitoring of the exclusion zones for 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 a plan at night or when visual observation is otherwise impaired, an alternative monitoring plan detailing the alternative monitoring methodology (e.g. active or passive acoustic monitoring technologies) must be submitted to the Lessor for consideration. The Lessor may, after consultation with NMFS, decide to allow the Lessee to conduct G&G surveys in support of a plan at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.

Protected-Species Observer. 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 a NMFS approved protected-species observer. The Lessee must provide to the Lessor a list of observers and their résumés no later than forty-five (45) calendar days prior to the scheduled start of surveys performed in support of plan submittal. The résumés of any additional observers must be provided fifteen (15) calendar days prior to each observer's start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The Lessee must ensure that binoculars or other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during surveys conducted in support of plan (i.e., SAP and/or COP) submittal.

### B.2.1. High Resolution Geophysical Survey Requirements

1. Establishment of Exclusion Zone. The lessee must ensure that a 200 m radius exclusion zone for cetaceans, pinnipeds, and sea turtles will be monitored by a protected species observer around a survey vessel actively using electromechanical survey equipment. In the case of the North Atlantic right whale, the minimum separation distance of 457 m (1,500 ft) is in effect when the vessel is underway as described in the vessel-strike avoidance measures.

    a. If the Lessor determines that the exclusion zone does not encompass the 180-dB Level A harassment radius calculated for the acoustic source having the highest source level, the Lessor will consult with NMFS about additional requirements.

    b. The Lessor may authorize surveys having an exclusion zone larger than 200 m (656 ft) to encompass the 160-dB Level B harassment radius if the Lessee can demonstrate the zone can be effectively monitored.

2. Modification of Exclusion Zone. The Lessee may use the field-verification method described below to modify the HRG survey exclusion zone for specific HRG survey equipment being utilized. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 160 dB or 180 dB zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring described below. The Lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

3. Field Verification of Exclusion Zone. If the Lessee wishes to modify the exclusion zone as described above, the Lessee must conduct field verification of the exclusion zone for specific HRG survey equipment. The results of the sound measurements from the survey equipment must be used to establish a new exclusion zone which may be greater than or less than the 200-m default exclusion zone depending on the results of the field tests. The Lessee must take acoustic measurements at a minimum of two reference locations. The first location must be at a distance of 200 meters from the sound source and the second location must be as close to the sound source as technically feasible. Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 m above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the sound source to the reference location.

4. Clearance of Exclusion Zone. The lessee must ensure that active acoustic sound sources must not be activated until the protected species observer has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

5. Electromechanical Survey Equipment Ramp-Up. The lessee must ensure that when technically feasible a "ramp-up" of the electromechanical survey equipment occur at the start or re-start of HRG survey activities. A ramp-up would begin with the power of the smallest acoustic equipment for the HRG survey at its lowest power output. The power output would 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-min period.

6. Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If a non-delphinoid cetacean or sea turtle is sighted within or transiting towards the 200 m exclusion zone, an immediate shutdown of the electromechanical survey equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the electromechanical survey equipment must use the ramp-up provisions described above and may only occur following clearance minutes.

7. Power Down for Delphinoid Cetaceans and Pinnipeds. If a delphinoid cetacean or pinniped is sighted within or transiting towards the 200 m exclusion zone, the electromechanical survey equipment must be powered down to the lowest power output that is technically feasible. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after power-down. Subsequent power up of the electromechanical survey equipment must use the ramp-up provisions described above and may occur after (1) as soon as the 200 m exclusion zone is clear of a delphinoid cetacean and/or pinniped or (2) a determination by the protected species observer after a minimum of 10 minutes of observation that the delphinoid cetacean and/or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bowride or chase towed equipment. An incursion into the exclusion zone by a non-delphinoid cetacean or sea turtle during a power-down requires implementation of the shut-down procedures described above.

8. Pauses in Electromechanical Survey Sound Source. The lessee must ensure that if the electromechanical sound source shuts down for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must restart the electromechanical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all

cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started 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 cetaceans, pinnipeds, 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 using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

### B.2.2. Geotechnical Survey Requirements

1. Establishment of Exclusion Zone. The lessee must ensure that a 200 m radius exclusion zone for all cetaceans, pinnipeds, and sea turtles will be monitored by a protected species observer around any vessel conducting geotechnical surveys (i.e. drilling, cone penetrometer tests, etc.).

2. Modification of Exclusion Zone. The Lessee may use the field-verification method as described below to modify the geotechnical survey exclusion zone for specific geotechnical sampling equipment being utilized. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the 160 dB zone. This modified zone must be used for all subsequent use of field-verified equipment and may be periodically reevaluated based on the regular sound monitoring described below. The Lessee must obtain Lessor approval of any new exclusion zone before it may be implemented.

3. Field Verification of Exclusion Zone. If the Lessee wishes to modify the exclusion zone as described above, the Lessee must conduct field verification of the exclusion zone for specific geotechnical sampling equipment. The results of the measurements from the equipment must be used to establish a new exclusion zone, which may be greater than or less than the 200-meter default exclusion zone depending on the results of the field tests. The Lessee must take acoustic measurements at a minimum of two reference locations. The first location must be at a distance of 200 meters from the sound source and the second location must be as close to the sound source as technically feasible. Sound measurements must be taken at the reference locations at two depths (i.e., a depth at mid-water and a depth at approximately 1 m above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the sound source to the reference location.

4. Clearance of Exclusion Zone. helessee must ensure that geotechnical sound source must not be activated until the protected species observer has reported the exclusion zone clear of all cetaceans, pinnipeds, and sea turtles for 60 minutes

5. Shut Down for Non-Delphinoid Cetaceans and Sea Turtles. If any non-delphinoid cetaceans or sea turtles are sighted within or transiting towards the 200 m exclusion zone, an immediate shutdown of the geotechnical survey equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the geotechnical survey equipment may only occur following clearance of the 200 m exclusion zone for 60 minutes.

6. Pauses in Geotechnical Survey 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, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the lessee must restart the geotechnical survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, 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 only after the clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

## B.3. REQUIREMENTS FOR PILE DRIVING OF A METEOROLOGICAL TOWER FOUNDATION

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.

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 for consideration. The Lessor may, after consultation with NMFS, decide to allow the Lessee to conduct pile driving for a meteorological tower foundation at night or when visual observation is otherwise impaired.

Protected-Species Observer. The Lessee must ensure that the exclusion zone for all pile driving for a meteorological tower foundation is monitored by a NMFS-approved protected-species observer. The Lessee must provide to the Lessor a list of observers 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 observers must be provided fifteen (15) calendar days prior to each observer's start date. The Lessor will send the observer information to NMFS for approval.

Optical Device Availability. The Lessee must ensure that binoculars or other suitable equipment are available to each observer to adequately perceive and monitor distant objects within the exclusion zone during meteorological tower construction activities.

Pre-Construction Briefing. Prior to the start of construction, 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 purposes, and review operational procedures. This briefing must include construction supervisors and crews, and the protected species observer(s) (see further below). The Resident Engineer (or other authorized individual) will have the authority to stop or delay any construction activity, if deemed necessary by the resident Engineer. New personnel must be briefed as they join the work in progress.

### B.3.1. Requirements for Pile Driving

Prohibition on Pile Driving. The lessee must ensure that no pile-driving activities (e.g. pneumatic, hydraulic, or vibratory installation of foundation piles) occur from November 1 – April 30 nor during an active Dynamic Management Area (DMA) if the pile driving location is within the boundaries of the DMA as established by the National Marine Fisheries Service or within 7 kilometers of the boundaries of the DMA.

Establishment of Exclusion Zone. The lessee must ensure the establishment of a default 3281-foot (1,000-meter) radius exclusion zone for cetaceans, sea turtles, and pinnipeds around each pile driving site. The 3,281 feet (1,000 m) exclusion zone must be monitored from two locations. One observer 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. An additional observer 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 m to 1,000 m from the sound source.

Modification of Exclusion Zone. If multiple piles are being driven, the lessee may use the field verification method described below to modify the default exclusion zone provided above for pile driving activities. 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.

Field Verification of Exclusion Zone. If the lessee wishes to modify the exclusion zone the lessee must conduct a field verification of the exclusion zone during pile driving of the first pile if the meteorological tower foundation design includes multiple piles. The results of the measurements from the first pile must be used to establish a new exclusion zone which may be greater than or less than the 3281-foot (1,000-meter) default exclusion zone, depending on the results of the field tests. Acoustic measurements must take place during the driving of the last half (deepest pile segment) for any given openwater pile. A minimum of two reference locations must be established at a distance of 1,640 feet (500 meters) and 3281-foot (1,000-meter) from the pile driving. Sound measurements must be taken at the reference locations at two depths (a depth at midwater and a depth at approximately 1m above the seafloor). Sound pressure levels must be measured and reported in the field in dB re 1 μPa rms (impulse). An infrared range finder may be used to determine distance from the pile to the reference location.

Clearance of Exclusion Zone. The lessee must ensure that visual monitoring of the 1,000 m exclusion zone must begin no less than 60 minutes prior to the beginning of soft start and continue until pile driving operations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a cetacean, pinniped, or sea turtle is observed, the observer 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 observer must continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals.

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 cetaceans, pinnipeds, and sea turtles near the project area by allowing them to vacate the area prior to the commencement of pile driving activities. The soft start requires an initial set of 3 strikes from the impact hammer at 40 percent energy with a one minute waiting period between subsequent 3 strike sets.

Shut Down for Cetaceans, Pinnipeds, and Sea Turtles. The lessee must ensure that any time a cetacean, pinniped, and/or sea turtle is observed within the 1,000 m exclusion zone, the observer must notify the Resident Engineer (or other authorized individual) and call for a shutdown of pile driving activity. The pile driving activity must cease as soon as it is safe to do so. Any disagreement or discussion should occur only after shut-down, 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 1,000 m exclusion zone of any cetacean, pinniped, and/or sea turtle for 60 minutes.

Pauses in Pile Driving Activity. The lessee must ensure that if pile driving ceases for 30 minutes or more and a cetacean, pinniped, and/or sea turtle is sighted within the exclusion zone prior to re-start of pile driving, the observer(s) must notify the Resident Engineer (or other authorized individual) that an additional 60 minute visual and acoustic observation period must be completed, as described above, before restarting pile driving activities.

A pause in pile driving for less than 30 minutes must still begin with soft start but will not require the 60 minute clearance period as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 30-minutes or less, the lessee must clear the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

## B.4. 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 contact information provided by the Lessor, to fulfill these requirements:

1. Reporting Injured or Dead Protected Species. The Lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals or sea turtles) are reported to the NMFS Northeast Region's Stranding Hotline (800-900-3622 or current) within 24 hours of sighting, regardless of whether the injury or death is caused by a vessel. In addition, if the injury or death was caused by a collision with a project-related vessel, the Lessee must ensure that the Lessor is notified of the strike within 24 hours. The notification of such strike must include the date and location (latitude/longitude) of the strike, the name of the vessel involved, and the species identification or a description of the animal, if possible. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure that the vessel assist in any salvage effort as requested by NMFS.

2. Reporting Observed Impacts to Protected Species. heobserver must report any observations concerning impacts on Endangered Species Act listed marine mammals or sea turtles to the Lessor and NMFS within 48 hours. Any observed Takes of listed marine mammals or sea turtles resulting in injury or mortality must be reported within 24 hours to the Lessor and NMFS.

3. Report Information. Data on all protected-species observations must be recorded based on standard marine mammal observer collection data by the protected-species observer. This information must include: dates, times, and locations of survey operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, and behavior); and details of any observed Taking (e.g., behavioral disturbances or injury/mortality).

4. Final Report of G&G Survey Activities and Observations. The lessee must provide the Lessor and NMFS with a report within ninety (90) calendar days following the commencement of HRG and/or geotechnical sampling activities that includes a summary

of the survey activities and an estimate of the number of listed marine mammals and sea turtles observed or Taken during these survey activities.

5. Final Technical Report for Meteorological Tower Construction and Observations. The lessee must provide the Lessor and NMFS a report within 120 days after completion of the pile driving and construction activities. The report must include full documentation of methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals and sea turtles that may have been taken during construction activities, and provides an interpretation of the results and effectiveness of all monitoring tasks.

Reports must be sent to:

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 Incidental Take Coordinator
Phone: 978-281-9328
Email: incidental.take@noaa.gov

## B.5. MEASURES FOR ESA-LISTED BIRDS AND BATS

Based on the following assumptions regarding the proposed action (see Section 3 of the EA) within the WEA (Figure 2-1), no additional mitigations for ESA-listed and ESA candidate species are necessary.

Assumptions:

- It is anticipated that meteorological towers constructed for site assessment activities would be self-supported structures and would not require guy wires for support or stability.
- It is anticipated that only red flashing strobe-like lights metrological towers will be used for metrological towers to meet FAA requirements. In addition, it also anticipated that navigation lights for towers and buoys will be compliance with USCG requirements. Finally, it is anticipated that any additional lights (e.g., work lights) on towers and support vessels will be used only when necessary and be hooded downward and directed when possible to reduce upward illumination and illumination of adjacent waters.

In addition, meteorological towers will be required to have visibility sensors to collect data on climatic conditions above and beyond wind speed, direction and other associated metrics generally collected at meteorological towers. This information will assist BOEM and USFWS with evaluating the impacts of future offshore wind facilities on threatened and endangered birds, migratory birds, and bats.

## B.6. REQUIREMENTS DURING DECOMMISSIONING

Essentially, the decommissioning process is the reverse of the construction process (absent pile driving), and the impacts from decommissioning would likely mirror those of construction. In addition, vessel activity during decommissioning would be essentially the same as that required during construction. Therefore, the vessel mitigation measures will be required.

Foundation structures must be removed by cutting at least 15 feet (4.6 meters) below mudline (see 30 CFR 585.910(a). BOEM assumes the meteorological towers to be constructed in southern New England can be removed using non-explosive severing methods. As detailed in 30 CFR Part 585.902, before the lessee decommissions the facilities under their SAP, the lessee must submit a decommissioning application and receive approval from the BOEM. Furthermore, the approval of the decommissioning concept/methodology in the SAP is not an approval of a decommissioning application.

## B.7. OTHER NON-ESA RELATED STANDARD OPERATING CONDITIONS

The regulations for site assessment plans found at 30 CFR Part 585.610 specify the requirements of a site assessment plan. These include a description of the measures the lessee will use to avoid or minimize adverse effects and any potential incidental take of endangered species before conducting activities on the lease, and how the lessee will mitigate environmental impacts from your proposed activities. 30 CFR 585.801 also specify requirements of the lessee to reduce impacts on protected species.

## B.8. SITE CHARACTERIZATION DATA COLLECTION

In addition to the collection of meteorological and oceanographic data, the purpose of these meteorological towers/buoys and site characterization surveys are to also collect biological and archaeological data. This data will assist in future analysis of proposed wind facilities. In addition to required reports, all site characterization data will be shared with NMFS, USFWS, and appropriate State agencies upon request.

# Appendix C
# Vessel Trip Calculations

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| HRG surveys of OCS blocks | | | |
|---|---|---|---|
| Alternative | # leases | 297 survey days/lease | # round trips |
| A | 5 | 297 | 1485 |
| B | 3 | 297 | 891 |
| C | 5 | 297 | 1485 |
| D | 3 | 297 | 891 |

| **HRG surveying of cable routes** | | | | | |
|---|---|---|---|---|---|
| Alternative | # cable routes | miles/ route | 1 hr survey per mile cable | # hrs surveyed per day | total days (round trips) |
| A | 5 | 150 | 150 | 10 | 15 |
| B | 3 | 90 | 90 | 10 | 9 |
| C | 5 | 150 | 150 | 10 | 15 |
| D | 3 | 90 | 90 | 10 | 9 |

| **Avian Surveys - high** | | | |
|---|---|---|---|
| Alternative | baseline - Alt A max surveys | ratio to Alt A | total round trips |
| A | 540 | 1 | 540 |
| B | 540 | 0.6 | 324 |
| C | 540 | 1 | 540 |
| D | 540 | 0.6 | 324 |

| **Avian Surveys - low** | | | |
|---|---|---|---|
| Alternative | baseline - Alt A max surveys | ratio to Alt A | total round trips |
| A | 360 | 1 | 360 |
| B | 360 | 0.6 | 216 |
| C | 360 | 1 | 360 |
| D | 360 | 0.6 | 216 |

| **Fish Surveys** | | | |
|---|---|---|---|
| Alternative | baseline - Alt A max surveys | ratio to Alt A | total round trips |
| A | 60 | 1 | 60 |
| B | 60 | 0.6 | 36 |
| C | 60 | 1 | 60 |
| D | 60 | 0.6 | 36 |

| **Geotech sampling - high** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alternative | # whole blocks | # partial blocks | turbines per whole block | turbines per partial block | WEA surveying total | # samples @ buoy foundations | # samples per nm of cable route | **TOTAL GEOTECH** |
| A | 117 | 20 | 20 | 10 | 2540 | 10 | 150 | **2700** |
| B | 83 | 18 | 20 | 10 | 1840 | 6 | 90 | **1936** |
| C | 108 | 20 | 20 | 10 | 2360 | 8 | 120 | **2488** |
| D | 81 | 28 | 20 | 10 | 1900 | 6 | 90 | **1996** |

| **Geotech sampling - low** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alternative | # whole blocks | # partial blocks | turbines per whole block | turbines per partial block | WEA surveying total | # samples @ buoy foundations | # samples per nm of cable route | **TOTAL GEOTECH** |
| A | 117 | 20 | 4 | 2 | 508 | 10 | 150 | **668** |
| B | 83 | 18 | 4 | 2 | 368 | 6 | 90 | **464** |
| C | 108 | 20 | 4 | 2 | 472 | 8 | 120 | **600** |
| D | 81 | 28 | 4 | 2 | 380 | 6 | 90 | **476** |

| **Total Vessel Trips** | **Low Range** | **High Range** |
|---|---|---|
| **Alternative A** | 2588 | 4800 |
| **Alternative B** | 1616 | 3196 |
| **Alternative C** | 2520 | 4588 |
| **Alternative D** | 1628 | 3256 |

| Construction | | | |
|---|---|---|---|
| | # towers | round trips for construction per tower | total round trips |
| Alt A | 5 | 40 | 200 |
| Alt B | 3 | 40 | 120 |
| Alt C | 5 | 40 | 200 |
| Alt D | 3 | 40 | 120 |

| Maintenance - quarterly and weekly | | | | |
|---|---|---|---|---|
| | # towers | quarterly visits | years | total trips |
| Alt A | 5 | 4 | 5 | 100 |
| Alt B | 3 | 4 | 5 | 60 |
| Alt C | 5 | 4 | 5 | 100 |
| Alt D | 3 | 4 | 5 | 60 |
| | | | | |
| | # towers | weekly visits | years | total trips |
| Alt A | 5 | 52 | 5 | 1300 |
| Alt B | 3 | 52 | 5 | 780 |
| Alt C | 5 | 52 | 5 | 1300 |
| Alt D | 3 | 52 | 5 | 780 |

| Decommission | | | |
|---|---|---|---|
| | # towers | round trips for construction per tower | total round trips |
| Alt A | 5 | 40 | 200 |
| Alt B | 3 | 40 | 120 |
| Alt C | 5 | 40 | 200 |
| Alt D | 3 | 40 | 120 |

| Total | Low Range | High Range |
|---|---|---|
| **Alternative A** | 500 | 1700 |
| **Alternative B** | 300 | 1020 |
| **Alternative C** | 500 | 1700 |
| **Alternative D** | 300 | 1020 |

| Construction | | | |
|---|---|---|---|
| | #buoys | round trips for construction per buoy - low | total round trips |
| Alt A | 10 | 1 | 10 |
| Alt B | 6 | 1 | 6 |
| Alt C | 10 | 1 | 10 |
| Alt D | 6 | 1 | 6 |

| Maintenance - quarterly and monthly | | | | |
|---|---|---|---|---|
| | #buoys | quarterly visits | years | total trips |
| Alt A | 10 | 4 | 5 | 200 |
| Alt B | 6 | 4 | 5 | 120 |
| Alt C | 10 | 4 | 5 | 200 |
| Alt D | 6 | 4 | 5 | 120 |
| | | | | |
| | #towers | monthly | years | total trips |
| Alt A | 10 | 12 | 5 | 600 |
| Alt B | 6 | 12 | 5 | 360 |
| Alt C | 10 | 12 | 5 | 600 |
| Alt D | 6 | 12 | 5 | 360 |

| Decommission | | | |
|---|---|---|---|
| | #buoys | round trips for construction per buoy - low | total round trips |
| Alt A | 10 | 1 | 10 |
| Alt B | 6 | 1 | 6 |
| Alt C | 10 | 1 | 10 |
| Alt D | 6 | 1 | 6 |

| Total | Low Range |
|---|---|
| **Alternative A** | 220 |
| **Alternative B** | 132 |
| **Alternative C** | 220 |
| **Alternative D** | 132 |

Total Vessel Trip Calculations for Site Characterization and Site Assessment Activites

| | **Site Characterization** | | **Site Assessment** | | **TOTAL** | |
|---|---|---|---|---|---|---|
| | Low Range | High Range | Low Range | High Range | Low Range | High Range |
| Alternative A | 2588 | 4800 | 220 | 1700 | 2808 | 6500 |
| Alternative B | 1616 | 3196 | 132 | 1020 | 1748 | 4216 |
| Alternative C | 2520 | 4588 | 220 | 1700 | 2740 | 6288 |
| Alternative D | 1624 | 3236 | 132 | 1020 | 1756 | 4256 |

# Appendix D
# Air Quality Emissions Calculations

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## Emissions Summary for Average Year

| Phase/Source Description | Emissions (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | $NO_x$ | VOC | $PM_{2.5}$ | $PM_{10}$ | $SO_x$ | $CO_2$ | $N_2O$ | $CH_4$ |
| ***Site Characterization - Staff Commuting for Surveys*** | | | | | | | | | |
| - POVs | 0.88 | 4.00E-02 | 5.33E-02 | 3.11E-03 | 5.33E-03 | 2.22E-03 | 74.19 | 7.26E-04 | 3.49E-03 |
| ***Site Characterization - Off-Shore Surveys*** | | | | | | | | | |
| - Vessel Travel | 9.67 | 116.0 | 4.39 | 6.33 | 6.33 | 11.43 | 5,501.8 | 0.16 | 0.72 |
| - Fuel Spills | - | - | 0.31 | - | - | - | - | - | - |
| **SUBTOTAL One year from Years 1-5** | **10.55** | **116.1** | **4.45** | **6.33** | **6.33** | **11.43** | **5,576.0** | **0.16** | **0.72** |
| ***Site Assessment - On-Shore Tower Construction*** | | | | | | | | | |
| - POVs | 9.10E-02 | 1.43E-02 | 1.36E-02 | 1.84E-03 | 2.81E-03 | 9.68E-04 | 49.88 | 1.60E-04 | 3.21E-04 |
| - Construction Equipment | 0.16 | 0.37 | 3.84E-02 | 4.87E-02 | 4.87E-02 | 3.19E-02 | 20.35 | 5.96E-04 | 3.69E-02 |
| ***Site Assessment - Off-Shore Tower Construction*** | | | | | | | | | |
| - Vessel Travel | 0.36 | 4.28 | 0.16 | 0.23 | 0.23 | 0.42 | 202.8 | 5.88E-03 | 2.65E-02 |
| - Construction Equipment | 0.11 | 0.20 | 2.53E-02 | 2.73E-02 | 2.73E-02 | 1.76E-02 | 9.54 | 2.79E-04 | 1.73E-02 |
| - Fuel Spills | - | - | 0.31 | - | - | - | - | - | - |
| ***Site Assessment - On-Shore O&M*** | | | | | | | | | |
| - POVs | 6.83E-02 | 3.10E-03 | 4.13E-03 | 2.41E-04 | 4.13E-04 | 1.72E-04 | 5.74 | 5.62E-05 | 2.70E-04 |
| ***Site Assessment - Off-Shore O&M*** | | | | | | | | | |
| - Vessel Travel | 1.16 | 13.96 | 0.53 | 0.76 | 0.76 | 1.38 | 662.2 | 1.92E-02 | 8.64E-02 |
| - Generators | 10.53 | 48.88 | 3.96 | 3.47 | 3.47 | 3.23 | 1,544.9 | - | - |
| - Fuel Spills | - | - | 0.31 | - | - | - | - | - | - |
| ***Site Assessment - On-Shore Decommission*** | | | | | | | | | |
| - POVs | 9.10E-02 | 1.43E-02 | 1.36E-02 | 1.84E-03 | 2.81E-03 | 9.68E-04 | 49.88 | 1.60E-04 | 3.21E-04 |
| ***Site Assessment - Off-Shore Decommission*** | | | | | | | | | |
| - Vessel Travel | 0.36 | 4.28 | 0.16 | 0.23 | 0.23 | 0.42 | 202.8 | 5.88E-03 | 2.65E-02 |
| - Construction Equipment | 0.16 | 0.29 | 3.68E-02 | 3.95E-02 | 3.95E-02 | 2.55E-02 | 21.19 | 6.21E-04 | 3.84E-02 |
| - Fuel Spills | - | - | 0.31 | - | - | - | - | - | - |
| **SUBTOTAL One year from Years 1-5** | **13.09** | **72.29** | **5.89** | **4.82** | **4.82** | **5.53** | **2,769.3** | **3.28E-02** | **0.23** |
| **TOTAL Emissions from Average Year*** | **23.64** | **188.3** | **10.33** | **11.15** | **11.15** | **16.96** | **-** | **-** | **-** |
| | | | | | **TOTAL GHG** | | **8,345.2** | **0.19** | **0.95** |

## Site Characterization Activities

**On-Shore Activities - Staff Commuting to Job Site**

***Personal Vehicle Round Trips for Vessel Trips Associated with Site Characterization Activities***

| Survey Task | Total No. of Vessel Round Trips | Duration of Survey Task (years) | No. of Vessel Round Trips (per year)[1] | No. of POV Round Trips (per year)[2] |
|---|---|---|---|---|
| HRG Survey of OCS blocks within WEA under Alternative A | 1,485 | 5 | 297 | 891 |
| HRG surveys of 5 cable routes | 15 | 5 | 3 | 9 |
| Geotechnical Sampling | 2,900 | 5 | 580 | 1,740 |
| Avian surveys | 540 | 3 | 180 | 540 |
| Fish surveys | 60 | 1 | 60 | 180 |
| **TOTAL** | **5,000** | **19** | **1,120** | **3,360** |

1. Round trips per year estimated by dividing total round trips per task by the number of years over which the surveys will be conducted.
2. 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.

***Personal Vehicle Emission Factors*** [1]

| Personal Vehicle Type | Model Year[2] | Calendar Year[2] | Emission Factors (grams/mile) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$[3] | $PM_{10}$[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***

| Personal Vehicle Type | Total No. of Round Trips | Total Miles (per trip)[4] | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Light Duty Gasoline Vehicles | 3,360 | 60 | **0.88** | **4.00E-02** | **5.33E-02** | **3.11E-03** | **5.33E-03** | **2.22E-03** | **74.19** | **7.26E-04** | **3.49E-03** |

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 each employee drives 60 miles round trip.

## Site Characterization Activities

### Off-Shore Activities - Surveys

***Survey Vessel Details***

| Survey Task | Vessel Type | Total No. of Vessel Round Trips | Duration of Survey Task (years) | No. of Vessel Round Trips (per year)[2] | Avg. Miles Per Round Trip (nautical miles) | Total (nautical miles/yr)[3] | Activity (hrs/yr)[4] |
|---|---|---|---|---|---|---|---|
| HRG Survey of OCS blocks within WEA under Alternative A | Crew Boat | 1,485 | 5 | 297 | - | 12,700 | 2,822 |
| HRG Surveys of 5 cable routes | Crew Boat | 15 | 5 | 3 | - | 150 | 33 |
| Geotechnical Sampling[1] | Small Tug Boat | 2,900 | 5 | 580 | 180 | 104,400 | 8,700 |
| Geotechnical Sampling[1] | Cargo Barge | 2,900 | 5 | 580 | 180 | 104,400 | 8,700 |
| Avian Surveys | Crew Boat | 540 | 3 | 180 | 180 | 32,400 | 1,800 |
| Fish Surveys | Crew Boat | 60 | 1 | 60 | 180 | 10,800 | 600 |

1. Assume all of the 2,900 total 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. 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 HRG Survey of 63,500 nautical miles (i.e., 14,100 hours of vessel time) over 5 years equals 12,700 nm per year. Similarly, 750 nm of HRG Survey Cable Routes over 5 years equals 150 nm per year. Total nm for other surveys based on calculated round trips multipled by average round trip nm.
4. Assume an average speed of 4.5 knots/hour for HRG surveys, 12 knots/hour for the tug boats/barges, and 18 knots/hour for crew boats 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

***Emission Factors for Vessels***

| Vessel Type | Engine Size (hp) | Engine Power (kW)[1] | Load Factor (%)[2] | Emission Factors (g/kW-hr)[3] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CO | NOx | VOC | $PM_{2.5}$[4] | $PM_{10}$ | SOx[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 | 1,491 | 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***

| Vessel Type | Emission (tons/year, metric tons/year for GHG pollutants)[1,2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Crew Boat | 2.35 | 28.2 | 1.07 | 1.54 | 1.54 | 2.78 | 1,338.6 | 3.88E-02 | 0.17 |
| Small Tug Boat | 7.32 | 87.8 | 3.33 | 4.79 | 4.79 | 8.65 | 4,163.2 | 0.12 | 0.54 |
| **TOTAL** | **9.67** | **116.0** | **4.39** | **6.33** | **6.33** | **11.43** | **5,501.8** | **0.16** | **0.72** |

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.

### Off-Shore 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.

## Site Assessment Activities

**On-Shore Activities - Staff Commuting to Job Site and Material/Equipment Delivery**

***Vehicle Emission Factors*** [1]

| Personal Vehicle Type | Model Year[2] | Calendar Year[2] | Emission Factors (grams/mile) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$[3] | $PM_{10}$[3] | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| 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***

| Personal Vehicle Type | Total No. of Round Trips[4] | Total Miles (per trip)[5] | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Heavy Duty Diesel Vehicles | 12 | 60 | 2.38E-04 | 2.67E-03 | 2.86E-04 | 3.17E-05 | 4.76E-05 | 1.59E-05 | 1.48 | 6.91E-06 | 7.34E-06 |
| Light Duty Gasoline Vehicles | 48 | 60 | 6.30E-02 | 2.86E-03 | 3.81E-03 | 2.22E-04 | 3.81E-04 | 1.59E-04 | 5.30 | 5.18E-05 | 2.49E-04 |
| Light Duty Diesel Trucks | 48 | 60 | 2.78E-02 | 8.73E-03 | 9.52E-03 | 1.59E-03 | 2.38E-03 | 7.94E-04 | 43.10 | 1.01E-04 | 6.48E-05 |
| **TOTAL** | - | - | **9.10E-02** | **1.43E-02** | **1.36E-02** | **1.84E-03** | **2.81E-03** | **9.68E-04** | **49.88** | **1.60E-04** | **3.21E-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-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 erection of all five towers will take place over the course of five years. Assume an average of 25 contractors travel to the site over 240 days total. In addition, assume an average of five staff travel to the site over 240 days total. Lastly, assume two heavy duty trucks travel to the site over 60 days total. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
5. Assume each employee drives 60 miles round trip.

**On-Shore Activities - Heavy Equipment Use**

| Construction Equipment | Usage (hrs) | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Cranes | 192 | 7.42E-02 | 0.18 | 2.28E-02 | 2.54E-02 | 2.54E-02 | 1.64E-02 | 10.17 | 2.98E-04 | 1.84E-02 |
| Rubber Tired Loaders | 192 | 8.67E-02 | 0.19 | 1.56E-02 | 2.33E-02 | 2.33E-02 | 1.55E-02 | 10.17 | 2.98E-04 | 1.84E-02 |
| **TOTAL** | **-** | **0.16** | **0.37** | **3.84E-02** | **4.87E-02** | **4.87E-02** | **3.19E-02** | **20.35** | **5.96E-04** | **3.69E-02** |

1. Only cranes and loaders were assumed to be used on-shore during assembly of the towers to move and lift the pieces into place.
2. Assume crane and rubber tire loader operate half of the 240 days estimated to complete the construction of the towers, for 8 hours per day (i.e., 960 hours) over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume $PM_{10} = PM_{2.5}$. See EF Construction Equip tab for emission factors.

## Site Assessment Activities

**Off-Shore Activities - Transport of Towers to Sites from Ports**

***Vessel Details for Construction of Towers***

| Vessel Type | Total No. of Vessel Round Trips[1] | Avg. Miles Per Round Trip (nautical miles) | Total (nautical miles/yr) | Activity (hrs/yr)[2] |
|---|---|---|---|---|
| Crane Barge | 2 | 180 | 360 | 30 |
| Deck Cargo | 2 | 180 | 360 | 30 |
| Small Cargo Barge | 2 | 180 | 360 | 30 |
| Crew Boat | 21 | 180 | 3,780 | 210 |
| Small Tug Boat | 4 | 180 | 720 | 60 |
| Large Tug Boat | 8 | 180 | 1,440 | 120 |

1. Based upon projected vessel usage for the construction of one met tower (Table 3.5), total round trips multipled by five for a total of five met towers. It was assumed that these trips would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**

2. Assume an average speed of 12 knots/hour for the tug boats/barges and 18 knots/hour 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

***Emission Factors for Vessels***

| Vessel Type[1] | Engine Size (hp) | Engine Power (kW)[2] | Load Factor (%)[3] | Emission Factors (g/kW-hr)[4] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CO | NOx | VOC | $PM_{2.5}$[5] | $PM_{10}$ | SOx[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 construction 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***

| Vessel Type | Emission (tons/year, metric tons/year for GHG pollutants)[1,2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Crew Boat | 9.40E-02 | 1.13 | 4.27E-02 | 6.15E-02 | 6.15E-02 | 0.11 | 53.49 | 1.55E-03 | 6.98E-03 |
| Small Tug Boat | 5.05E-02 | 0.61 | 2.29E-02 | 3.30E-02 | 3.30E-02 | 5.96E-02 | 28.71 | 8.32E-04 | 3.74E-03 |
| Large Tug Boat | 0.21 | 2.54 | 0.10 | 0.14 | 0.14 | 0.25 | 120.6 | 3.50E-03 | 1.57E-02 |
| **TOTAL** | **0.36** | **4.28** | **0.16** | **0.23** | **0.23** | **0.42** | **202.8** | **5.88E-03** | **2.65E-02** |

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.

## Site Assessment Activities

**Off-Shore Activities - Construction of Pilings**

| Construction Equipment | Usage (hrs) | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Bore/Drill Rigs | 30 | 4.77E-02 | 5.71E-02 | 7.48E-03 | 7.46E-03 | 7.46E-03 | 4.82E-03 | 1.59 | 4.66E-05 | 2.88E-03 |
| Cranes | 150 | 5.79E-02 | 0.14 | 1.78E-02 | 1.99E-02 | 1.99E-02 | 1.28E-02 | 7.95 | 2.33E-04 | 1.44E-02 |
| **TOTAL** | **-** | **0.11** | **0.20** | **2.53E-02** | **2.73E-02** | **2.73E-02** | **1.76E-02** | **9.54** | **2.79E-04** | **1.73E-02** |

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 each of the five towers. It was assumed that these activities would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume $PM_{10} = PM_{2.5}$. See EF Construction Equip tab for emission factors.
4. Assume construction of towers instead of buoys for a worst case scenario.

**Off-Shore 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.

*Personal Vehicle Emission Factors*[1]

| Personal Vehicle Type | Model Year[2] | Calendar Year[2] | Emission Factors (grams/mile) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$[3] | $PM_{10}$[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*

| Personal Vehicle Type | Total No. of Round Trips[4] | Total Miles (per trip)[5] | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Light Duty Gasoline Vehicles | 260 | 60 | **6.83E-02** | **3.10E-03** | **4.13E-03** | **2.41E-04** | **4.13E-04** | **1.72E-04** | **5.74** | **5.62E-05** | **2.70E-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-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 five weekly trips by one person to observe/service each of the five towers, and to refuel/perform maintenance of the assumed three generators. Only one year was modeled but it captures all five towers.
5. Assume 60 miles round trip.

## Site Assessment- Operation and Maintenance

**Off-Shore Activities - Routine Maintenance and Evaluation**

***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 | 260 | 1 | 260 | 180 | 46,800 | 2,600 |

1. Assume five round trips each week using a crew boat to observe/service each of the five towers, including fueling/performing maintenance on the assumed three generators. Only one year was modeled but it captures all five towers.
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/hour 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 | NOx | VOC | $PM_{2.5}$[4] | $PM_{10}$ | SOx[5] | $CO_2$ | $N_2O$ | $CH_4$ |
| Crew Boat | 1,000 | 746 | 45% | 1.10 | 13.20 | 0.50 | 0.72 | 0.72 | 1.30 | 690.00 | 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***

| Vessel Type | Emission (tons/year, metric tons/year for GHG pollutants))[1,2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Crew Boat | 1.16 | 13.96 | 0.53 | 0.76 | 0.76 | 1.38 | 662.2 | 1.92E-02 | 8.64E-02 |
| **TOTAL** | **1.16** | **13.96** | **0.53** | **0.76** | **0.76** | **1.38** | **662.2** | **1.92E-02** | **8.64E-02** |

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.

## Site Assessment- Operation and Maintenance

**Off-Shore Activities - Operation of Three Prime Generators**

**Unit Information**

| Source | Estimated Rated Capacity (hp) | Hours (hours/year) | Fuel |
|---|---|---|---|
| Three 75 kW diesel-fired generators to serve as primary source of electricity for three of the five towers | 120 | 8,760 | Diesel |

**Emission Factors** [1,2]

| Pollutant | Diesel (lb/hp-hr) |
|---|---|
| $NO_x$ | 0.031 |
| CO | 6.68E-03 |
| PM | 2.20E-03 |
| $SO_2$ | 2.05E-03 |
| VOC | 2.51E-03 |
| $CO_2$ | 1.08 |

**Potential Criteria Pollutant Emissions** [3]

| Source | $NO_x$ (tpy) | CO (tpy) | $PM/PM_{10}/PM_{2.5}$ (tpy) | $SO_2$ (tpy) | VOC (tpy) | $CO_2$ (metric tpy) |
|---|---|---|---|---|---|---|
| Three 75 kW diesel-fired generators to serve as primary source of electricity for three of the five towers | 48.88 | 10.53 | 3.47 | 3.23 | 3.96 | 1,544.9 |
| **TOTAL** | **48.88** | **10.53** | **3.47** | **3.23** | **3.96** | **1,544.9** |

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, capturing all three generators.

**Off-Shore 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.

## Site Assessment - Decommission

**On-Shore Activities - Contractors Commuting to Job Site for Decommission**

***Vehicle Emission Factors*** [1]

| Personal Vehicle Type | Model Year[2] | Calendar Year[2] | Emission Factors (grams/mile) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$[3] | $PM_{10}$[3] | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| 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***

| Personal Vehicle Type | Total No. of Round Trips[4] | Total Miles (per trip)[5] | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Heavy Duty Diesel Vehicles | 12 | 60 | 2.38E-04 | 2.67E-03 | 2.86E-04 | 3.17E-05 | 4.76E-05 | 1.59E-05 | 1.48 | 6.91E-06 | 7.34E-06 |
| Light Duty Gasoline Vehicles | 48 | 60 | 6.30E-02 | 2.86E-03 | 3.81E-03 | 2.22E-04 | 3.81E-04 | 1.59E-04 | 5.30 | 5.18E-05 | 2.49E-04 |
| Light Duty Diesel Trucks | 48 | 60 | 2.78E-02 | 8.73E-03 | 9.52E-03 | 1.59E-03 | 2.38E-03 | 7.94E-04 | 43.10 | 1.01E-04 | 6.48E-05 |
| **TOTAL** | - | - | **9.10E-02** | **1.43E-02** | **1.36E-02** | **1.84E-03** | **2.81E-03** | **9.68E-04** | **49.88** | **1.60E-04** | **3.21E-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-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 PM2.5 an PM10 include fugitive sources of PM from brake and tire.
4. Assume decommissioning of all five towers will take place over the course of five years. Assume an average of 25 contractors travel to the site over 240 days total. In addition, assume an average of five staff travel to the site over 240 days total. Lastly, assume two heavy duty trucks travel to the site over 60 days total. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
5. Assume each employee drives 60 miles round trip.

## Site Assessment - Decommission

**Off-Shore Activities - Tower Decommissioning**

***Vessel Details for Decommissioning of Towers***

| 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 | 180 | 360 | 30 |
| Deck Cargo | 2 | 180 | 360 | 30 |
| Small Cargo Barge | 2 | 180 | 360 | 30 |
| Crew Boat | 21 | 180 | 3,780 | 210 |
| Small Tug Boat | 4 | 180 | 720 | 60 |
| Large Tug Boat | 8 | 180 | 1,440 | 120 |

1. Round trips for the decommissioning of five towers assumed to be equivalent to the construction of five towers, using Table 3-5 round trips per tower. It was assumed that these trips would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**

2. Assume an average speed of 12 knots/hour for the tug boats/barges and 18 knots/hour 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

***Emission Factors for Vessels***

| Vessel Type[1] | Engine Size (hp) | Engine Power (kW)[2] | Load Factor (%)[3] | Emission Factors (g/kW-hr)[4] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CO | NOx | VOC | $PM_{2.5}$[5] | $PM_{10}$ | SOx[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***

| Vessel Type | Emission (tons/year, metric tons/year for GHG pollutants)[1,2] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Crew Boat | 9.40E-02 | 1.13 | 4.27E-02 | 6.15E-02 | 6.15E-02 | 0.11 | 53.49 | 1.55E-03 | 6.98E-03 |
| Small Tug Boat | 5.05E-02 | 0.61 | 2.29E-02 | 3.30E-02 | 3.30E-02 | 5.96E-02 | 28.71 | 8.32E-04 | 3.74E-03 |
| Large Tug Boat | 0.21 | 2.54 | 0.10 | 0.14 | 0.14 | 0.25 | 120.6 | 3.50E-03 | 1.57E-02 |
| **TOTAL** | **0.36** | **4.28** | **0.16** | **0.23** | **0.23** | **0.42** | **202.8** | **5.88E-03** | **2.65E-02** |

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.

## Site Assessment - Decommission

**Off-Shore Activities - Deconstruction of Pilings**

| Construction Equipment | Usage (hrs) | Emission (tons/year, metric tons/year for GHG pollutants) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | CO | NOx | VOC | $PM_{2.5}$ | $PM_{10}$ | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Concrete/Indust. Saw | 200 | 8.29E-02 | 0.10 | 1.30E-02 | 1.30E-02 | 1.30E-02 | 8.38E-03 | 10.60 | 3.11E-04 | 1.92E-02 |
| Cranes | 200 | 7.72E-02 | 0.19 | 2.38E-02 | 2.65E-02 | 2.65E-02 | 1.71E-02 | 10.60 | 3.11E-04 | 1.92E-02 |
| **TOTAL** | **-** | **0.16** | **0.29** | **3.68E-02** | **3.95E-02** | **3.95E-02** | **2.55E-02** | **21.19** | **6.21E-04** | **3.84E-02** |

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 each of the five towers. It was assumed that these activities would be conducted over the course of five years. **Only one representative year was modeled in these calculations, assuming the work is evenly distributed over the five year span.**
3. Assume $PM_{10}$ = $PM_{2.5.}$ See EF Construction Equip tab for emission factors.
4. Assume decommissioning of towers instead of buoys for a worst case scenario.

**Off-Shore 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.

## Construction Equipment Air Quality Emission Factors

| Diesel Equipment | Average Rated HP[1] | Consumption (mpg)[2] | Loading Factors[3] | Emission Factors (grams/HP-hr)[4] | | | | | | Emission Factors (lbs/hr)[5] | | | | | | Emission Factors (grams/mile)[6] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CO | NOx | VOC | PM | Aldehydes | SOx | CO | NOx | VOC | PM | Aldehydes | SOx | $CO_2$ | $N_2O$ | $CH_4$ |
| Bore/Drill Rigs | 209 | 6.17 | 75% | 9.20 | 11.01 | 1.443 | 1.44 | 0.20 | 0.93 | 3.18 | 3.80 | 0.50 | 0.50 | 0.07 | 0.32 | 116.81 | 3.42E-03 | 0.21 |
| Concrete/Indust. Saw | 56 | 6.17 | 73% | 9.20 | 11.01 | 1.443 | 1.44 | 0.20 | 0.93 | 0.83 | 0.99 | 0.13 | 0.13 | 0.02 | 0.08 | 116.81 | 3.42E-03 | 0.21 |
| Cranes | 194 | 6.17 | 43% | 4.20 | 10.30 | 1.293 | 1.44 | 0.20 | 0.93 | 0.77 | 1.89 | 0.24 | 0.26 | 0.04 | 0.17 | 116.81 | 3.42E-03 | 0.21 |
| Rubber Tired Loaders | 158 | 6.17 | 54% | 4.80 | 10.30 | 0.863 | 1.29 | 0.20 | 0.86 | 0.90 | 1.94 | 0.16 | 0.24 | 0.04 | 0.16 | 116.81 | 3.42E-03 | 0.21 |

**Note**: The above information was selected from the following tables provided in the *Nonroad Engine and Vehicle Emission Study--Report* , US EPA Doc 21A-2001, 1991.

1. Table 2-04 for Inventory A (Inventory A generally gives higher results and is, therefore, more conservative than Inventory B)
2. Vehicle fuel consumption from USAF IERA Air Emissions Inventory Guidance Document For Mobile Sources at Air Force Installations, May 1999, Revised January 2002, Section 4.
3. Table 2-05 for Inventory A
4. Table 2-07a for Diesel Equipment
5. **Emission Factors** (lbs/hr) = **Average Rated HP** X **Loading Factors** X **Emission Factors** (grams/HP-hr) X **Conversion Factor** (grams to lbs)

6. GHG Emission factors obtained from Environment Canada National Inventory Report Greenhouse Gas Sources Section A13.1.4 Moderately Controlled Diesel Mobile Combustion; factors were changed from grams/liter to grams/mile using conversion factor 1 liter=0.264 gallons and average fuel consumption.

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# Appendix E
# Non ESA-listed Marine Mammals Figures

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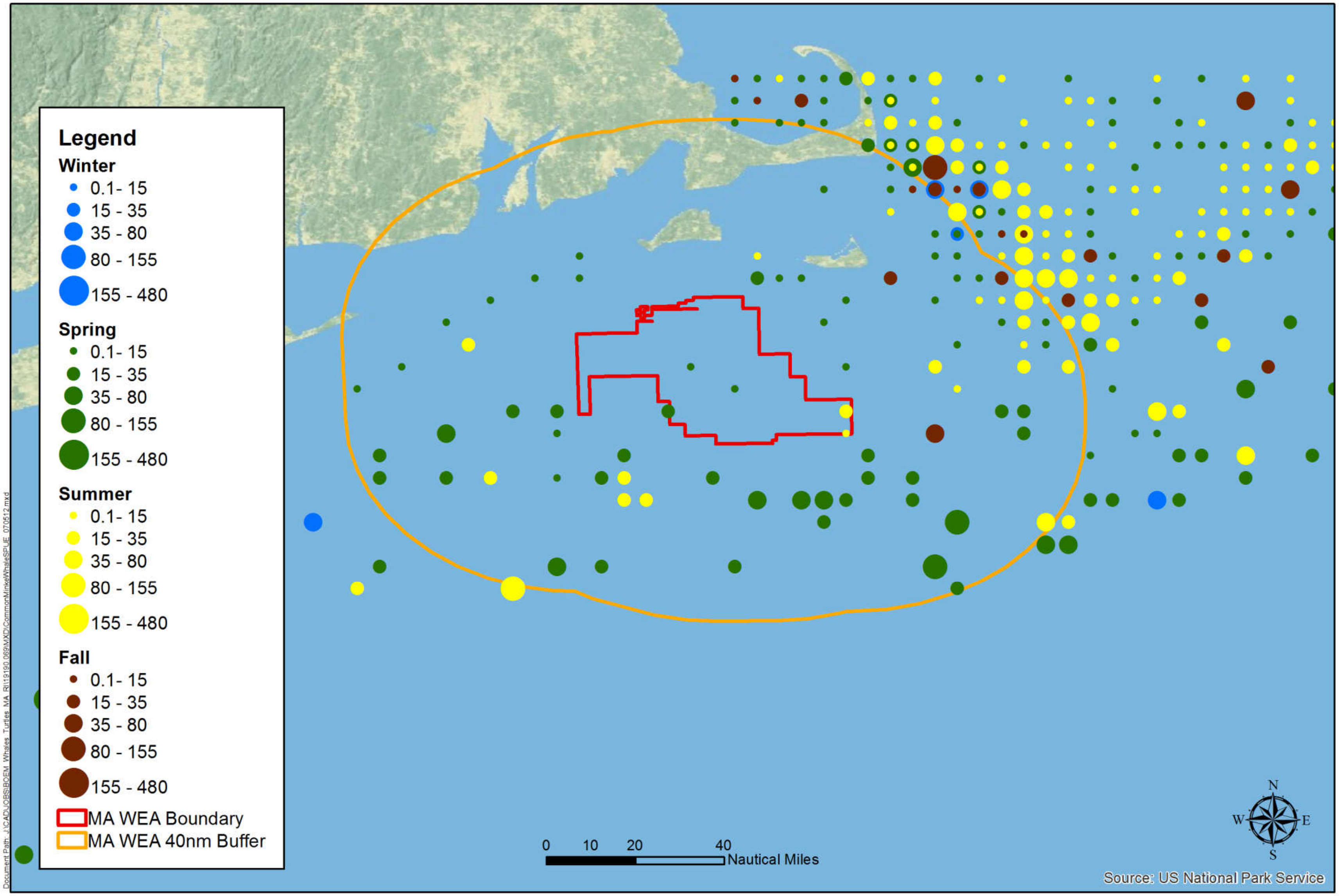


Figure 1. SPUE for minke whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

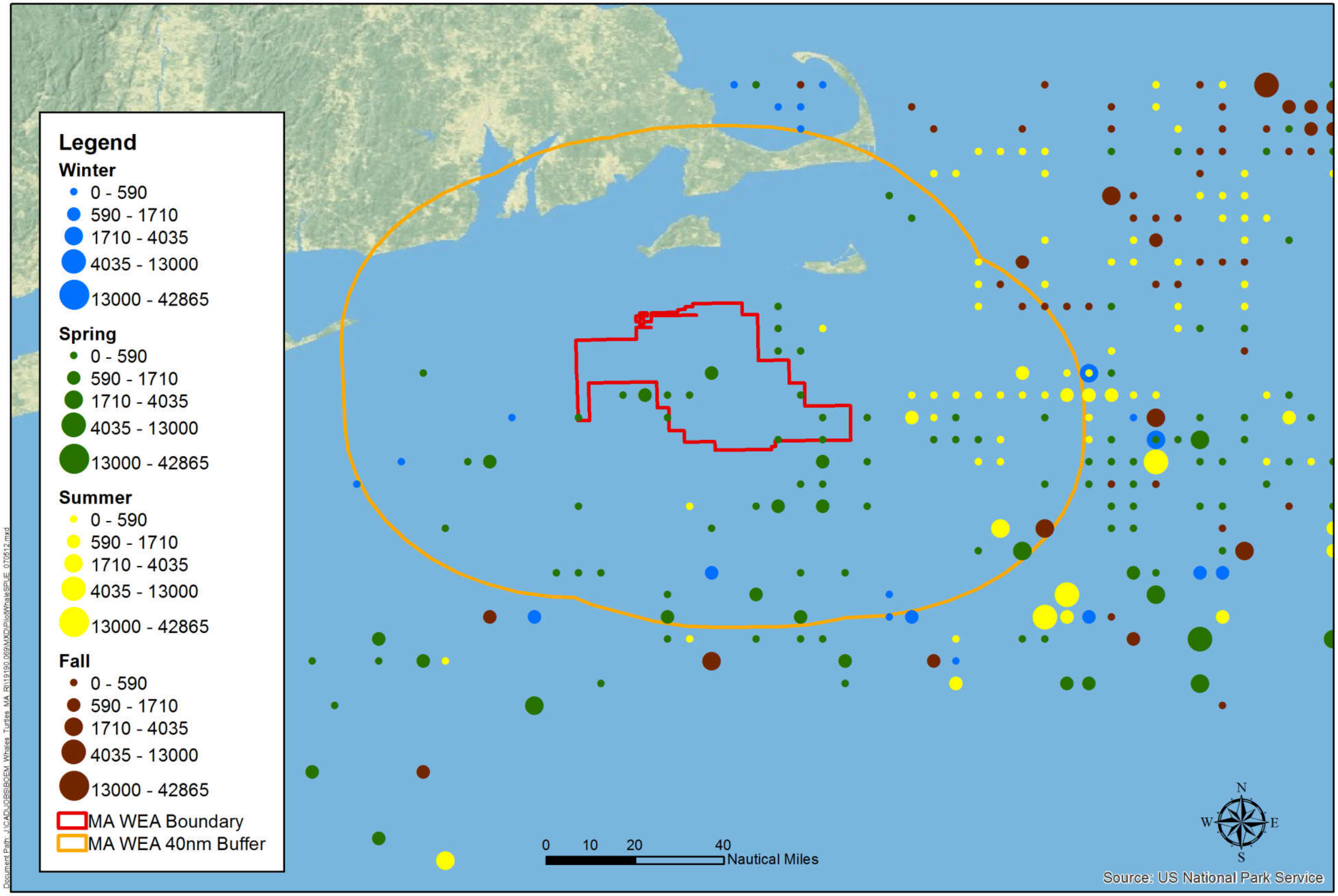


Figure 2. SPUE for pilot whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

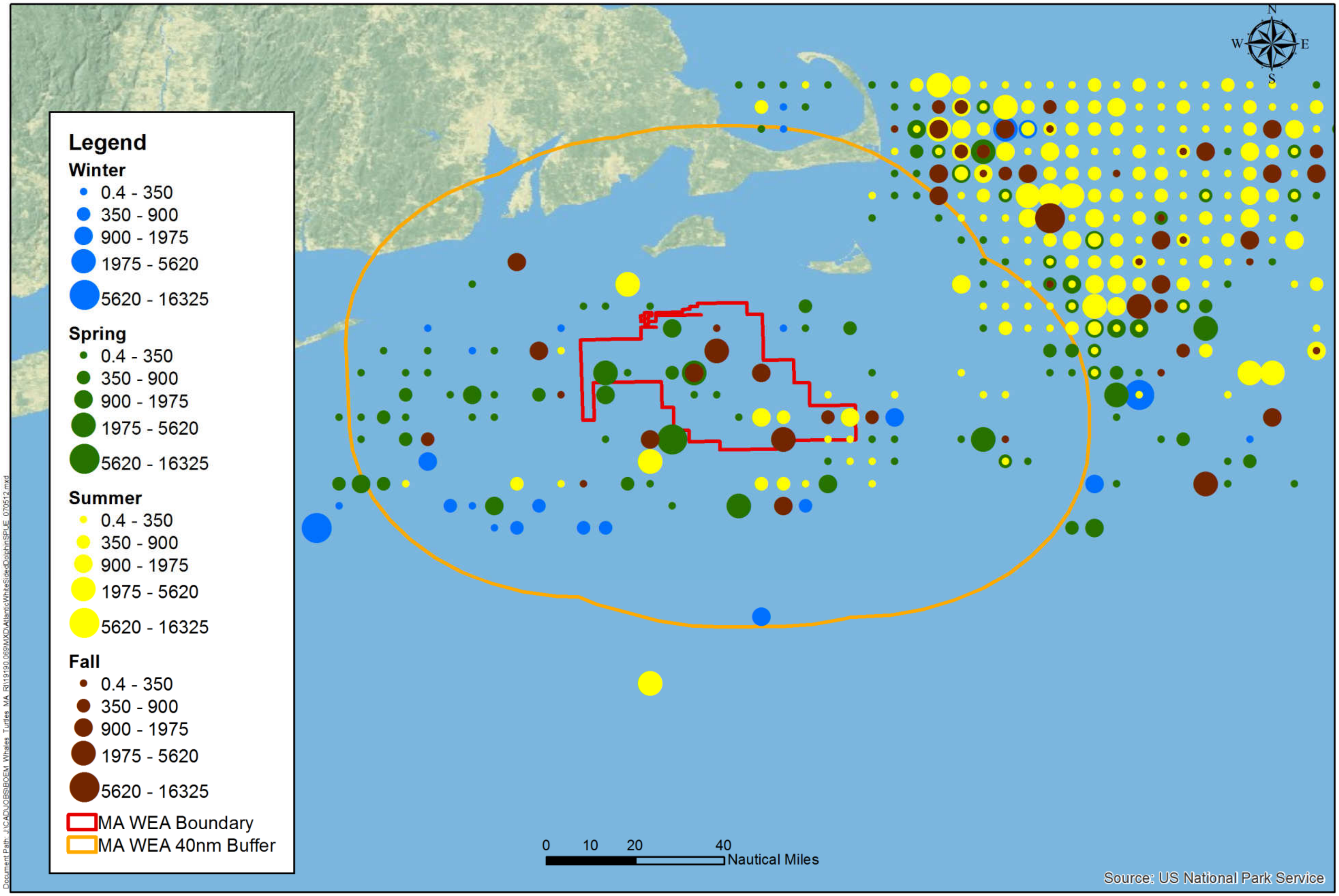


Figure 3. SPUE for Atlantic white-sided dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

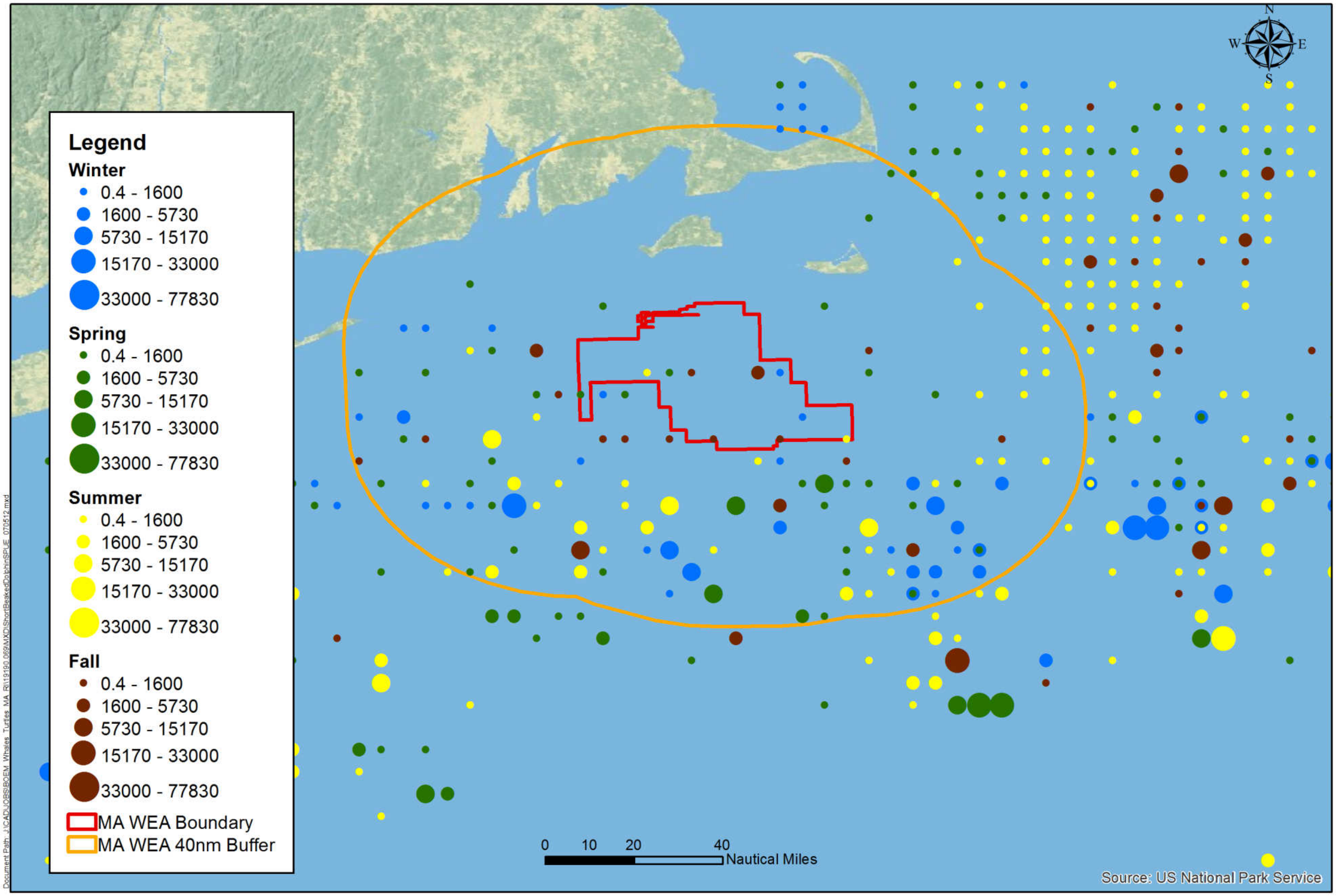


Figure 4. SPUE for short-beaked common dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

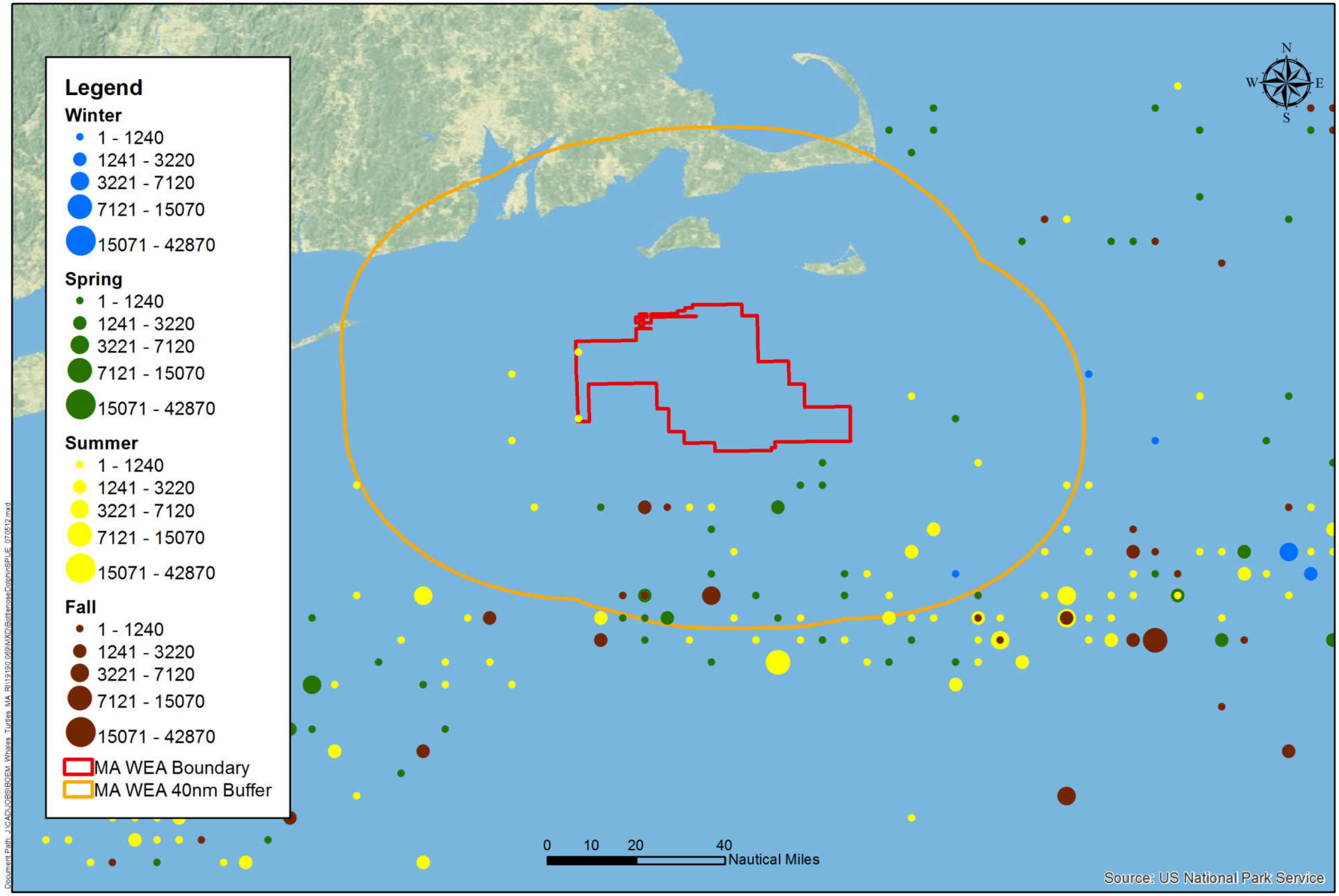


Figure 5. SPUE for Western North Atlantic offshore stock of bottlenose dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

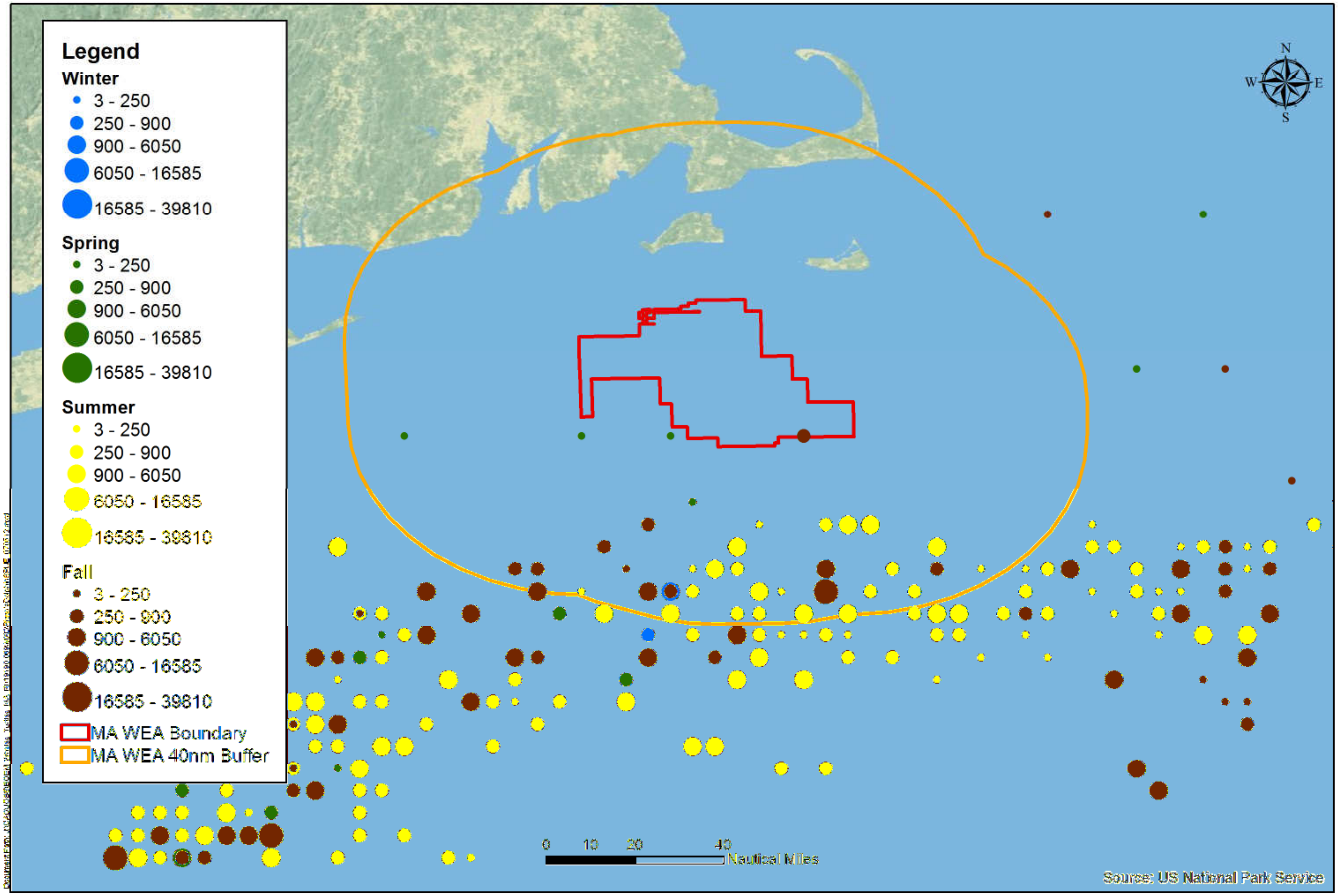


Figure 6. SPUE for Risso's dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

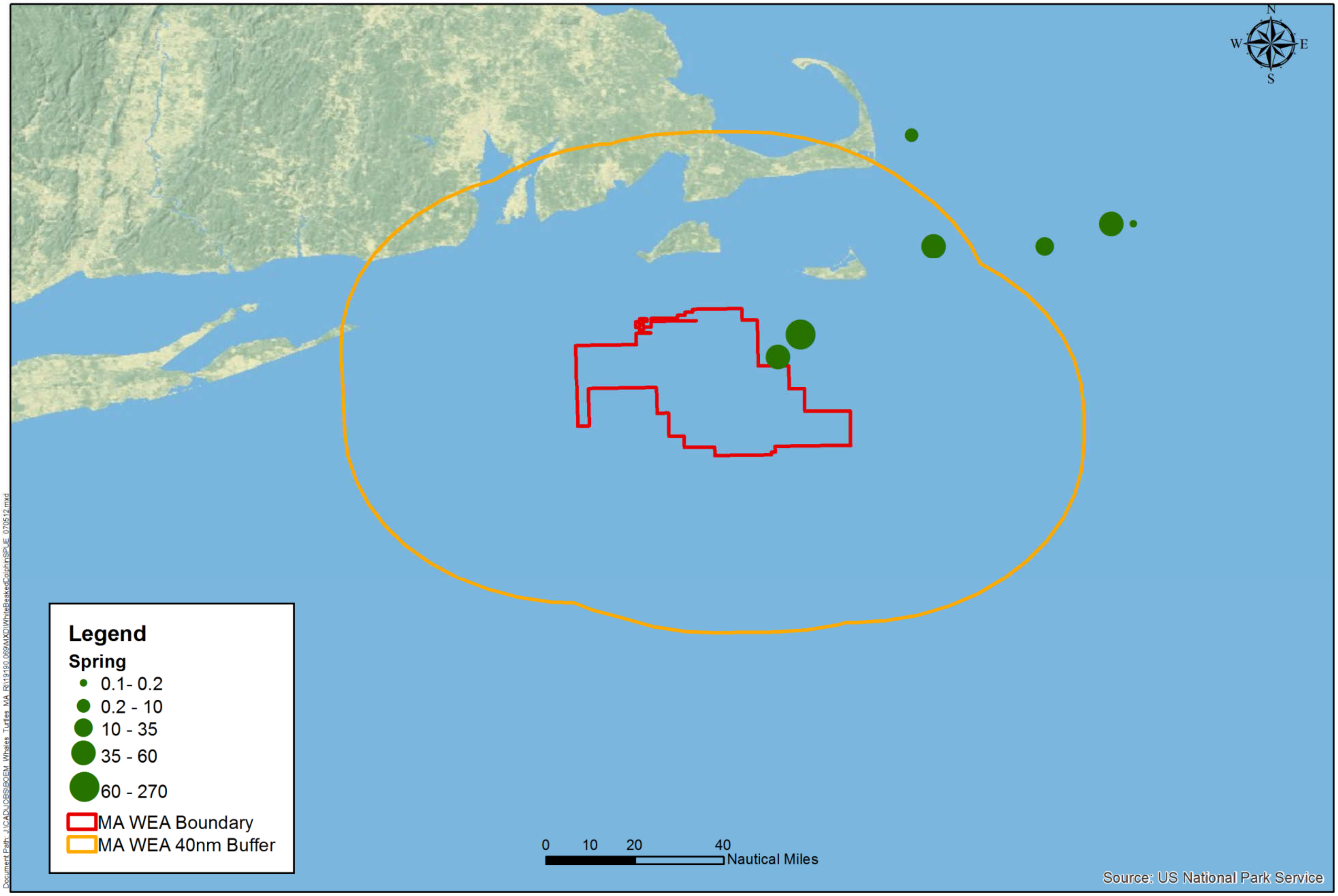


Figure 7. SPUE for white-beaked dolphins in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

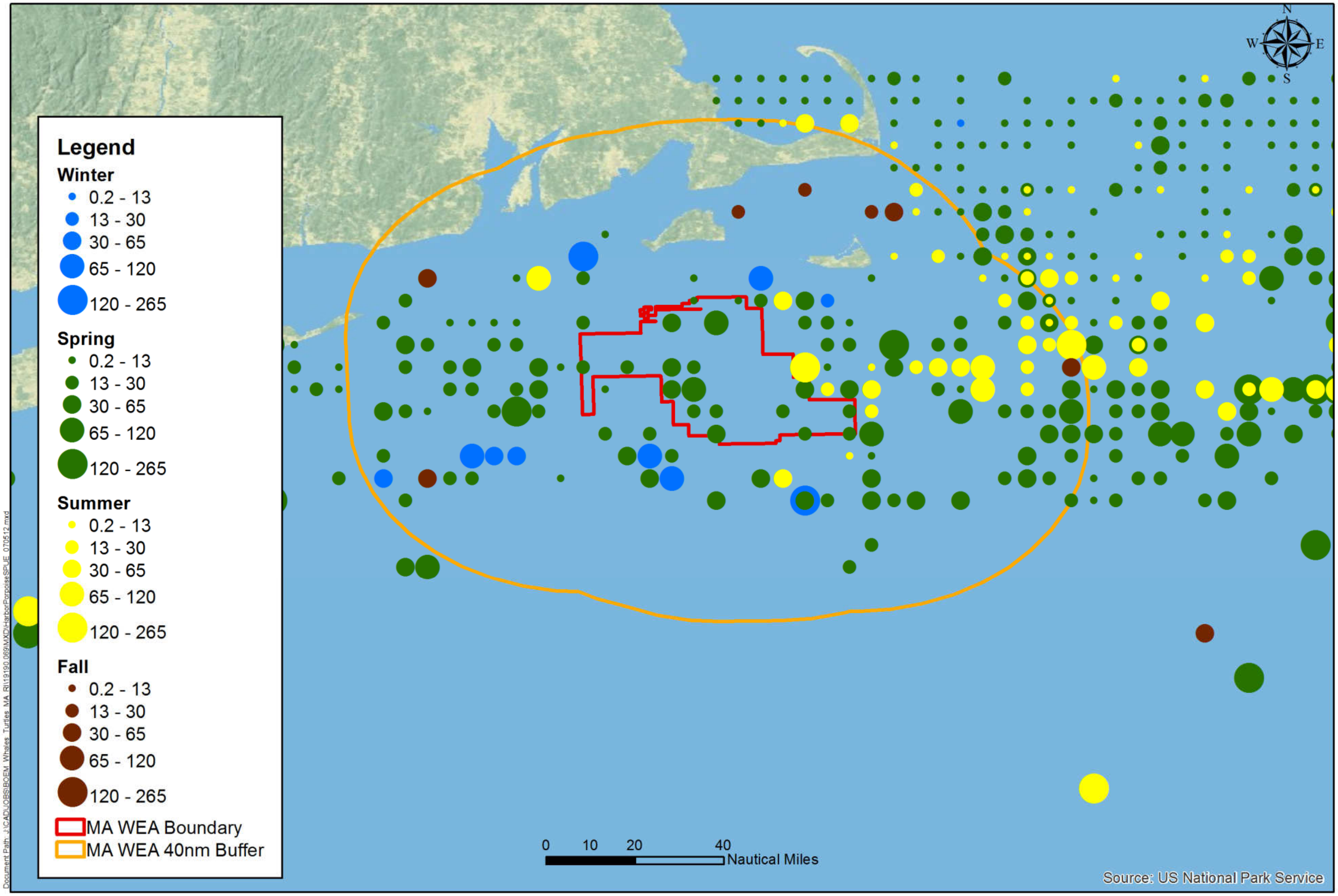


Figure 8. SPUE for harbor porpoise in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

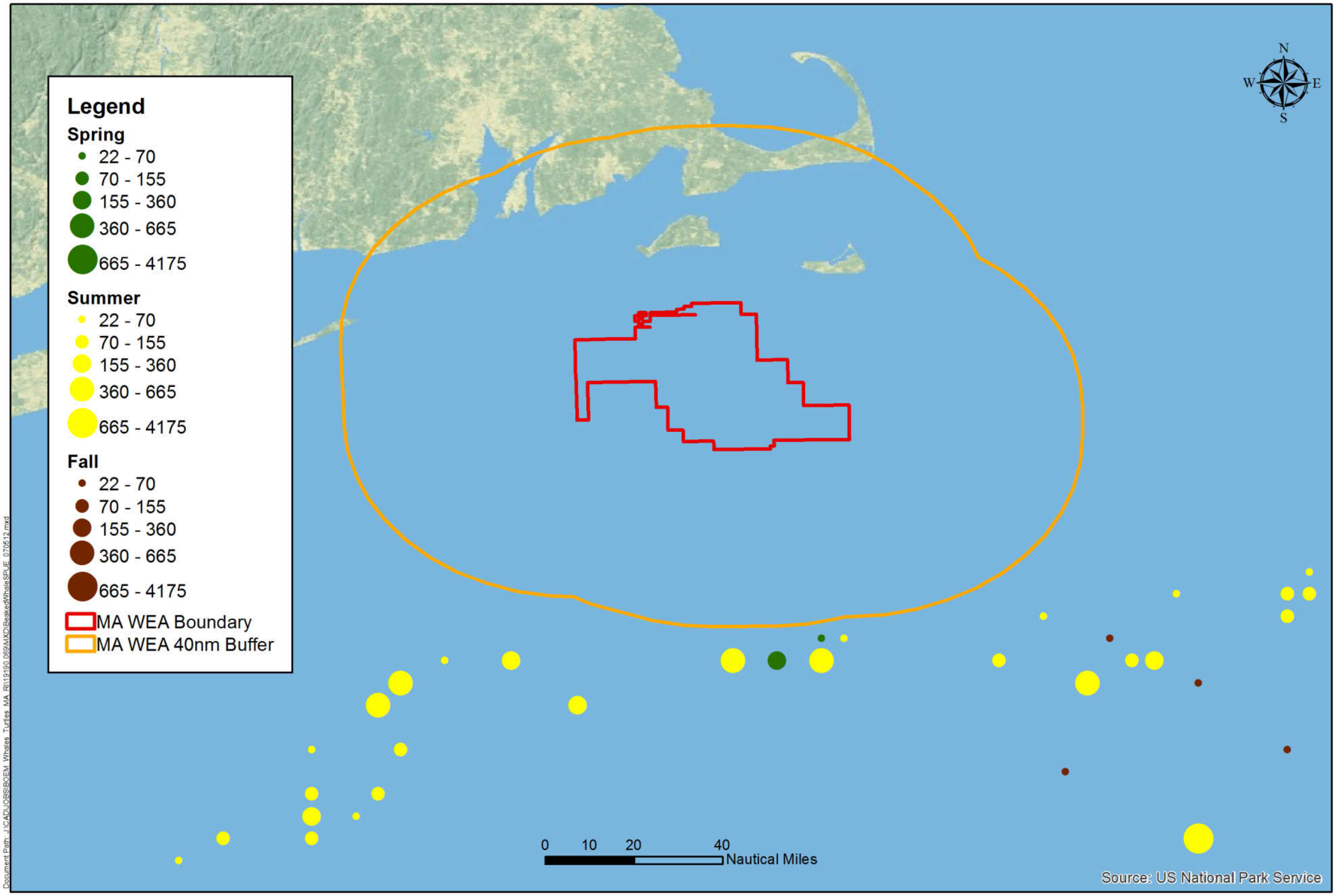


Figure 9. SPUE for beaked whales in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

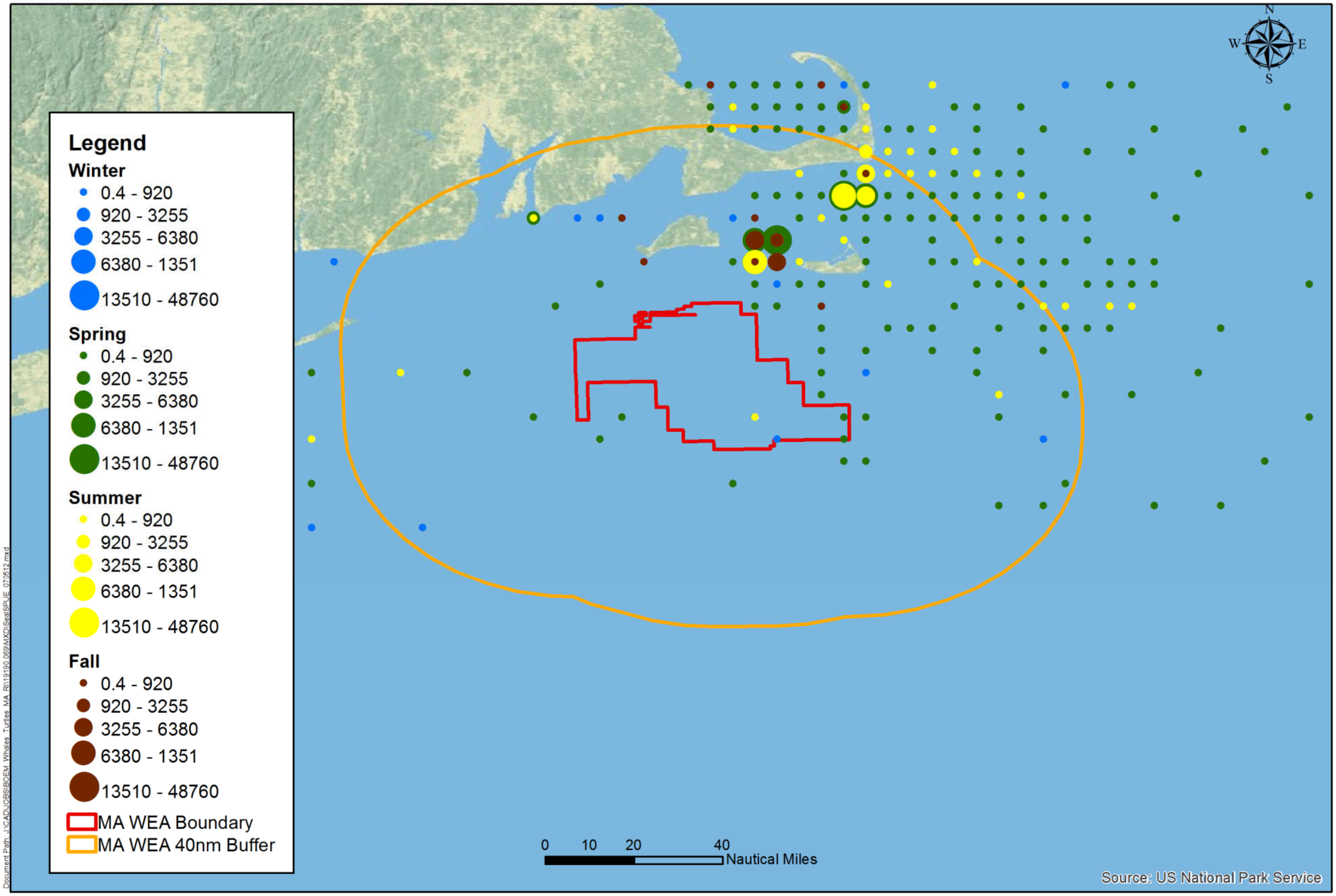


Figure 10. SPUE for seals (harbor, gray, hooded, and harp seals) through 2009 in the WEA (outlined in red) and within 40 nm of the WEA (outlined in orange). Data Source: Right Whale Consortium (2012).

# Appendix F
# Sightings per Unit Effort Figures for Threatened and Endangered Whales and Sea Turtles

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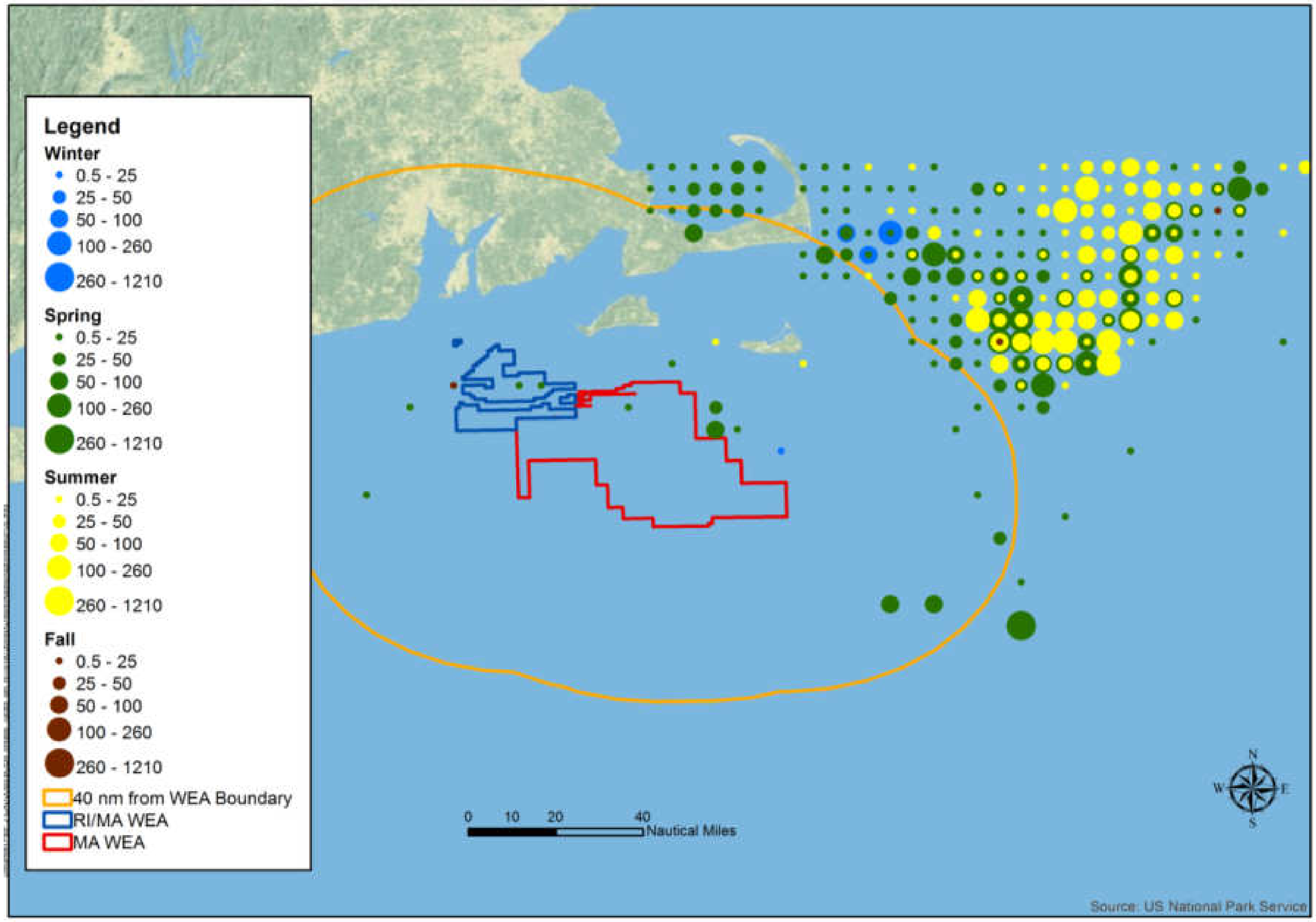


Figure 1. SPUE for North Atlantic right whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

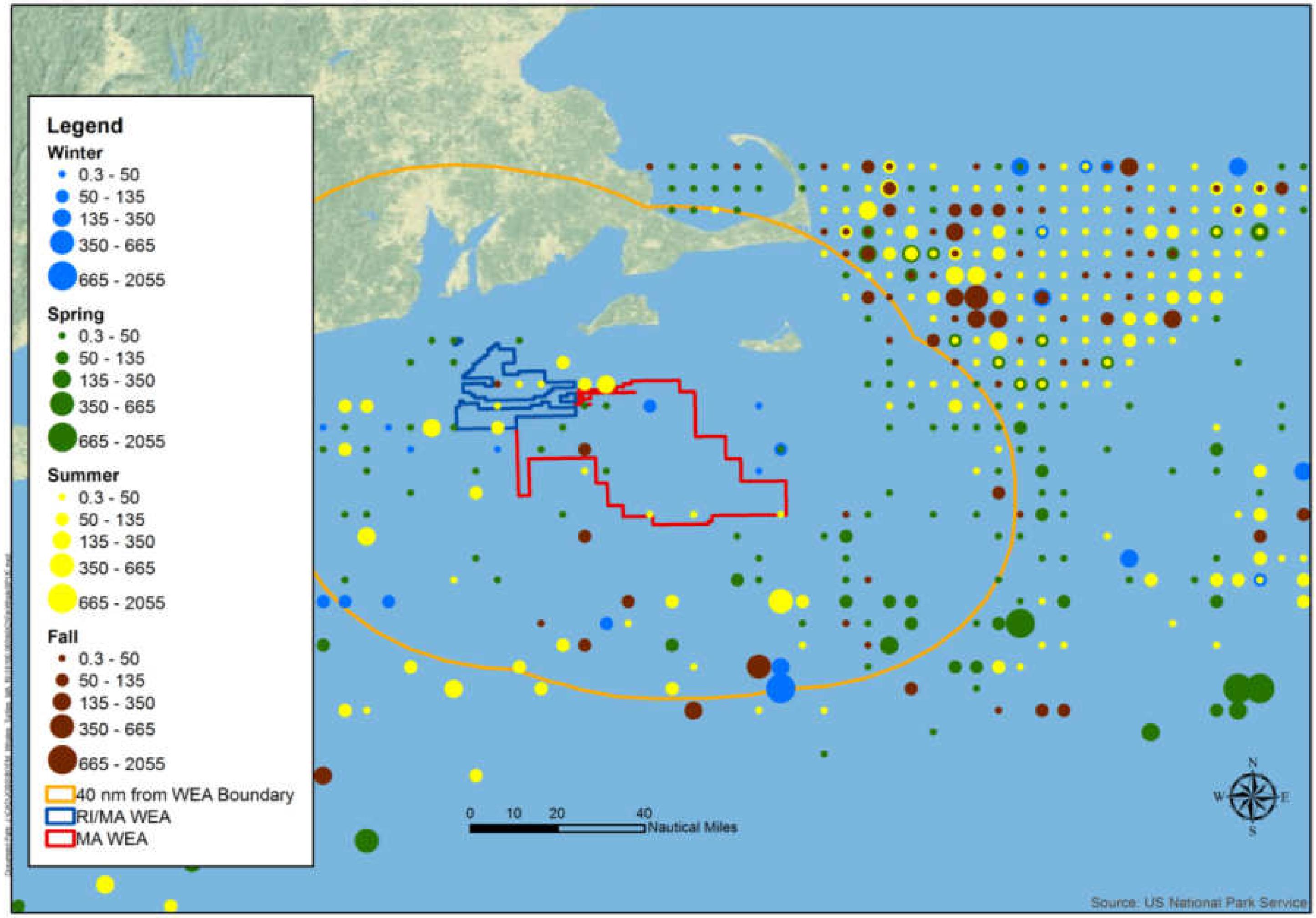


Figure 2. SPUE for fin whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

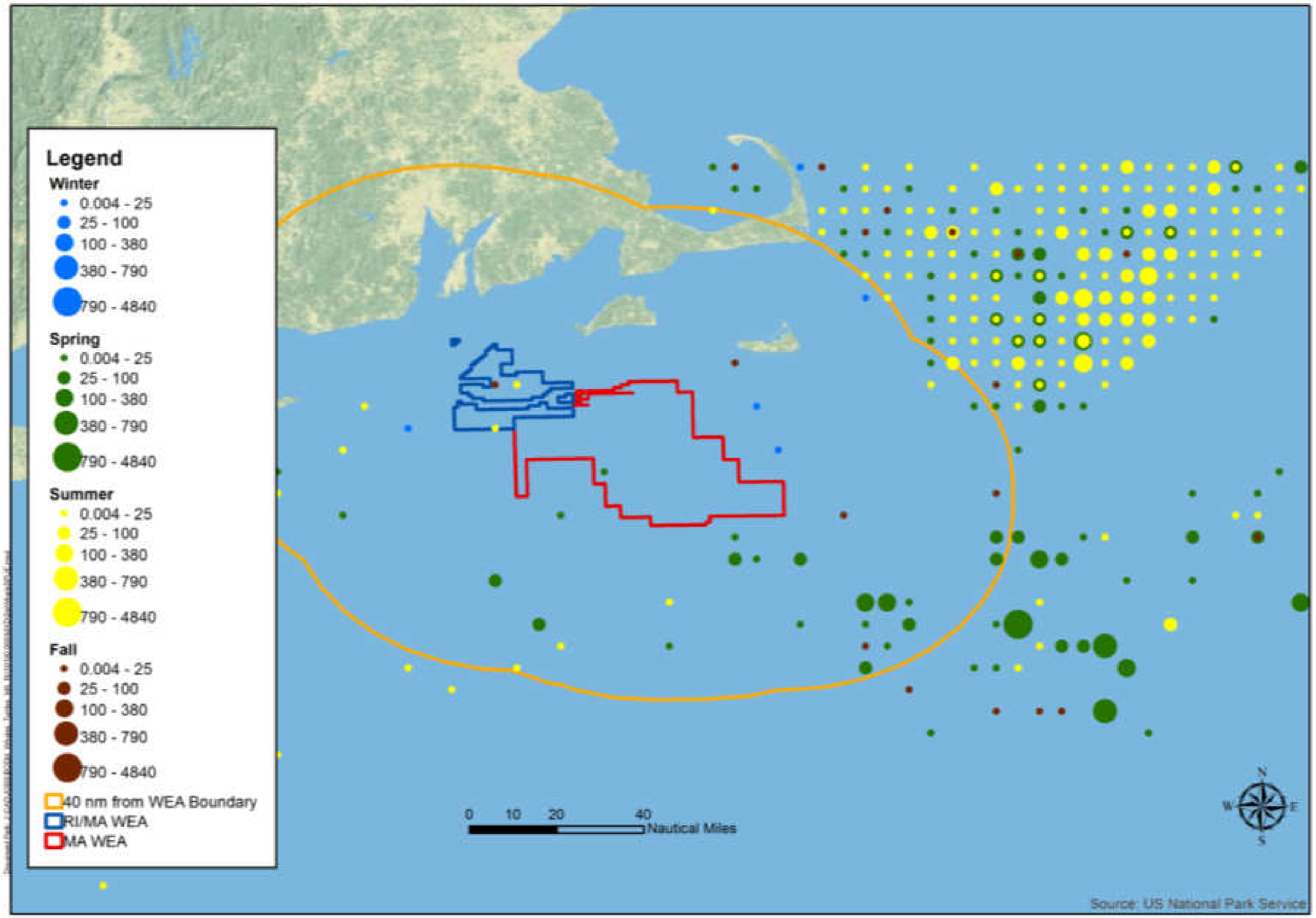


Figure 3. SPUE for sei whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

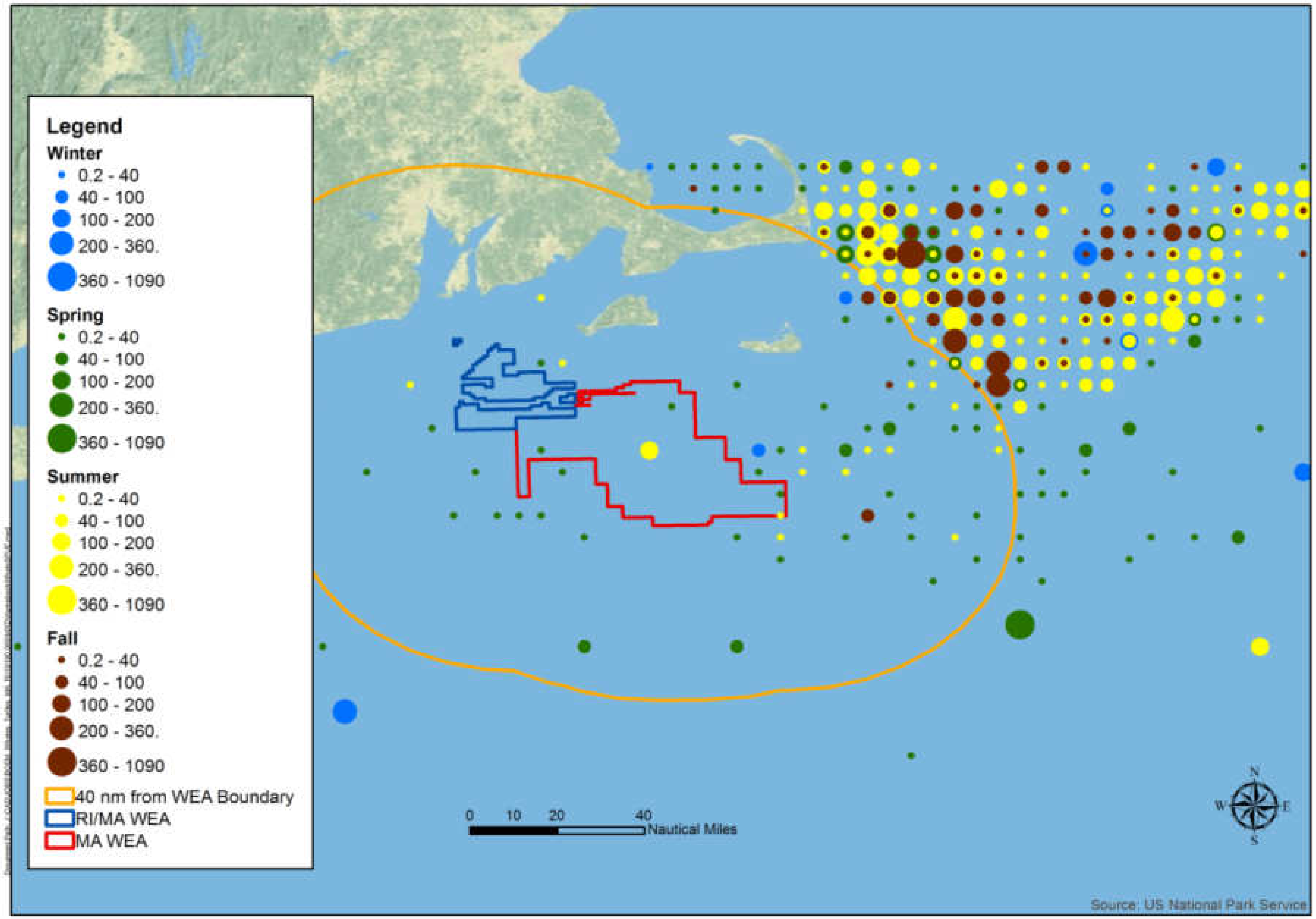


Figure 4. SPUE for humpback whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

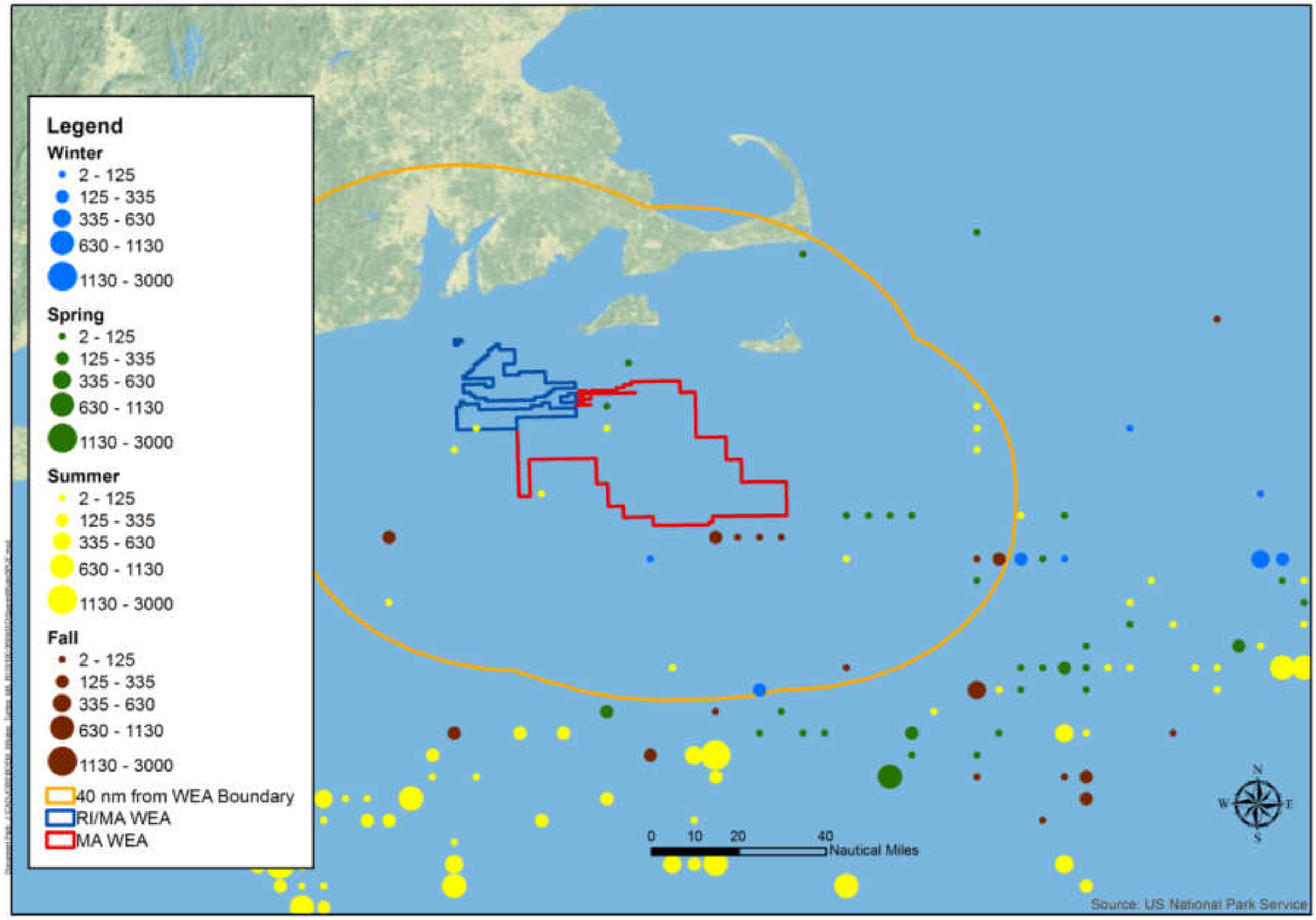


Figure 5. SPUE for sperm whales in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

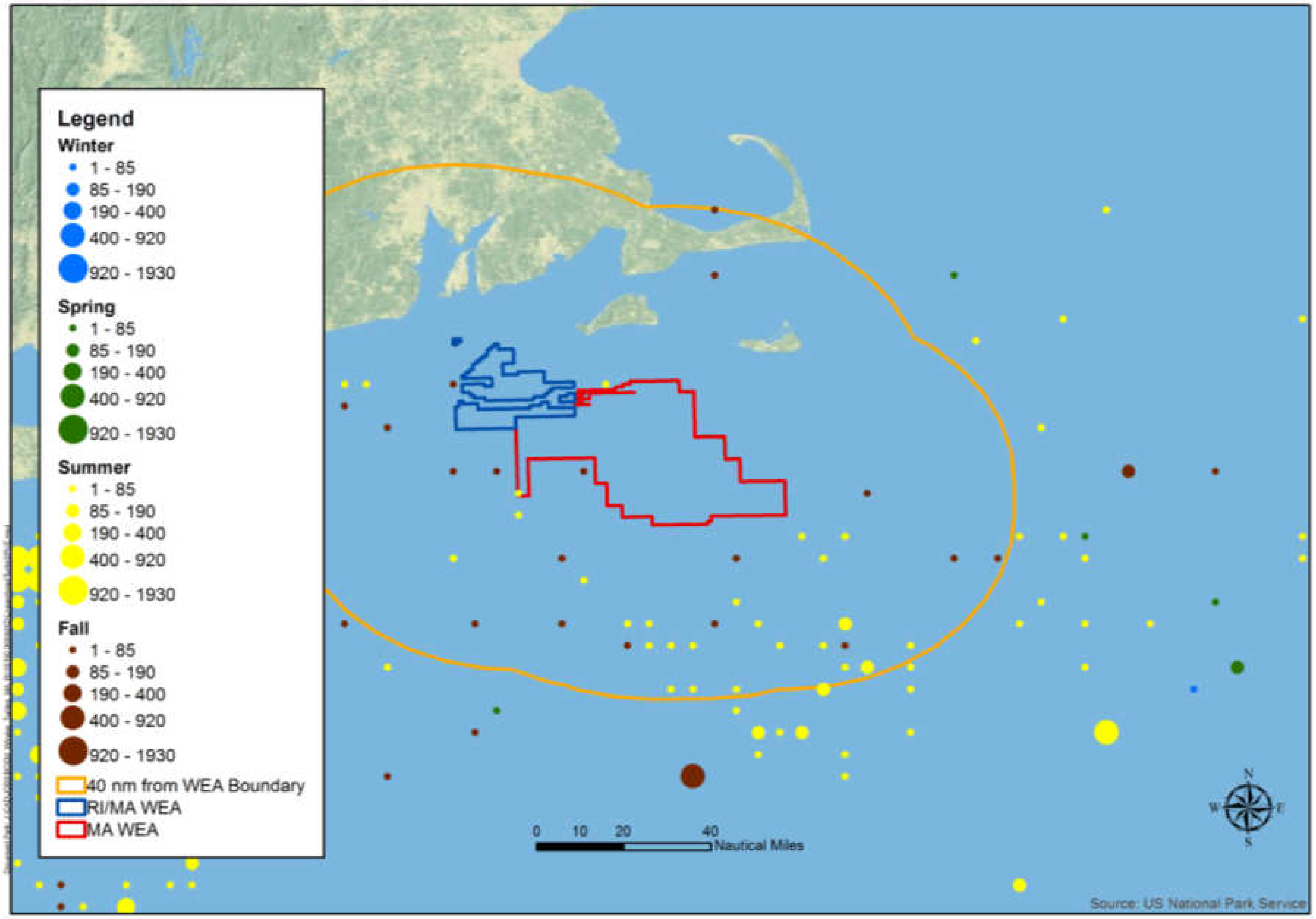


Figure 6. SPUE for loggerhead sea turtle in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

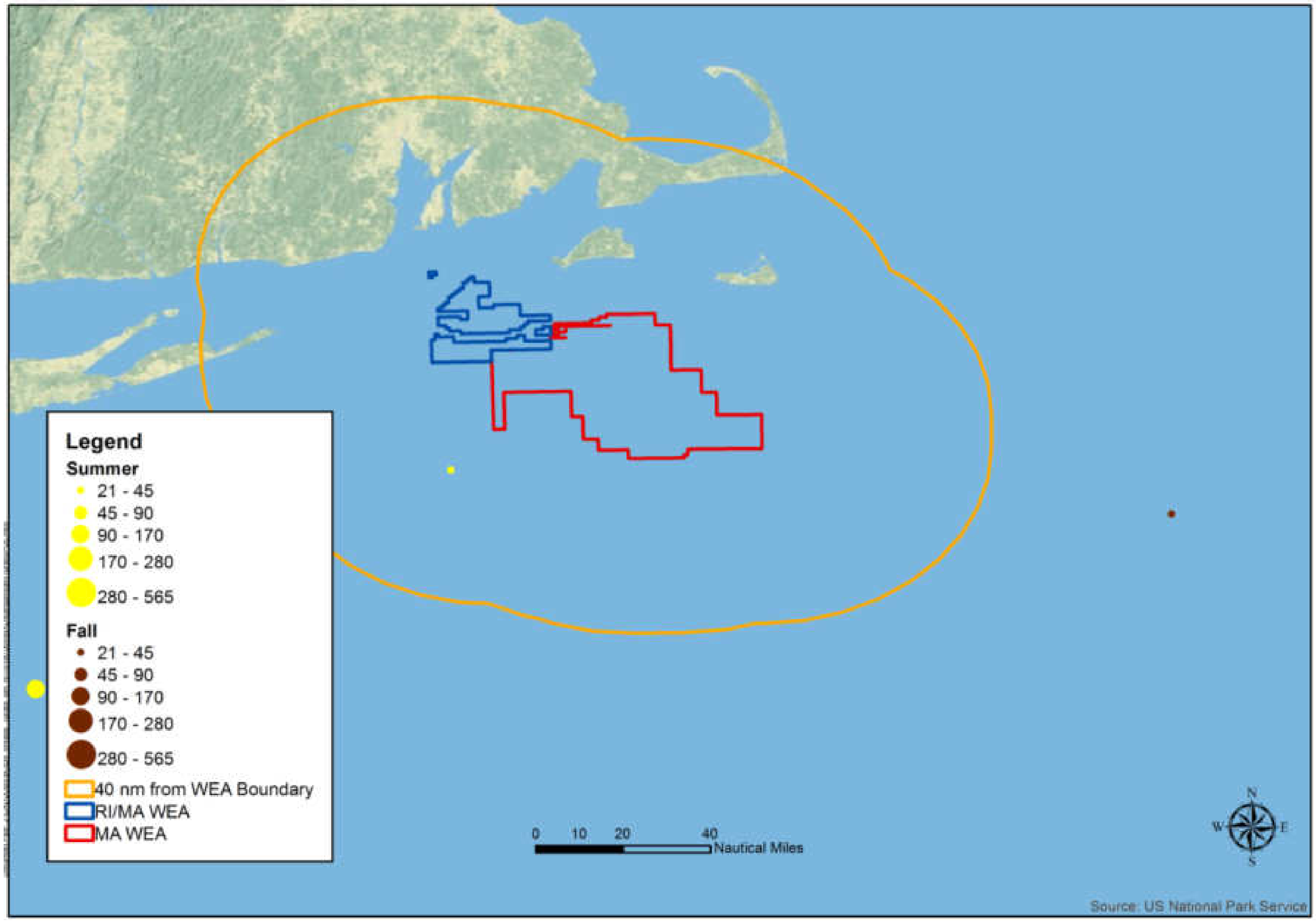


Figure 7. SPUE for Kemp's ridley sea turtles in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

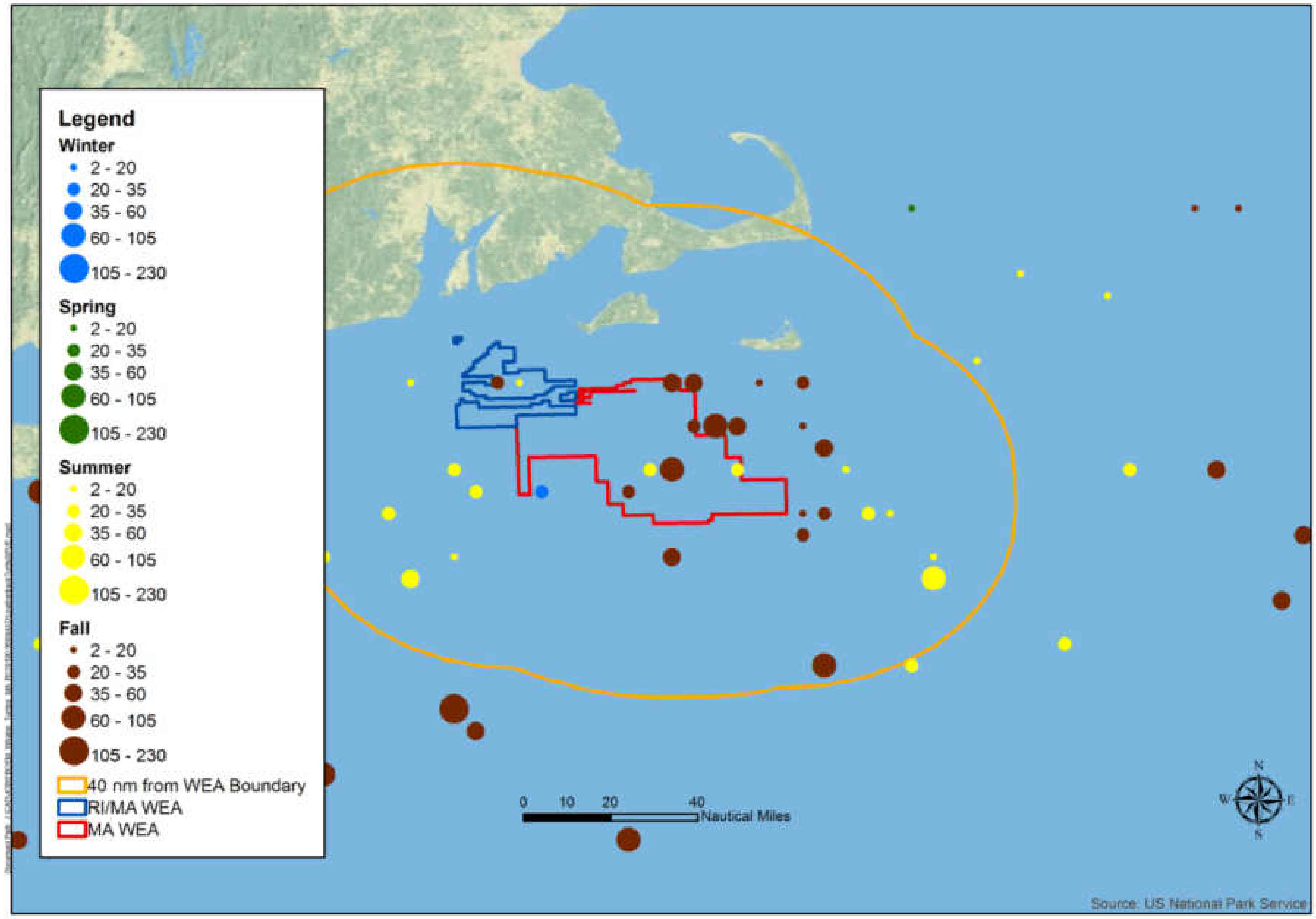


Figure 8. SPUE for leatherback sea turtles in the Massachusetts WEA and surrounding waters. WEA outlined in red and 40 nm from the WEA outlined in orange for reference. Data Source: Right Whale Consortium, 2012. Map prepared by Normandeau Associates, Inc.

# Appendix G
# Programmatic Agreement

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MAY 23 2012

PROGRAMMATIC AGREEMENT
Among
The U.S. Department of the Interior, Bureau of Ocean Energy Management;
the State Historic Preservation Officers of Massachusetts and Rhode Island;
The Mashpee Wampanoag Tribe;
The Narragansett Indian Tribe;
The Wampanoag Tribe of Gay Head (Aquinnah); and
The Advisory Council on Historic Preservation;
Regarding
the "Smart from the Start" Atlantic Wind Energy Initiative:
Leasing and Site Assessment Activities offshore Massachusetts and Rhode Islands

WHEREAS, the Energy Policy Act of 2005, Pub. L. No. 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which grants the Secretary of the Interior the authority to issue leases, easements, or rights-of-way on the Outer Continental Shelf (OCS) for the purpose of renewable energy development, including wind energy development. *See* 43 U.S.C. § 1337(p)(1)(C); and

WHEREAS, the Secretary delegated this authority to the former Minerals Management Service (MMS), now the Bureau of Ocean Energy Management (BOEM), and promulgated final regulations implementing this authority at 30 CFR Part 585; and

WHEREAS, 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 that occurs in distinct phases: lease issuance; approval of a site assessment plan (SAP); and approval of a construction and operation plan (COP); and

WHEREAS, BOEM is currently identifying areas that may be suitable for wind energy leasing through collaborative, consultative, and analytical processes; and

WHEREAS, the issuance of a commercial wind energy lease gives the lessee the exclusive right to subsequently seek BOEM approval of plans (SAPs and COPs) for the development of the leasehold; and

WHEREAS, the lease does not grant the lessee the right to construct any facilities; rather, the lease grants the lessee the right to use the leased area to develop its plans, which must be approved by BOEM before the lessee implements them. *See* 30 CFR 585.600 and 585.601; and

WHEREAS, the SAP contains the lessee's detailed proposal for the construction of a meteorological tower and/or the installation of meteorological buoys ("site assessment activities") on the leasehold. *See* 30 CFR 585.605 - 585.618; and

WHEREAS, the lessee's SAP must be approved by BOEM before it conducts these "site assessment" activities on the leasehold; and

WHEREAS, BOEM may approve, approve with modification, or disapprove a lessee's SAP. *See* 30 CFR 585.613; and

WHEREAS, the COP is a detailed plan for the construction and operation of a wind energy project on the lease. *See* 30 CFR 585.620-585.638; and

WHEREAS, BOEM approval of a COP is a precondition to the construction of any wind energy facility on the OCS. *See* 30 CFR 585.600; and

WHEREAS, the regulations require that a lessee provide the results of surveys with its SAP and COP for the areas affected by the activities proposed in each plan, including an archaeological resource survey. *See* 30 CFR 585.610(b)(3) and 30 CFR 585.626(a)(5). BOEM refers to surveys undertaken to acquire this information as "site characterization" activities. *See Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585* at: http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/GGARCH4-11-2011-pdf.aspx; and

WHEREAS, BOEM has embarked upon the "Smart from the Start" Atlantic Wind Energy Initiative for the responsible development of wind energy resources on the Atlantic OCS; and

WHEREAS, under the "Smart from the Start" Initiative, BOEM has identified areas on the OCS that appear most suitable for future wind energy activities offshore the Commonwealth of Massachusetts (MA) and the State of Rhode Island (RI); and

WHEREAS these areas are located: (1) within the Rhode Island-Massachusetts Wind Energy Area (WEA); and (2) within the MA Call area east of the Rhode Island-Massachusetts WEA (hereafter known as "Areas"); and

WHEREAS BOEM may issue multiple renewable energy leases and approve multiple SAPs on leases issued within these Areas; and

WHEREAS, BOEM has determined that issuing leases and approving SAPs within these Areas constitute multiple undertakings subject to Section 106 of the National Historic Preservation Act (NHPA; 16 U.S.C. § 470f), and its implementing regulations (36 CFR 800); and

WHEREAS, BOEM has determined that the implementation of the program is complex as the decisions on these multiple undertakings are staged, pursuant to 36 CFR § 800.14(b); and

WHEREAS, the implementing regulations for Section 106 (36 CFR § 800) prescribe a process that seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among parties with an interest in the effects of the undertakings, commencing at the early stages of the process; and

WHEREAS, the Section 106 consultations have been initiated and coordinated with other reviews, including the National Environmental Policy Act (NEPA), in accordance with 36 CFR § 800.3(b); and

WHEREAS, 36 CFR § 800.14(b)(3) provides for developing programmatic agreements (Agreements) for complex or multiple undertakings and § 800.14(b)(1)(ii) and (v) provide for developing Agreements when effects on historic properties cannot be fully determined prior to approval of an undertaking and for other circumstances warranting a departure from the normal section 106 process; and

WHEREAS, 36 CFR § 800.4(b)(2) provides for phased identification and evaluation of historic properties where alternatives consist of large land areas, and for the deferral of final identification and evaluation of historic properties when provided for in a Agreement executed pursuant to 36 CFR §800.14(b); and

WHEREAS, BOEM has determined that the identification and evaluation of historic properties shall be conducted through a phased approach, pursuant to 36 CFR § 800.4(b)(2), where the final identification of historic properties will occur after the issuance of a lease or leases and before the approval of a SAP; and

WHEREAS, the Section 106 consultations described in this Agreement will be used to establish a process for identifying historic properties located within the undertakings' Areas of Potential Effects (APE) that are listed in or eligible for listing in the National Register of Historic Places (National Register), and assess the potential adverse effects and avoid, reduce, or resolve any such effects through the process set forth in this Agreement; and

WHEREAS, according to 36 CFR § 800.16(l)(1) "historic property" means

> *any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria*; and

WHEREAS, the APEs, as defined in 36 CFR § 800.16(d) of the Advisory Council on Historic Preservation's (ACHP's) regulations implementing Section 106 of the NHPA, for the undertakings that are the subject of this Agreement, are: (1) the depth and breadth of the seabed that could potentially be impacted by seafloor/bottom-disturbing activities associated with the undertakings (e.g., core samples, anchorages and installation of meteorological towers and buoys); and (2) the viewshed from which lighted meteorological structures would be visible; and

WHEREAS, BOEM has identified and consulted with the State Historic Preservation Offices (SHPOs) for MA and RI, (collectively, "the SHPOs"); and

WHEREAS, BOEM initiated consultation in 2011 and 2012 through letters of invitation, telephone calls, emails, meetings, webinars, and the circulation and discussion of this Agreement in draft; and this outreach and notification included contacting over 66 individuals and entities, including federally-recognized Indian Tribes (Tribes), local governments, SHPOs, and the public; and

WHEREAS, BOEM has initiated formal government-to-government consultation with the following Tribes: the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Shinnecock Indian Nation, and the Wampanoag Tribe of Gay Head (Aquinnah); and

WHEREAS, these Tribes have chosen to consult with BOEM and participate in development of this Agreement, in which the term Tribe refers to them, within the meaning of 36 CFR § 800.16(m); and

WHEREAS, BOEM shall continue to consult with these Tribes to identify properties of religious and cultural significance that may be eligible for listing in the National Register of Historic Places (Traditional Cultural Properties or TCPs) and that may be affected by these undertakings; and

WHEREAS, BOEM involves the public and identifies other consulting parties through notifications, requests for comments, existing renewable energy task forces, contact with SHPOs, NEPA scoping meetings and communications for these proposed actions; and

WHEREAS, BOEM, the SHPOs, the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, and the Wampanoag Tribe of Gay Head (Aquinnah) and the ACHP are Signatories to this Agreement, and

WHEREAS, future submission of a COP and commercial-scale development that may or may not occur within the Areas would be separate undertakings and considered under future, separate Section 106 consultation(s) not under this Agreement; and

WHEREAS, BOEM requires a SAP to include the results of site characterization surveys that will identify potential archaeological resources that could be affected by the installation and operation of meteorological facilities. *See* (30 CFR § 585.611 (b)(6); and

WHEREAS, consultations conducted prior to the execution of this Agreement included all steps in the Section 106 process up to and including consulting on the scope of identification efforts that would be used to conduct site characterization surveys that would identify historic properties that may be impacted by activities described in the SAP pursuant to 36 CFR § 800.4(a); and

WHEREAS, these consultations resulted in recommendations to BOEM that the following items should be added to leases issued within the Areas, both to ensure that historic properties that may be impacted by activities described in the SAP are identified through a reasonable and good faith effort (§ 800.4(b)(1)), and also to ensure that properties identified through the geophysical surveys are not impacted by geotechnical sampling:

> *The lessee may only conduct geotechnical (sub-bottom) sampling activities in areas of the leasehold in which an analysis of the results of geophysical surveys has been completed for that area. The geophysical surveys must meet BOEM's minimum standards (see Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 285 at* http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/GGARCH4-11-2011-pdf.aspx*), and 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. This analysis must include a determination whether any potential archaeological resources are present in the area and the geotechnical (sub-bottom) sampling activities must avoid potential archaeological resources by a minimum of 50.0 meters (m; 164.0 feet). The avoidance distance must be calculated from the maximum discernible extent of the archaeological resource. In no case may the lessee's actions impact a potential archaeological resource without BOEM's prior approval*;

NOW, THEREFORE, BOEM, the ACHP, the SHPOs, Tribes, and the other concurring parties (the Parties), agree that Section 106 consultation shall be conducted in accordance with the following stipulations in order to defer final identification and evaluation of historic properties.

STIPULATIONS

I. SAP Decisions. Before making a decision on a SAP from a lessee, BOEM will treat all potential historic properties identified as a result of site characterization studies and consultations as historic properties potentially eligible for inclusion on the National Register and avoid them by requiring the lessee to relocate the proposed project, resulting in a finding of *No historic properties affected* (36 CFR § 800.4(d)(1)). If a potential historic property is identified, and the lessee chooses to conduct additional investigations, and:

   A. If additional investigations demonstrate that a historic property does not exist, then BOEM will make a determination of *No historic properties affected* and follow 36 CFR § 800.4(d)(1).

B. If additional investigations demonstrate that a historic property does exist and may be affected, BOEM will evaluate the historic significance of the property, in accordance with 800.4(c); make a determination of *Historic properties affected* and follow 36 CFR § 800.4(d)(2); and resolve any adverse effects by following 800.5.

II. Tribal Consultation. BOEM shall continue to consult with the Tribes throughout the implementation of this Agreement in a government-to-government manner consistent with Executive Order 13175, Presidential memoranda, and any Department of the Interior policies, on subjects related to the undertakings.

III. Public Participation

A. Because BOEM and the Parties recognize the importance of public participation in the Section 106 process, BOEM shall continue to provide opportunities for public participation in Section 106-related activities, and shall consult with the Parties on possible approaches for keeping the public involved and informed throughout the term of the Agreement.

B. BOEM shall keep the public informed and may produce reports on historic properties and on the Section 106 process that may be made available to the public at BOEM's headquarters, on the BOEM website, and through other reasonable means insofar as the information shared conforms to the confidentiality clause of this Agreement (Stipulation IV).

IV. Confidentiality. Because BOEM and the Parties agree that it is important to withhold from disclosure sensitive information such as that which is protected by NHPA Section 304 (16 U.S.C. § 470w-3) (*e.g.*, the location, character and ownership of an historic resource, if disclosure would cause a significant invasion of privacy, risk harm to the historic resources, or impede the use of a traditional religious site by practitioners), BOEM shall:

A. Request that each Party inform the other Parties if, by law or policy, it is unable to withhold sensitive data from public release.

B. Arrange for the Parties to consult as needed on how to protect such information collected or generated under this Agreement.

C. Follow, as appropriate, 36 CFR 800.11(c) for authorization to withhold information pursuant to NHPA Section 304, and otherwise withhold sensitive information to the extent allowable by laws including the Freedom of Information Act, 5 U.S.C. § 552, through the Department of the Interior regulations at 43 CFR Part 2.

D. Request that the Parties agree that materials generated during consultation be treated by the Parties as internal and pre-decisional until they are formally released, although the Parties understand that they may need to be released by one of the Parties if required by law.

V. Administrative Stipulations

A. In coordinating reviews, BOEM shall follow this process:

1. Standard Review: The Parties shall have a standard review period of thirty (30) calendar days for commenting on all documents which are developed under the terms of this Agreement, from the date they are sent by BOEM.

2. Expedited Request for Review: The Parties recognize the time-sensitive nature of this work and shall attempt to expedite comments or concurrence when BOEM so requests. The expedited comment period shall not be less than fifteen (15) calendar days from the date BOEM sends such a request.

3. If a Party cannot meet BOEM's expedited review period request, it shall notify BOEM in writing within the fifteen (15) calendar day period. If a Party fails to provide comments or respond within the time frame requested by BOEM (either standard or expedited), then BOEM may proceed as though it has received concurrence from that Party. BOEM shall consider all comments received within the review period.

4. All Parties will send correspondence and materials for review via electronic media unless a Party requests, in writing, that BOEM transmit the materials by an alternate method specified by that Party. Should BOEM transmit the review materials by the alternate method, the review period will begin on the date the materials were received by the Party, as confirmed by delivery receipt.

5. MA and RI SHPO Review Specifications: All submittals to the MA and RI SHPOs shall be in paper format and shall be delivered to the MA and RI SHPOs' offices by US Mail, by a delivery service, or by hand. Plans and specifications submitted to the MA and RI SHPOs shall measure no larger than 11" x 17" paper format (unless another format is specified in consultation). The MA and RI SHPOs shall review and comment on all adequately documented project submittals within 30 calendar days of receipt unless a response has been requested within the expedited review period specified in Stipulation V.A.2.

6. Each Signatory shall designate a point of contact for carrying out this Agreement and provide this contact's information to the other Parties, updating it as necessary while this Agreement is in force. Updating a point of contact alone shall not necessitate an amendment to this Agreement.

B. Dispute Resolution. Should any Signatory object in writing to BOEM regarding an action carried out in accordance with this Agreement, or lack of compliance with the terms of this Agreement, the Signatories shall consult to resolve the objection. Should the Signatories be unable to resolve the disagreement, BOEM shall forward its background information on the dispute as well as its proposed resolution of the dispute to the ACHP. Within 45 calendar days after receipt of all pertinent documentation, the ACHP shall either: (1) provide BOEM with written recommendations, which BOEM shall take into account in reaching a final decision regarding the dispute; or (2) notify BOEM that it shall comment pursuant to 36 CFR 800.7(c), and proceed to comment. BOEM shall take this ACHP comment into account, in accordance with 36 CFR 800.7(c)(4). Any ACHP recommendation or comment shall be understood to pertain only to the subject matter of the dispute; BOEM's responsibility to carry out all actions under this Agreement that are not subjects of dispute shall remain unchanged.

C. Amendments. Any Signatory may propose to BOEM in writing that the Agreement be amended, whereupon BOEM shall consult with the Parties to consider such amendment. This Agreement may then be amended when agreed to in writing by all Signatories, becoming effective on the date that the amendment is executed by the ACHP as the last Signatory.

D. Adding Federal Agencies. In the event that another Federal agency believes it has Section 106 responsibilities related to the undertakings which are the subject of this Agreement, that agency may attempt to satisfy its Section 106 responsibilities by agreeing in writing to the terms of this Agreement and notifying and consulting with the SHPOs and the ACHP. Any modifications to this agreement that may be necessary for meeting that agency's Section 106 obligations shall be considered in accordance with this Agreement.

E. Adding Concurring Parties. In the event that another party wishes to assert its support of this Agreement, that party may prepare a letter indicating its concurrence, which BOEM will attach to the Agreement and circulate among the Signatories.

F. Term of Agreement. The Agreement shall remain in full force until BOEM makes a final decision on the last SAP submitted under a lease issued under this portion of the "Smart from the Start" initiative, or for ten (10) years from the date the Agreement is executed, defined as the date the last signatory signs, whichever is earlier, unless otherwise extended by amendment in accordance with this Agreement.

G. Termination.

1. If any Signatory determines that the terms of the Agreement cannot or are not being carried out, that Party shall notify the other Signatories in writing and consult with them to seek amendment of the Agreement. If within sixty (60) calendar days, an amendment cannot be made, any Signatory may terminate the Agreement upon written notice to the other Signatories.

2. If termination is occasioned by BOEM’s final decision on the last SAP contemplated under this portion of the “Smart from the Start” Initiative, BOEM shall notify the Parties and the public, in writing.

H. Anti-Deficiency Act. Pursuant to 31 U.S.C. § 1341(a)(1), nothing in this Agreement shall be construed as binding the United States to expend in any one fiscal year any sum in excess of appropriations made by Congress for this purpose, or to involve the United States in any contract or obligation for the further expenditure of money in excess of such appropriations.

I. Existing Law and Rights. Nothing in this Agreement shall abrogate existing laws or the rights of any consulting party or agency party to this Agreement.

J. Compliance with Section 106. Execution and implementation of this Agreement evidences that BOEM has satisfied its Section 106 responsibilities for all aspects of these proposed undertakings by taking into account the effects of these undertakings on historic properties and affording the ACHP a reasonable opportunity to comment with regard to the undertakings.

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

By:

[signature] Date: 5-23-12

Maureen A. Bornholdt
Program Manager, Office of Renewable Energy Programs
Bureau of Ocean Energy Management

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

Brona Simon Date: 5/31/12

Brona Simon
Massachusetts Historical Commission
Massachusetts State Historic Preservation Officer

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

Edward F. Sanderson ______________________ Date: 6/4/2012 ______________________

[NAME] Edward F. Sanderson
[TITLE] Executive Director, Rhode Island Historical Preservation & Heritage Commission
Rhode Island State Historic Preservation Officer

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

______________________ Date: 05 June 2012

John Brown
Tribal Historic Preservation Officer
Narragansett Indian Tribe

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

[signature] Date: 5/29/12

Cedric Cromwell
Tribal Chairman
Mashpee Wampanoag Tribe

Programmatic Agreement concerning the "Smart from the Start" Atlantic Wind Energy Initiative: Leasing and Site Assessment Activities offshore Massachusetts and Rhode Island

John M. Fowler　　　Date: 6/8/12

John M. Fowler
Executive Director
Advisory Council on Historic Preservation

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# Appendix H
# Visual Simulations for Meteorological Tower

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**Static Simulation Viewing Instructions**

The static simulations are developed to be viewed 33.6” from the display when printed full size. The panorama is intended to be printed so that the height of the panorama is 18”. The panorama displays approximately a 30° vertical field of view and a 117° horizontal field of view. Using the formula tan(30°/2)=(18”/2)/(viewing distance), the approximate calculated true scale viewing distance is 33.6”.

**Video Simulations Viewing Instructions**

The video simulations were developed with a still photography base of existing conditions at the two requested locations. They were developed to display the same approximate 30° vertical field of view (FOV) as the print simulations with the horizontal viewing angle cropped to the limits of the video. Video simulations should be viewed approximately 38.1” from a 42” diagonal sized monitor screen when viewed full screen.

Because of the numerous sizes and aspect ratios of monitors, no single viewing distance recommendation can be given. The video simulations were prepared and checked on a Panasonic TH-42PH9 42” HD wide screen video monitor. This monitor has a vertical screen size of 20.4” and a horizontal screen size of 36.2”. The recommended viewing distance given above used this screen size as a reference. To calculate the viewing distance from different monitor sizes, the following equation can be used: tan(30/2°)=(video height/2)/(viewing distance) where the video height is the vertical size of the image as displayed on the screen. If a monitor adds areas of black on the top or bottom or the viewer has a banner on the application window this must be accounted for in the calculations.

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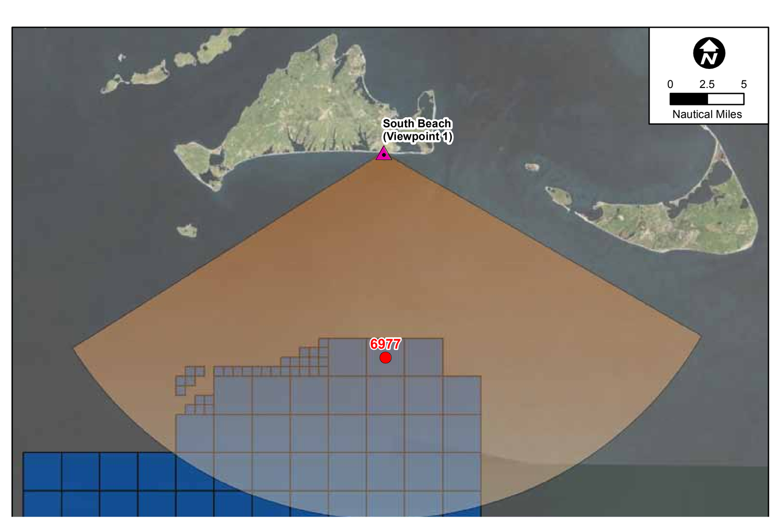
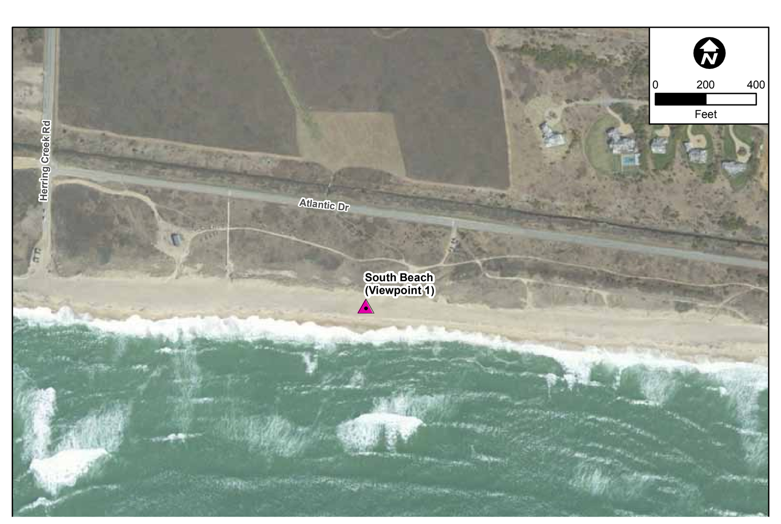
# South Beach – 8:17 AM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



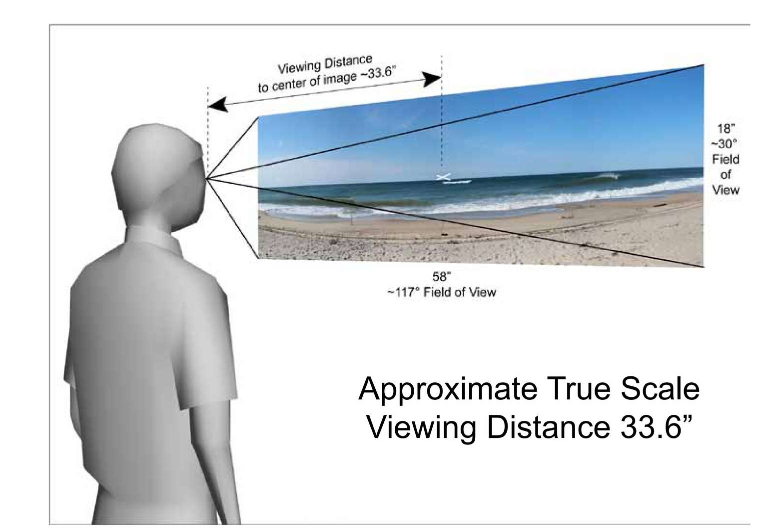




**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

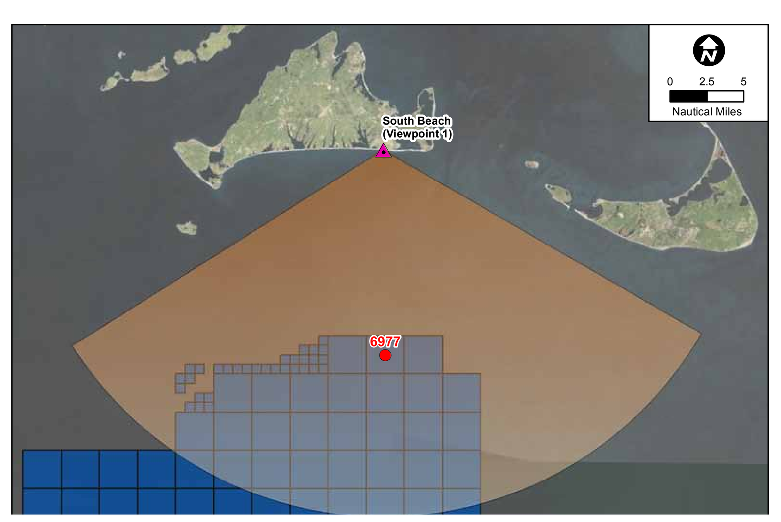
| | |
|---|---|
| Time of photograph: | 8:17 AM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Partly Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 8:17 AM

## Simulation of Meteorological Tower Placed in OCS Block 6977


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

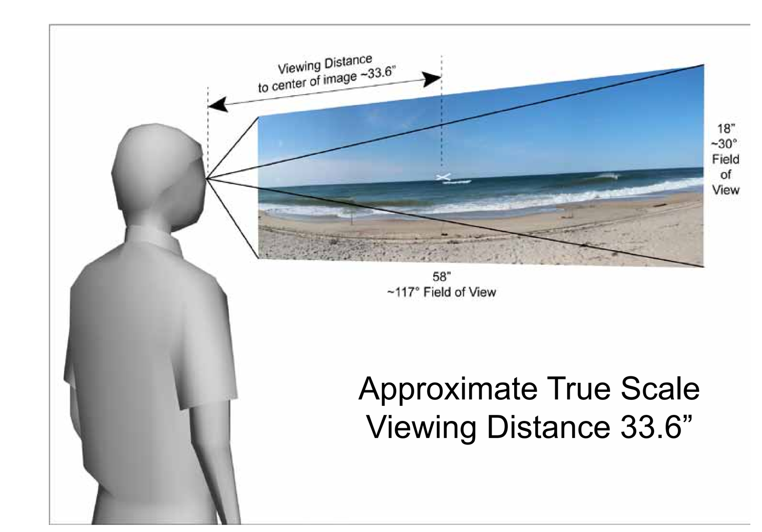


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

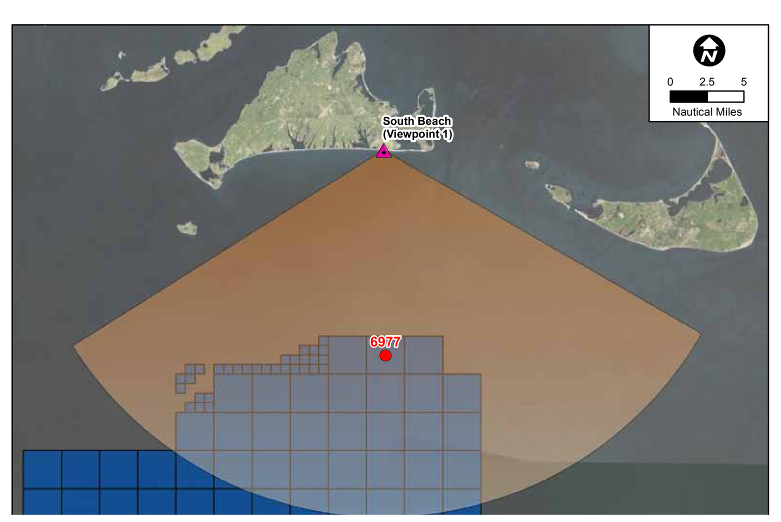
| | |
|---|---|
| Time of photograph: | 8:17 AM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Partly Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | 14 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# **South Beach –** 12:29 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

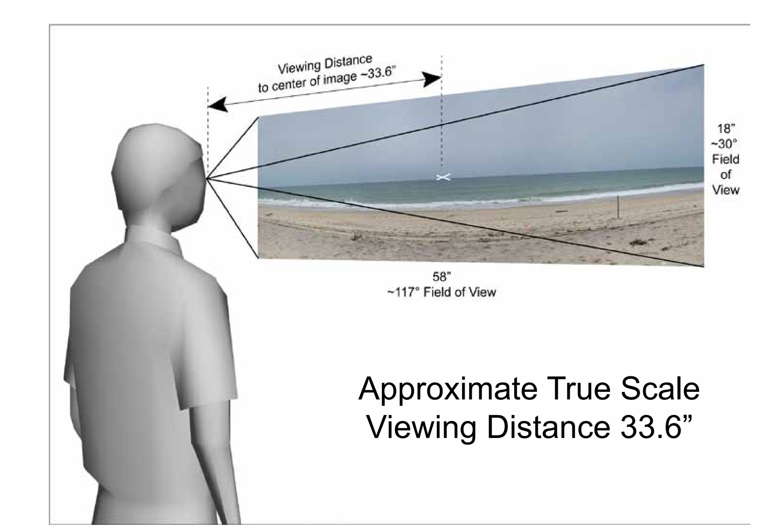


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

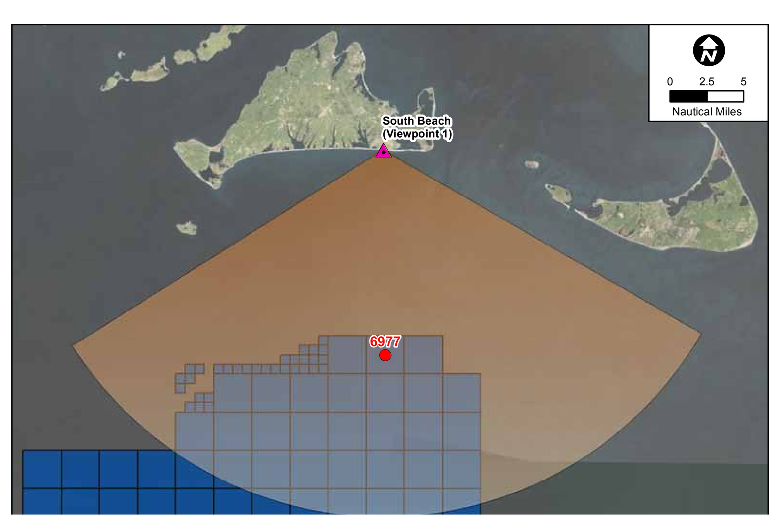
| | |
|---|---|
| Time of photograph: | 12:29 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 12:29 PM

## Simulation of Meteorological Tower Placed in OCS Block 6977


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

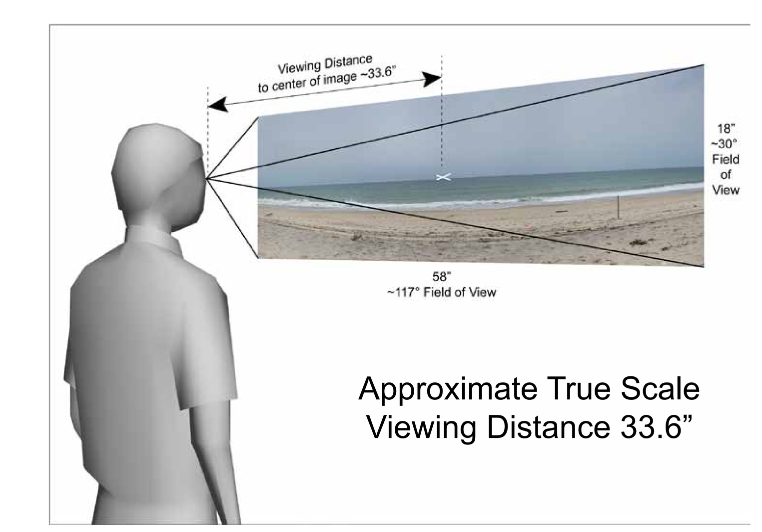


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

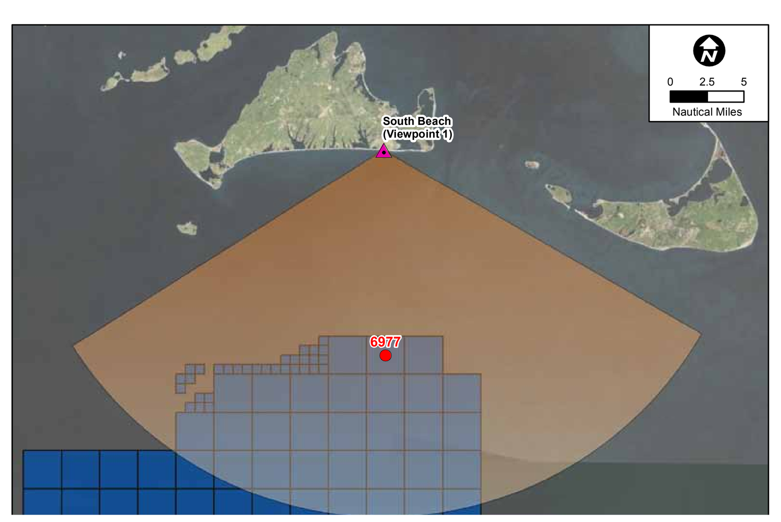
| | |
|---|---|
| Time of photograph: | 12:29 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | 14 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 1:03 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



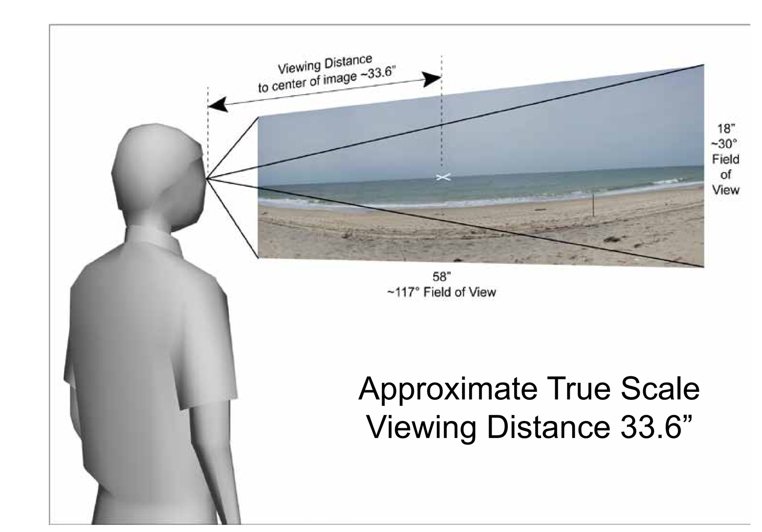


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

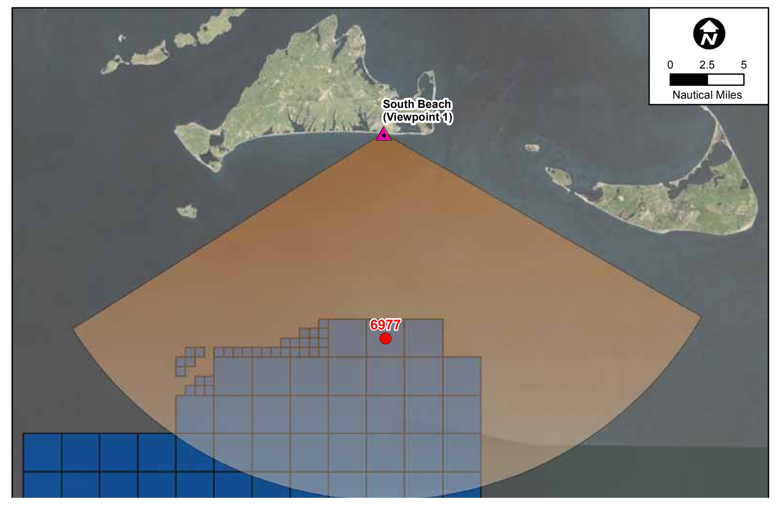
| | |
|---|---|
| Time of photograph: | 1:03 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 1:03 PM

## Simulation of Meteorological Tower Placed in OCS Block 6977


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



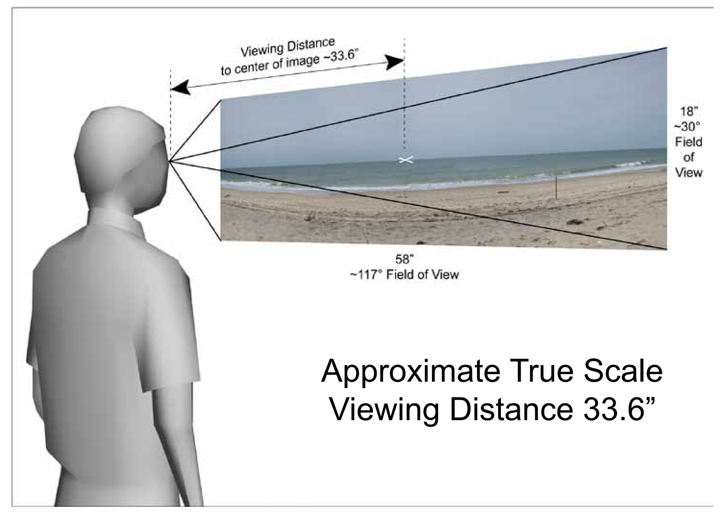


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

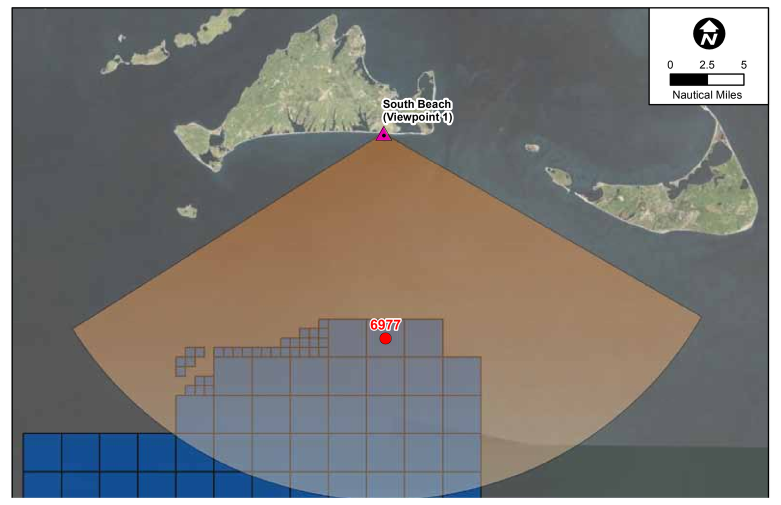
| | |
|---|---|
| Time of photograph: | 1:03 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | 14 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 7:03 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

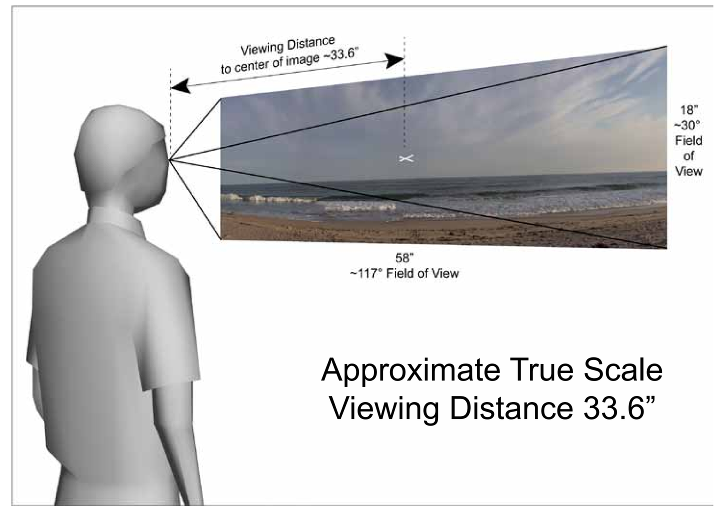


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

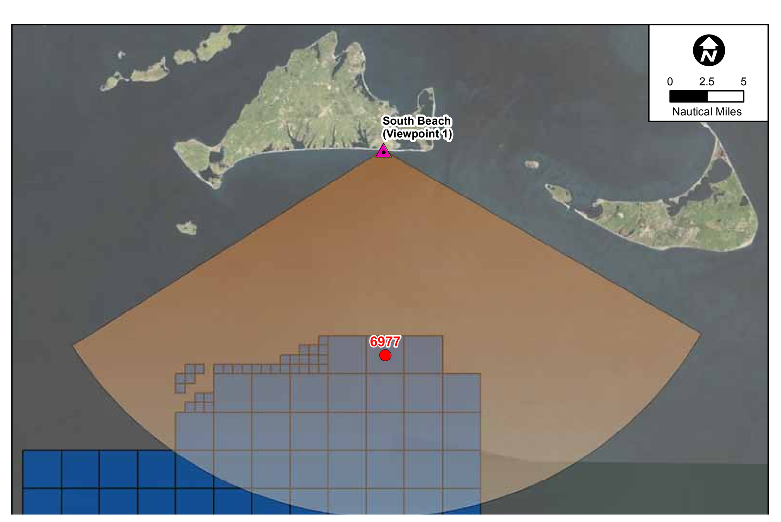
| | |
|---|---|
| Time of photograph: | 7:03 PM |
| Date of photograph: | 5-17-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 7:03 PM

## Simulation of Meteorological Tower Placed in OCS Block 6977


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

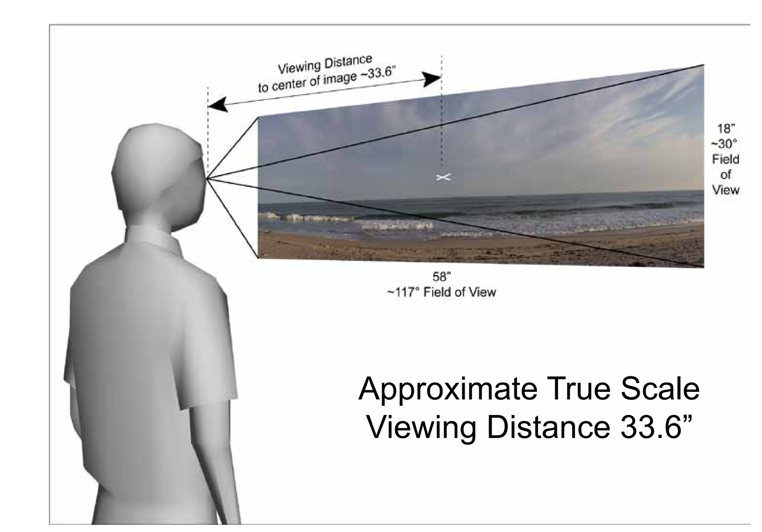


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

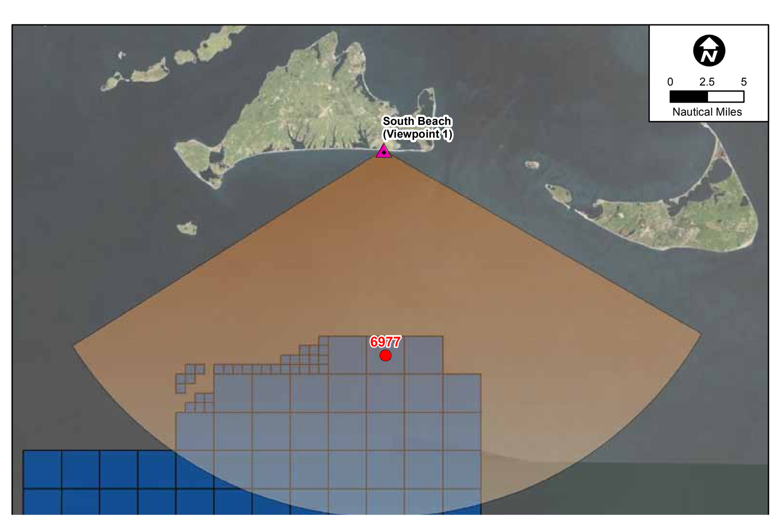
| | |
|---|---|
| Time of photograph: | 7:03 PM |
| Date of photograph: | 5-17-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | 14 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 10:08 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

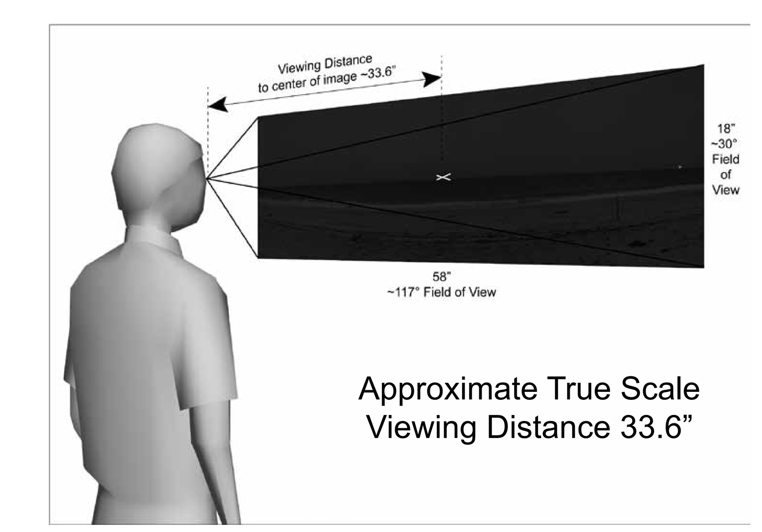


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

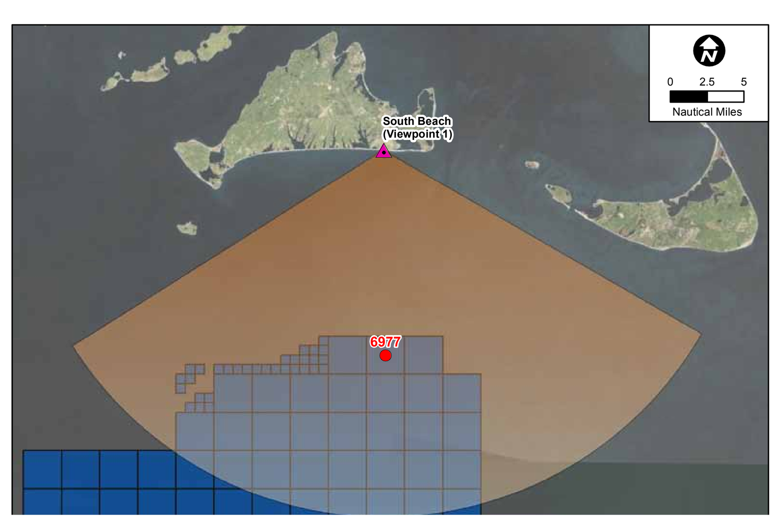
| | |
|---|---|
| Time of photograph: | 10:08 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | None |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# South Beach – 10:08 PM

## Simulation of Meteorological Tower Placed in OCS Block 6977


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

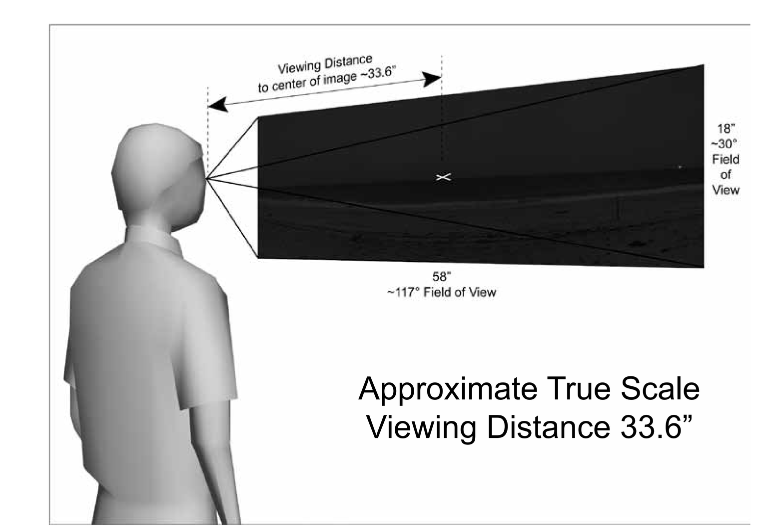


**Legend**

- Meteorological Tower
- South Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

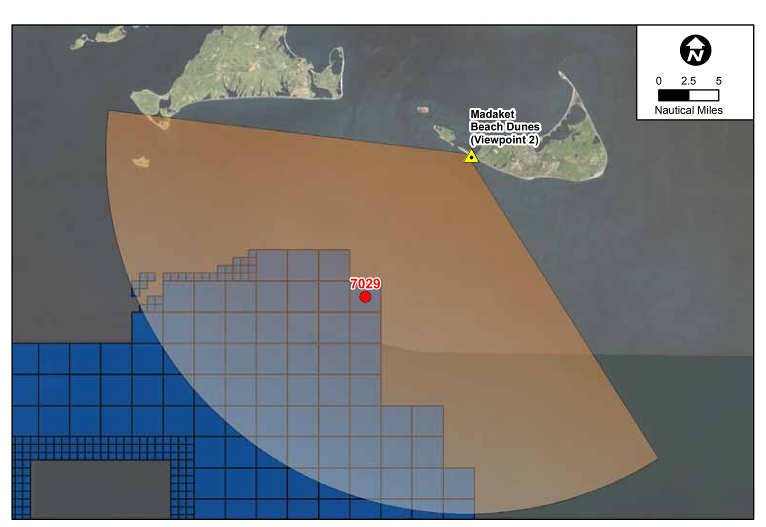
| | |
|---|---|
| Time of photograph: | 10:08 PM |
| Date of photograph: | 5-18-12 |
| Weather condition: | Cloudy |
| Viewing direction: | South |
| Latitude: | 41°19'19.431"N |
| Longitude: | 70°28'39.259"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | None |
| Distance to tower: | 14 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 183° |




# Madaket Beach Dunes – 8:02 AM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



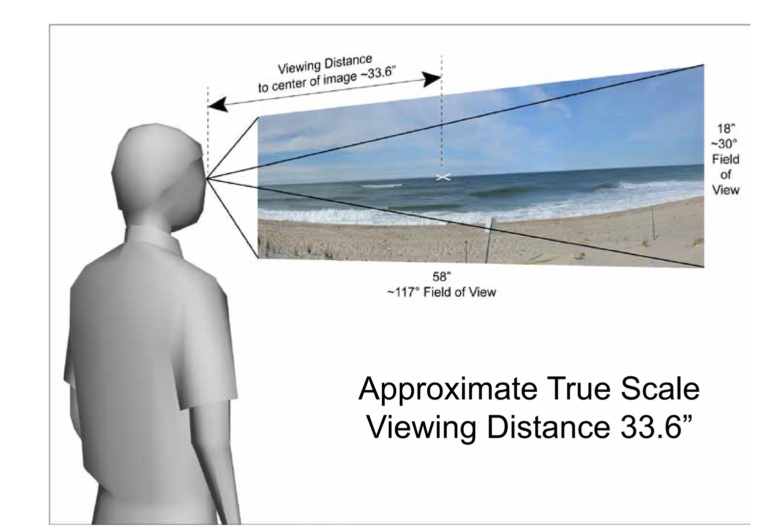


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

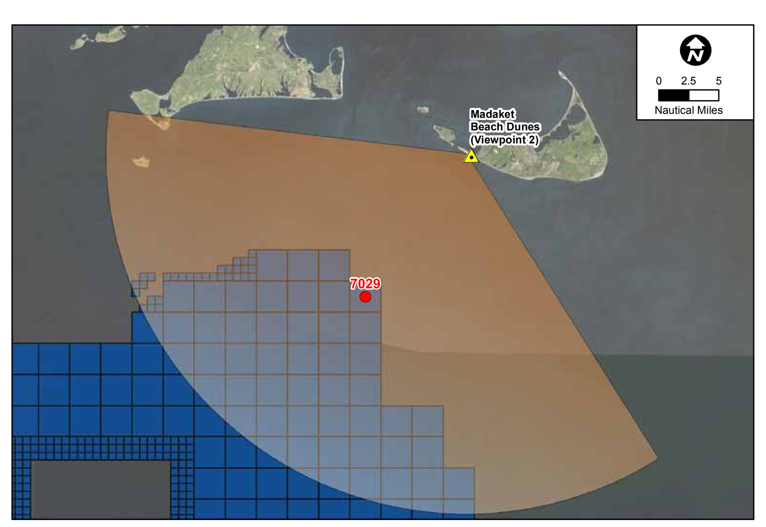
| | |
|---|---|
| Time of photograph: | 8:02 AM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Frontlight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 8:02 AM

## Simulation of Meteorological Tower Placed in OCS Block 7029


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

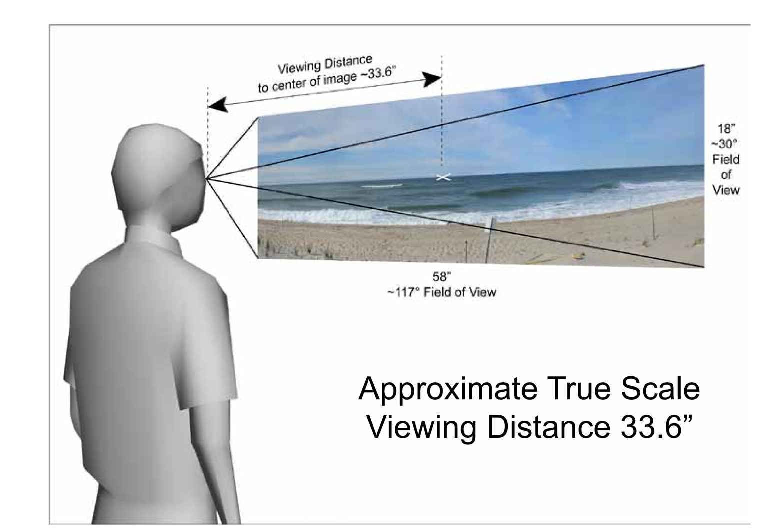



**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

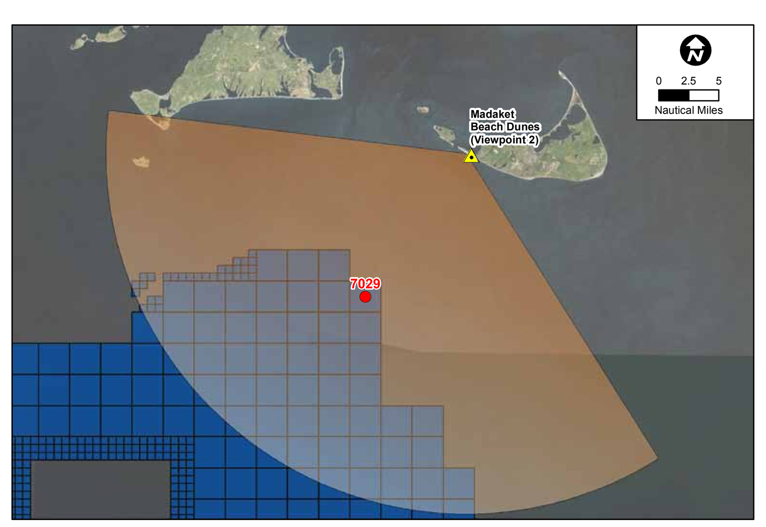
| | |
|---|---|
| Time of photograph: | 8:02 AM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Frontlight |
| Distance to tower: | 16.7 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 12:25 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



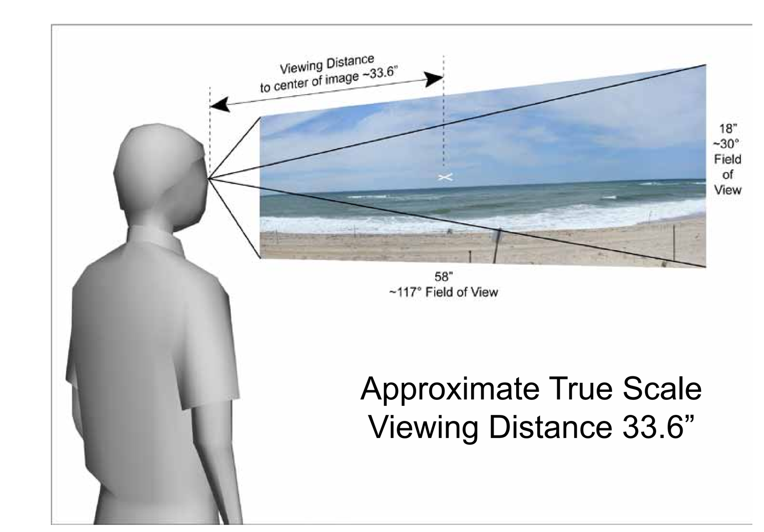


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

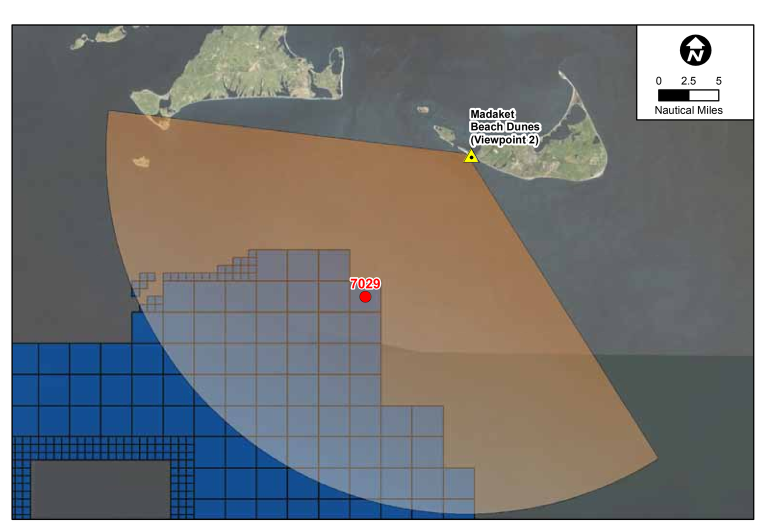
| | |
|---|---|
| Time of photograph: | 12:25 PM |
| Date of photograph: | 5-20-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 12:25 PM

Simulation of Meteorological Tower Placed in OCS Block 7029


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



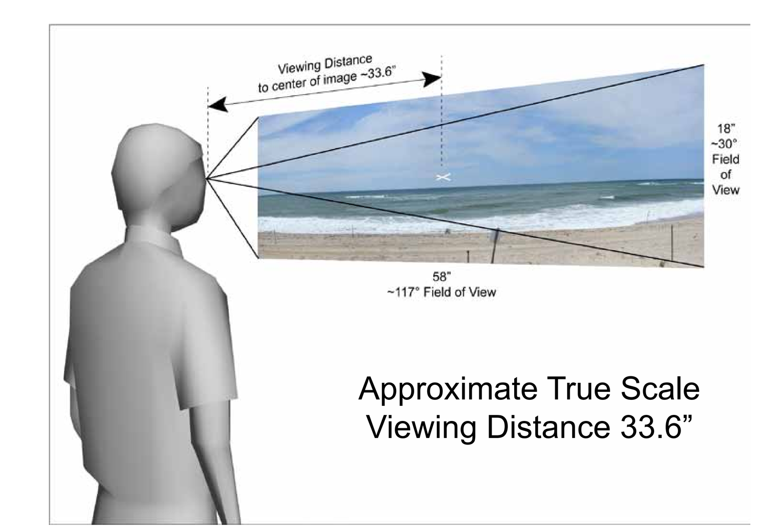


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

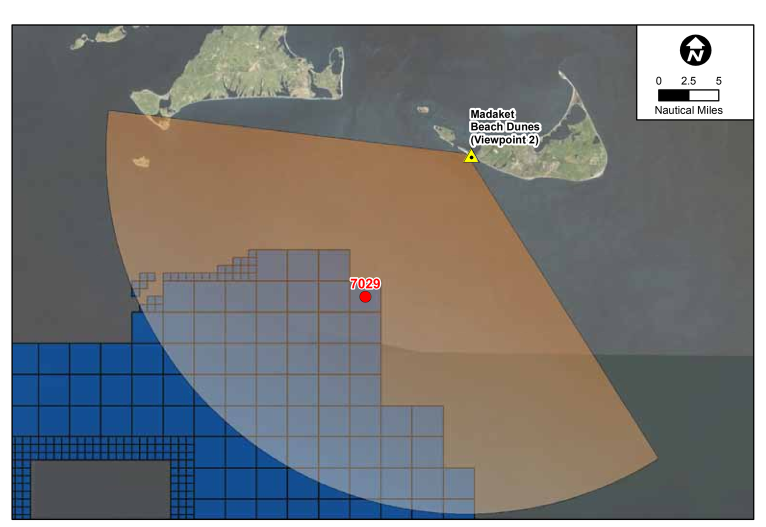
| | |
|---|---|
| Time of photograph: | 12:25 PM |
| Date of photograph: | 5-20-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Backlight |
| Distance to tower: | 16.7 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 4:34 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

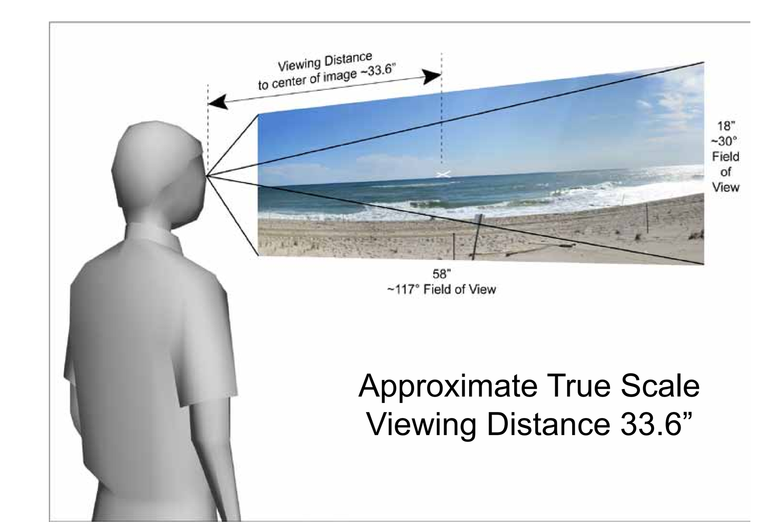


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

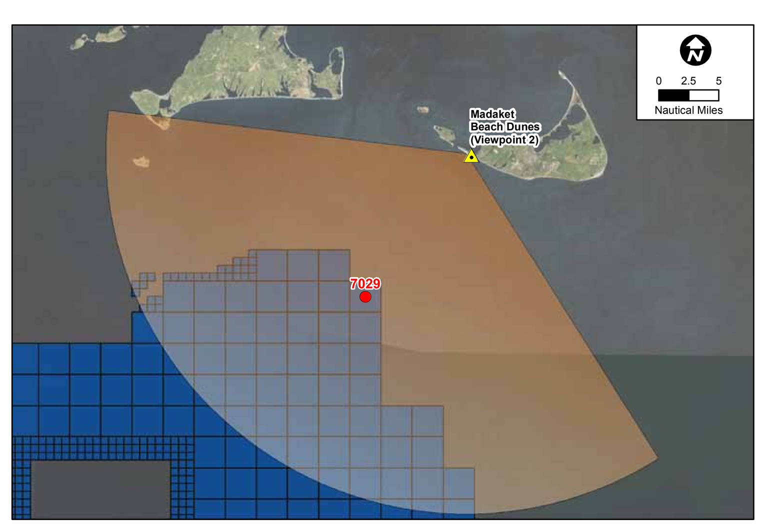
| | |
|---|---|
| Time of photograph: | 4:34 PM |
| Date of photograph: | 5-20-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 4:34 PM

## Simulation of Meteorological Tower Placed in OCS Block 7029


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.



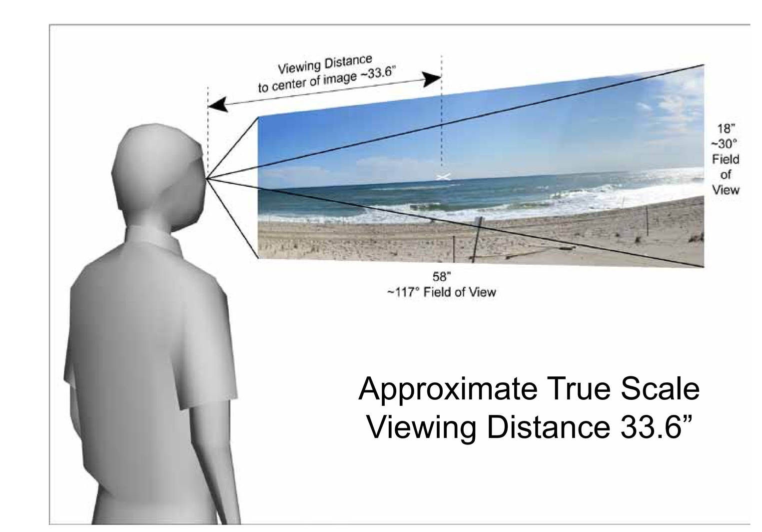


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

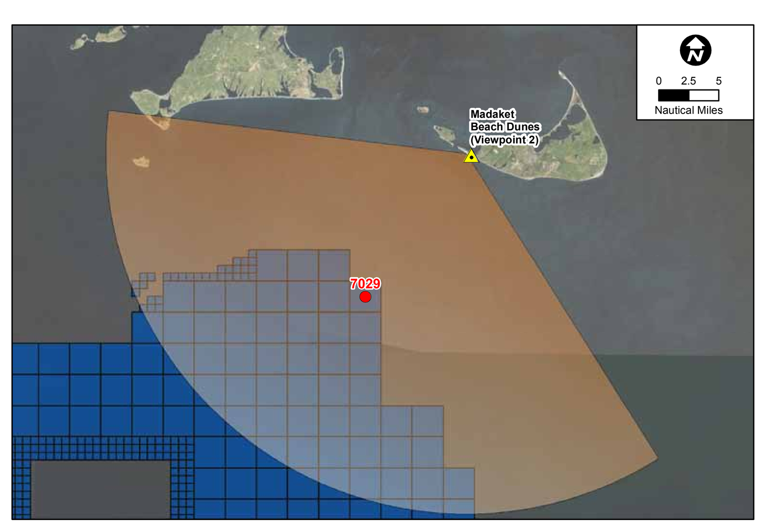
| | |
|---|---|
| Time of photograph: | 4:34 PM |
| Date of photograph: | 5-20-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56 |
| Lighting condition: | Sidelight |
| Distance to tower: | 16.7 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 7:45 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

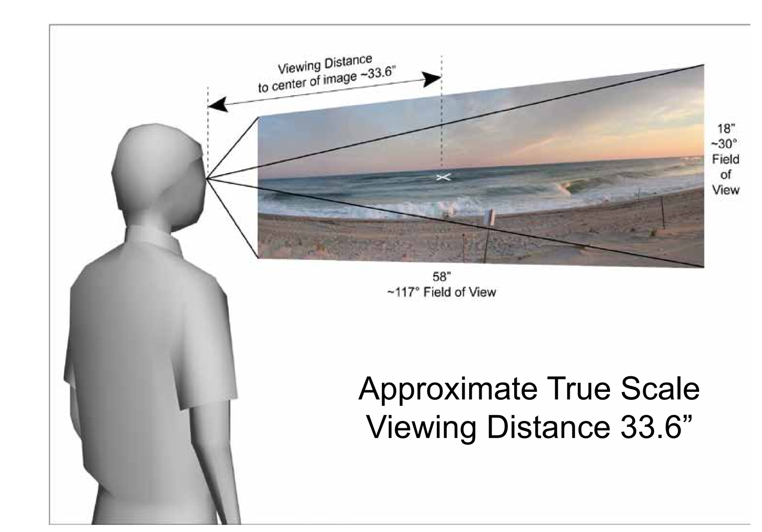


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

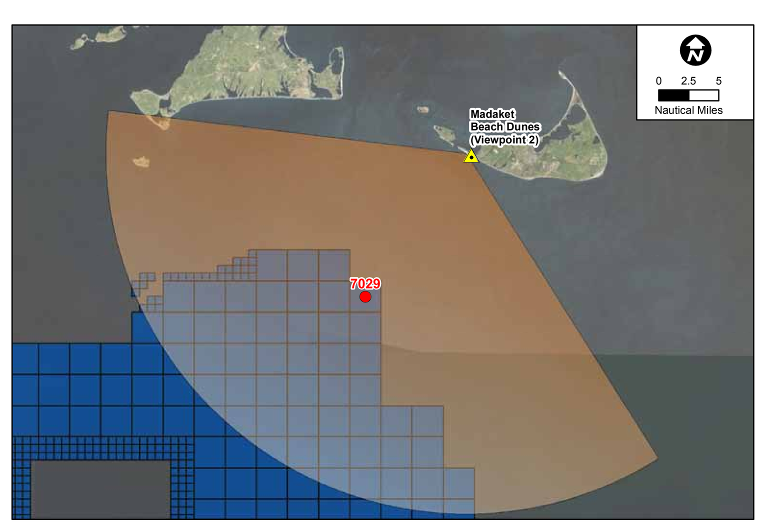
| | |
|---|---|
| Time of photograph: | 7:45 PM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 7:45 PM

## Simulation of Meteorological Tower Placed in OCS Block 7029


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

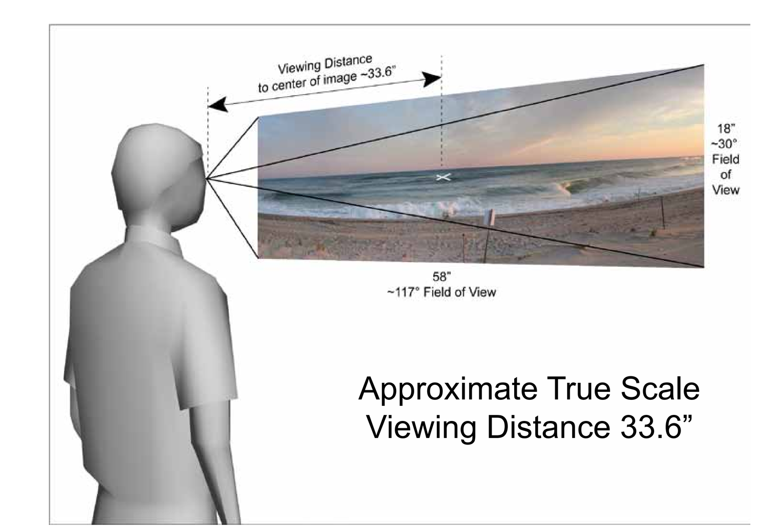


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

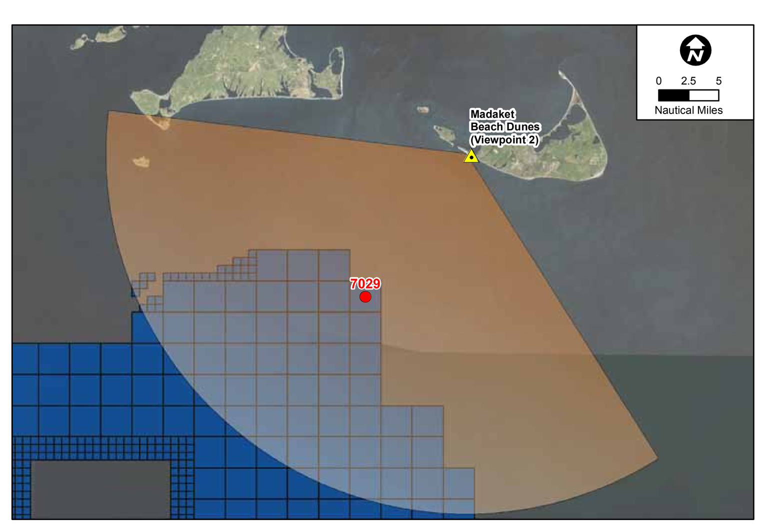
| | |
|---|---|
| Time of photograph: | 7:45 PM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | Sidelight |
| Distance to tower: | 16.7 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# Madaket Beach Dunes – 10:12 PM

Existing Conditions

Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

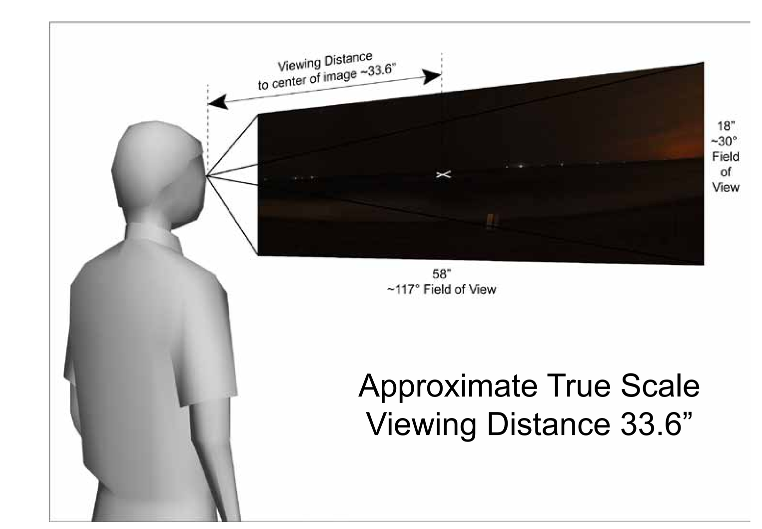


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

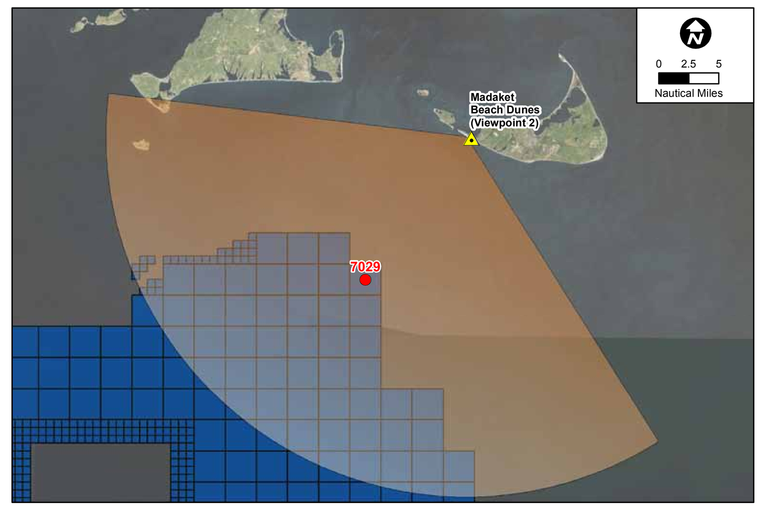
| | |
|---|---|
| Time of photograph: | 10:12 PM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | None |
| Distance to tower: | NA |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |




# **Madaket Beach Dunes** – 10:12 PM

Simulation of Meteorological Tower Placed in OCS Block 7029


Photograph is intended to be viewed approximately 33.6 inches from viewer's eyes when image is printed 18 inches tall by 58 inches long.

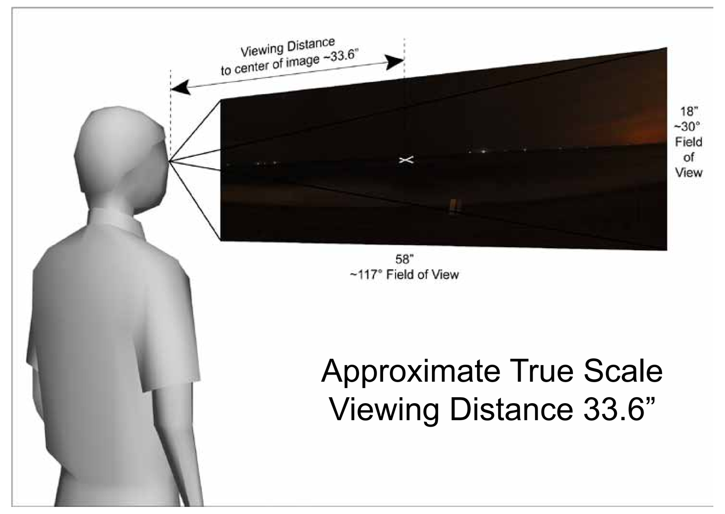


**Legend**

- Meteorological Tower
- Madaket Beach Viewpoint
- Field of View
- MA Wind Energy Area

**Photographic Information**

| | |
|---|---|
| Time of photograph: | 10:12 PM |
| Date of photograph: | 5-19-12 |
| Weather condition: | Cloudy |
| Viewing direction: | Southwest |
| Latitude: | 41°15'44.922"N |
| Longitude: | 70°11'12.26"W |
| Camera model: | Canon EOS Rebel T3i |
| Digital focal length: | 35mm |
| 35mm equivalent: | 56mm |
| Lighting condition: | None |
| Distance to tower: | 16.7 nautical miles |
| Horizontal field of view: | 117° |
| Vertical field of view: | 30° |
| Camera bearing: | 217° |

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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.

**www.boem.gov**