DONG energy

Bay State Wind LLC

Bay State Wind Offshore Wind Farm Project

Site Assessment Plan

Submitted to the Bureau of Ocean Energy Management

December 19, 2016, Revised March 17 and April 12 2017

Prepared by Tetra Tech, Inc.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

Alpine/Gardline	Alpine Ocean Seismic Survey, Inc., a Gardline Group Company
AXYS	AXYS Technologies Inc.
BMPs	best management practices
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CMECS	Coastal and Marine Ecological Classification Standard
COP	Construction and Operations Plan
CVA	Certified Verification Agent
EFH	Essential Fish Habitat
ESA	Endangered Species Act of 1973
FLIDAR	Floating Light Detection and Ranging
ft	feet
GHG	greenhouse gas
Ha	hectare
HAP	hazardous air pollutant
HAPC	Habitat Areas of Particular Concern
HRG	High Resolution Geophysical
HSE	health, safety, and environmental
kg	Kilogram
lb	Pound

Lease	Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0500)
LNM	Local Notice to Mariners
m	meter
MA EA	*Revised Environmental Assessment of Commercial Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts*
Met Buoys	Two AXYS Technologies WindSentinel™ FLIDAR Buoys and one TRIAXYS Wave and Current Buoy, to serve as the proposed meteorological and metocean data collection technologies
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act of 1972
NAAQS	National Ambient Air Quality Standard
NHPA	National Historic Preservation Act of 1966
nm	nautical mile
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NTL	Notice to Lessees
O_3	ozone
OCS	Outer Continental Shelf
PATON	Private Aids to Navigation
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
SAP	Site Assessment Plan
SO_2	sulfur dioxide
SOC	Standard Operating Conditions
TRIAXYS Buoy	TRIAXYS Wave and Current Buoy
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compounds
WatchMan™	WatchMan™ 500 controller
WEA	Wind Energy Area

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1. Introduction

Bay State Wind LLC has prepared this Site Assessment Plan (SAP) in support of the installation and operation of two floating light and detection ranging buoys (FLIDARs) and one metocean/current buoy to be located within Official Protraction Diagrams Providence NK19-07 and Block Island Shelf NK19-10, Blocks 6021 and 6976 (Installation Areas; see Figure 1-1). Bay State Wind LLC has selected the AXYS Technologies Inc. (AXYS) WindSentinel™ FLIDAR and TRIAXYS Wave and Current Buoy (TRIAXYS Buoy) (collectively referred to as the Met Buoys) as the proposed meteorological and metocean data collection technologies, respectively. The Installation Areas are contained within the Bay State Wind Offshore Wind Farm Lease Area[1] as defined under the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0500) (Lease). The Lease was issued to RES Americas Development Inc. on March 23, 2015, with an effective date of April 1, 2015. RES Americas Development Inc. subsequently assigned the lease to DONG Energy on June 12, 2015. On March 10, 2016, DONG Energy requested a 12-month extension of the Preliminary Term of the Lease from the Bureau of Ocean Energy Management (BOEM), which was approved on April 27, 2016 extending the Preliminary Term from April 1, 2016 to April 1, 2017 (see Appendix A).

This SAP has been prepared in accordance with 30 Code of Federal Regulations (CFR) §§ 585.606, 610, and 611 (see Table 1-1), the Guidelines for Information Requirements for a Renewable Energy SAP issued by BOEM on February 24, 2016, and in accordance with the stipulations of the Lease (see Table 2-1).

Prior to installation of the Met Buoys, Bay State Wind LLC will obtain all required permits and approvals from various jurisdictional agencies as identified in Table 1-2. Bay State Wind LLC will include copies of the final agency authorizations as part of the SAP (see Appendix A). Copies of agency authorizations will also be provided to BOEM prior to the initiation of SAP activities in 2017. All installation, operation, and decommissioning activities will be conducted in compliance with any additional requirements stipulated in the final permits to be issued by other regulatory agencies.

The Met Buoys described in this SAP will collect wind resource and metocean data to support development of the Lease Area.

[1] The Lease Area is defined by *Addendum A of BOEM Lease No. OCS-A 0500, Section II. Description of the Lease Area*. The total acreage of the Lease Area is approximately 187,523 acres. The Lease Area is depicted in its entirety on Figure 1-1 of this SAP.

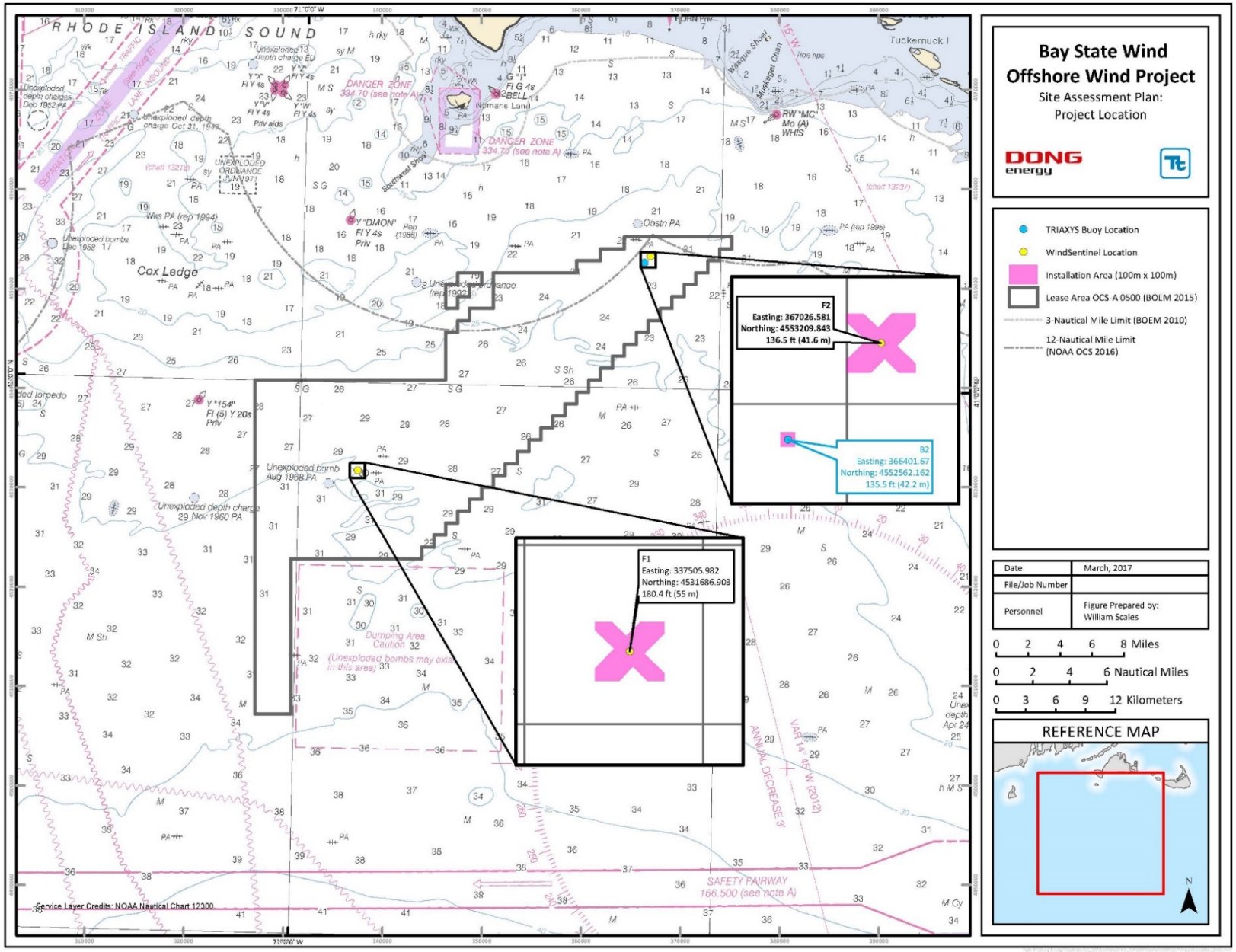

Figure 1-1 Site Assessment Plan Met Buoy Installation Area

Table 1-1 Site Assessment Plan Requirements for Commercial Leases Pursuant to §585.105(a), 606(a), 610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement
§ 585.105(a)	
1) The design of the environmental monitoring buoy and conduct of planned activities ensures safety and will not cause undue harm or damage to natural resources and will take measures to prevent unauthorized discharge of pollutants into the offshore environment.	Bay State Wind LLC will comply with this requirement, as evidenced in this SAP.
§ 585.606(a)	
1) The Project will conform to all applicable laws, regulations, and lease provisions.	Bay State Wind LLC will comply with this requirement. See Table 1-2, Table 1-3, Table 2-1, and Appendix A.
2) The Project will be safe.	Bay State Wind LLC will comply with this requirement. Specifically, see Section 4.7.
3) The Project will not unreasonably interfere with other uses of the Outer Continental Shelf (OCS), including national security or defense.	Bay State Wind LLC will comply with this requirement. See Table 2-1 for specific activities to ensure compliance.
4) The Project will not cause undue harm or damage to natural resources; life; property; the marine, coastal, or human environment; or historical or archeological resources.	See Section 7 for an analysis of site characteristics and for avoidance and mitigation measures.
5) The Project will use best available and safest technology.	Bay State Wind LLC will comply with this requirement. See Section 3.1 and Appendix B for a description and technical specifications on the selected Met Buoys
6) The Project will use best management practices.	Bay State Wind LLC will comply with this requirement. Best management practices are described in Table 1-3, Sections 4, 5, 6, and 7.
7) The Project will use properly trained personnel.	Bay State Wind LLC will ensure that all personnel meet the company's standard technical as well as health, safety, and environmental (HSE) standards for the work being conducted.
§ 585.610(a)	
1) Contact Information	Richard Khaira-Creswell Senior Measurement Engineer +44 20 7 8111183 riccr@dongenergy.co.uk 5 Howick Place, Westminster, SW1P 1WG, London, United Kingdom
2) Site assessment concept	Meteorological, metocean, and biological data collection using up to two FLIDAR WindSentinels™ and one TRIAXYS Buoy.
3) Designation of operator	Not applicable. See Section 1.1.
4) Commercial lease stipulations and compliance	See Table 2-1.
5) A location plat	See Figure 1-1.
6) General structural and project design, fabrication and installation information	See Sections 3, 4, and 5.
7) Deployment activities	See Section 4.
8) Measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	This SAP has been prepared in accordance with the Commercial Wind Lease Issuance and Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts (MA EA), and Stipulations in the Commercial Lease. Specific efforts to avoid, minimize, reduce, eliminate, or monitor environmental impacts can be found in Sections 4 and 7. Conformance with the MA EA is detailed in Section 2.
9) Certified Verification Agent nomination	Not applicable. See Section 1.2.
10) Reference information	See Section 0.
11) Decommissioning and site clearance procedures	See Section 6.

Table 1-1 Site Assessment Plan Requirements for Commercial Leases Pursuant to §585.105(a), 606(a), 610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement
12) Air quality information	See Section 7.5.2.
13) A listing of all federal, state, and local authorizations or approvals required to conduct site assessment activities on your lease	See Table 1-2.
14) A list of agencies and persons with whom you have communicated, or with whom you will communicate, regarding potential impacts associated with your proposed activities	See Appendix A.
15) Financial assurance information	To be provided by Bay State Wind LLC prior to initiation of installation activities, if requested.
§585.610(b)	
Geotechnical	
(i) A description of all relevant seabed and engineering data and information to allow for the design of the foundation for that facility	Section 7.1, Appendix C
Shallow Hazards	
(i) Shallow faults;	Section 7.1.1
(ii) Gas seeps or shallow gas;	Section 7.1.1
(iii) Slump blocks or slump sediments;	Section 7.1.1
(iv) Hydrates; or	Section 7.1.1
(v) Ice scour of seabed sediments.	Section 7.1.1
Archaeological Resources	
(i) A description of the results and data from the archaeological survey;	Section 0, Appendix D
(ii) A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act of 1966 (NHPA), as amended.	Section 0, Appendix D
Geological Survey	
(i) Seismic activity at your proposed site;	Section 7.1.1
(ii) Fault zones;	Section 7.1.1
(iii) The possibility and effects of seabed subsidence; and	Section 7.1.1
(iv) The extent and geometry of faulting attenuation effects of geologic conditions near your site.	Section 7.1.1
Biological	
(i) Live bottoms	Section 7.2.1
(ii) Hard bottoms	Section 7.2.1
(iii) Topographic features; and	Section 7.2.1
(iv) Surveys of other marine resources such as fish populations (including migratory populations), marine mammals, sea turtles, and sea birds.	Sections 7.2.1 and 7.2.2
§ 585.611(a) and (b) Requirements	
Hazard information	Section 7.1.1
Water quality	Section 7.5.1
Biological resources	
(i) Benthic communities	Section 7.2
(ii) Marine mammals	Section 7.3
(iii) Sea turtles	Section 7.3
(iv) Coastal and marine birds	Section 7.4
(v) Fish and shellfish	Section 7.2
(vi) plankton and seagrasses, and	Section 7.2

Table 1-1 Site Assessment Plan Requirements for Commercial Leases Pursuant to §585.105(a), 606(a), 610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement
(vii) plant life	Section 7.2
Threatened or endangered species	Sections 7.3 and 7.4
Sensitive biological resources or habitats	Section 7.2
Archaeological resources	Section 0, Appendix D
Social and economic resources	Section 7.6
Coastal and marine uses	Section 0
Consistency Certification	Table 1-2
Other Resources, conditions, and activities	Not Applicable.

Table 1-2 Permit Matrix

Permitting Agency	Applicable Permit or Approval	Statutory Basis	Regulations	Applicant Requirements
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS)	Endangered Species Act Section 7 Consultation	16 United States Code (U.S.C.) 1536	50 CFR 402	No Action Required. These consultations were completed prior to the issuance of the Lease.
	Magnuson-Stevens Fishery Conservation and Management Act Section 305(b) Consultation	16 U.S.C. 1801	50 CFR 600	No action required. These consultations were completed prior to the issuance of the Lease.
	Incidental Take Authorization	Marine Mammal Protection Act of 1972(MMPA)	16 U.S.C. §§ 1361 *et seq.*	No action required. As detailed in Sections 4, 5, and 6, installation, operation and decommissioning of the Met Buoys will not result in the harassment of marine mammals protected under the MMPA.
U.S. Army Corps of Engineers	Category 1 General Permit	Clean Water Act 33 U.S.C.134	33 CFR 320 *et seq*.	Bay State Wind LLC will file a Pre-Construction Notification with the United States Army Corps of Engineers documenting eligibility under and conformance with the terms of the General Permit.
United States Coast Guard (USCG)	Approval for Private Aids to Navigation	14 U.S.C. 81	33 CFR Part 66	Bay State Wind LLC will submit an application to the USCG for a Private Aids to Navigation (PATON) prior to the installation of the Met Buoys.
U.S. Department of Interior, BOEM	NHPA Section 106 Consultation	NHPA 16 U.S.C. 470	36 CFR Part 60, Part 800	No action required. BOEM has executed a Programmatic Agreement that establishes procedures for consultations for site assessment activities in the Massachusetts Wind Energy Area (WEA) and under NHPA Stipulations for the identification and protection of cultural resources are included in the Lease.
	Abandoned Shipwreck Act/Consultation and Determination	Abandoned Shipwreck Act 43 U.S.C. 2101 et seq.		Section 0 and Appendix D provide an evaluation of cultural resources that could occur in the Met Buoy Installation Area. Results of this assessment indicated that the installation, operation and decommissioning of the Met Buoys will have no impact on submerged archaeological properties.
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act Section 7 Consultation	16 U.S.C. 1536	50 CFR 402	No action required. These consultations were completed prior to the issuance of the Lease.
Massachusetts Office of Coastal Zone Management	Coastal Zone Program Consistency Certification	Coastal Zone Management Act	15 CFR 930 Subpart C	No action required. A final Coastal Zone Consistency Determination has been issued for SAP activities in the Massachusetts WEA. See Appendix A

1.1 Authorized Representative and Designated Operator

As the lease holder, Bay State Wind LLC, by default, is also the lease operator. Bay State Wind LLC proposes to have AXYS serve as the contracted operator for the met buoys. The contact information for AXYS's Authorized Representative is as follows:

Name of Authorized Representative	Richard Khaira-Creswell
Title	Senior Measurement Engineer
Phone Number	+44 20 7 8111183
Email	riccr@dongenergy.co.uk
Address	5 Howick Place, Westminster, SW1P 1WG, London, United Kingdom

1.2 Certified Verification Agent Waiver Request

Pursuant to 30 CFR § 585.610(a)(9), BOEM may require a Certified Verification Agent (CVA) to certify to BOEM that the Met Buoys are designed to withstand the environmental and functional load conditions for the intended life of the Met Buoys in the Installation Areas. Bay State Wind LLC requests a waiver of the CVA requirement per 30 CFR § 585.705(c) because the selected Met Buoys are a commercially available technology that has been deployed in similar conditions. Bay State Wind LLC will have a Senior Measurements Engineer from AXYS perform the duties similar to those of a CVA. The Senior Measurements Engineer will also inspect the equipment prior to installation, witness the installation, and prepare an installation report as described in Section 4.

1.3 Best Management Practices

Best management practices (BMPs) are described in Sections 1.3, 4, and 7. Bay State Wind LLC will use its standard internal project execution structure to manage activities described in the SAP. As stated in Section 4.7, SAP activities will be supported by a detailed HSE Plan, which is included as Appendix F.

In addition, Bay State Wind LLC will use many of the BMPs identified in the *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan* (BOEM 2016) and *Establishment of an OCS Alternative Energy and Alternate Use Program*, Record of Decision, December 2007 (BOEM 2007). See Table 1-3 for a summary of these BMPs (numbering in Table 1-3 corresponds to the format of the noted SAP Guidelines).

Table 1-3 Best Management Practices

Best Management Practices	Location in SAP Document
7. Avoid known sensitive seafloor habitats	Section 7.1.1
8. Avoid anchoring on sensitive seafloor habitats	Section 7.1.1
11. Routine inspection of the buoys to monitor scouring and ensure structural integrity	Section 5.2
12. Avoid the use of explosives that may impact fish or benthic organisms	No explosives will be used for activities proposed in the SAP.
15, 16, 18, and 22 related to minimizing/avoiding vessel impacts to marine mammals and sea turtles.	Section 4.4
19. Use existing data to identify important, sensitive, and unique marine habitats in the vicinity of the project and design the deployment to avoid adverse impacts to these habitats	Section 7
20. Minimize construction activities in areas containing anadromous fish during migration periods	Section 7.2.1
21. Minimize seafloor disturbance during installation of the buoys	Section 4.1
26. Minimize perching opportunities	Section 7.4.2

Table 1-3 Best Management Practices

Best Management Practices	Location in SAP Document
29. Comply with USCG lighting and marking requirements while using lighting technology that minimizes impacts to avian species	Table 1-2 and Section 7.4.2
37. Avoid impacts to the commercial fishing industry by marking the buoy(s) with USCG-approved marking and lighting to ensure safe vessel operation	Table 1-2 and Section 7.6.1
39. Avoid hard-bottom habitats, including seagrass communities and kelp beds	Section 7.2.1
54. Prepare an oil spill response plan	Prior to commencing installation of the Met Buoys, Bay State Wind LLC will submit an Oil Spill Response Plan for review and approval to the Oil Spill Response Division of the Bureau of Safety and Environmental Enforcement (BSEE). The plan will demonstrate compliance with 30 CFR 254.22(a), 254.23(a) and 254.23(g)(1).

2. Conformance with the Commercial Lease and the Massachusetts Environmental Assessment/Finding of No Significant Impact

On June 3, 2014, BOEM issued a Finding of No Significant Impact based on a comprehensive Environmental Assessment (referred to herein as the "MA EA") (BOEM 2014). The MA EA analyzed the foreseeable consequences associated with issuing commercial leases within the Massachusetts WEA, which is inclusive of the Lease Area (Figure 1-1), as well as the site assessment activities including the installation of Met Buoys. The Met Buoys proposed are consistent with the equipment that has been analyzed in the MA EA. BOEM identified several mitigation measures or Standard Operating Conditions (SOCs) in the MA EA for buoy installation, operation, and decommissioning. The SOCs were developed by BOEM in consultation with other federal and state agencies to reduce or eliminate the potential environmental risks to, or conflicts with, individual environmental and socioeconomic resources upon issuance of a commercial lease for site assessment and characterization activities. BOEM has issued the mitigation measures for Bay State Wind LLC's lease-specific site characterization activities and site assessment activities in the Lease based upon these SOCs. Bay State Wind will implement these measures as described in more detail in Table 2-1 and Section 7 of this SAP.

Table 2-1 Conformance with the Commercial Renewable Energy Lease Number OCS-A 0500 Stipulations

Addendum "C" Stipulation	Description	SAP Document
3 National Security and Military Operations		
3.2.4 Lessee Point-of-Contact for Evacuation/Suspension Notifications	The Lessee must inform the Lessor of the persons/offices to be notified to implement the terms of 3.2.2 and 3.2.3.	James Neveu Environmental Manager, USA (857) 210-9152 janev@dongenergy.com 1 International Place Boston, MA 02110
3.2.5 Coordination with Command Headquarters	The Lessee must establish and maintain early contact and coordination with the appropriate command headquarters, in order to avoid or minimize the potential to conflict with and minimize the potential effects of conflicts with military operations.	Bay State Wind LLC will establish an appropriate point of contact at Fleet Forces in Norfolk, Virginia, as provided in the Commercial Lease.
3.3 Electromagnetic Emissions	The Lessee, prior to entry into any designated defense operating area, warning area, or water test area, must enter into an agreement with the commander of the appropriate command headquarters prior to commencing survey	The Met Buoy Installation Area is located within the Narragansett Bay Operating Area. Bay State Wind LLC will provide the frequencies the Met

Table 2-1 Conformance with the Commercial Renewable Energy Lease Number OCS-A 0500 Stipulations

Addendum "C" Stipulation	Description	SAP Document
	activities undertaken to support SAP or Construction and Operations Plan (COP) submittal, to coordinate the electromagnetic emissions associated with any survey activities. The Lessee must ensure that all electromagnetic emissions associated with such survey activities are controlled as directed by the commander of the appropriate command headquarters.	Facilities will use to transmit data to confirm electromagnetic emissions from the SAP activities will not conflict with military operations.
4 Standard Operating Conditions		
4.1.1 Vessel Strike Avoidance Measures	The Lessee must ensure that all vessels associated with activities performed in support of plan (i.e., SAP and/or COP) submittal comply with the vessel-strike avoidance measures specified in stipulations 4.1.1.1 through 4.1.1.7, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk.	See Section 4.4, Protected Species Avoidance
4.1.2 Marine Trash and Debris Prevention	The Lessee must ensure that vessel operators, employees and contractors actively engaged [in] site characterization activities performed in support of plan (i.e., SAP and/or COP) submittal are briefed on marine trash and debris awareness and elimination, as described in the Bureau of Safety and Environmental Enforcement Notice to Lessees (NTL) No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination"), except that the Lessor will not require the Lessee, vessel operators, employees and contractors to undergo formal training or post placards. The Lessee must ensure that vessel operator employees, and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above-referenced NTL provides information the Lessee may use for this awareness training.	Bay State Wind LLC will comply with this stipulation and NTL 2015-G03 which has superseded NTL 2012-G01, except that formal training will not be conducted and placards will not be posted. Vessel Operators, employees, and contractors will be briefed prior to boarding the vessel.
4.4.1 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 Lessee must use the form provided in Appendix A to Addendum C of the Lease to report the sighting or incident. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure that the vessel assist in any salvage effort as requested by NMFS.	See Section 4.4

3. Project Description and Objectives

3.1 Project Description and Objectives

Bay State Wind LLC will conduct meteorological and metocean evaluations as part of the site assessment activities of the Project within the Lease Area. Bay State Wind LLC will collect and analyze meteorological data, inclusive of wind speed and direction at multiple heights, and information on other meteorological and metocean conditions within the Lease Area. As stated previously, Bay State Wind LLC has proposed that the collection of this data will be performed using two AXYS WindSentinels™ and one TRIAXYS Buoy. The proposed Met Buoys represent state-of-the-art equipment that incorporates the best available technologies. Design drawings of the technology proposed are provided in Appendix B.

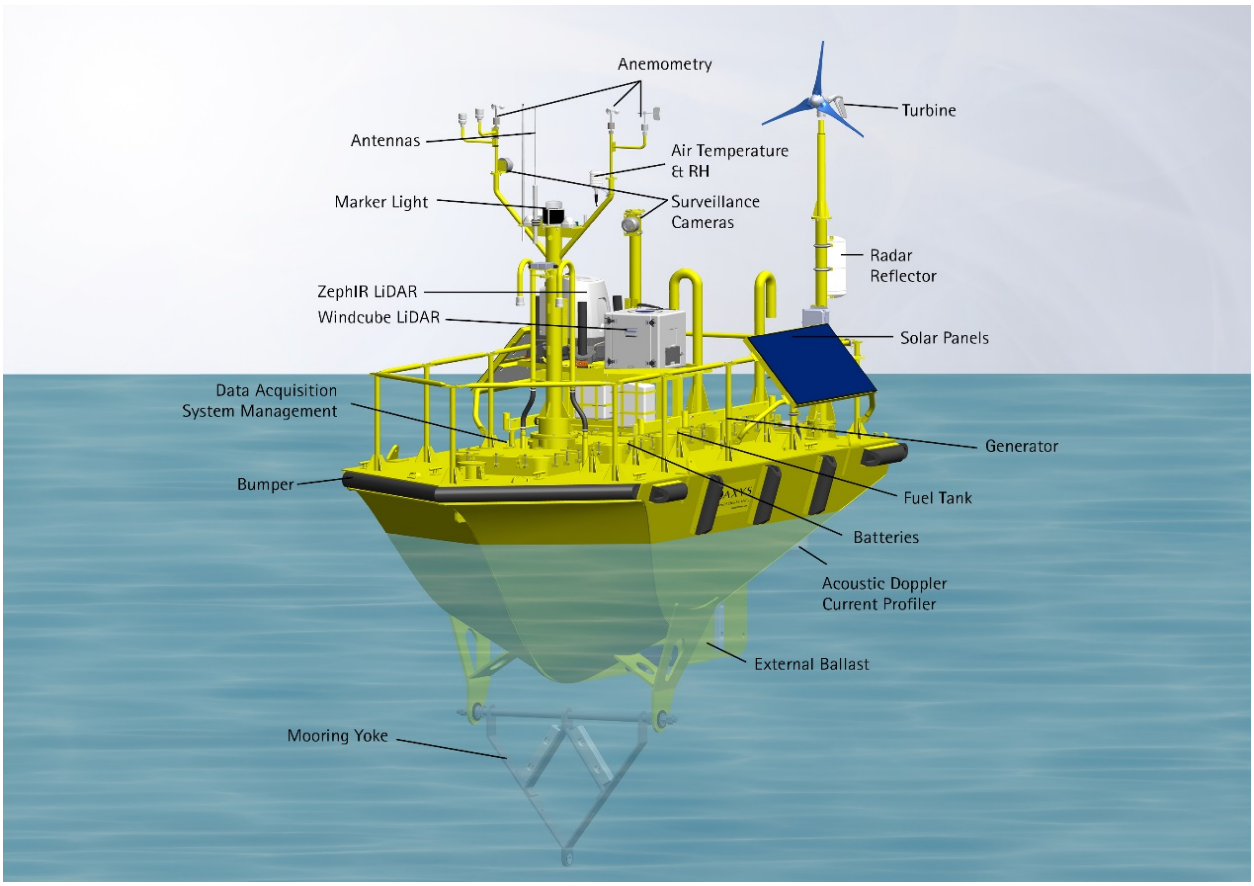

Figure 3-1 WindSentinel™ Buoy

The WindSentinel™ will consist of instrumentation and supporting systems atop a floating moored buoy platform (Figure 3-1). The floating platform consists of the AXYS Navy Oceanographic Meteorological Automated Device hull, mooring chain, and clump weight anchor. The hull consists of marine-grade 5086 aluminum and measures 20.7 feet (ft) (6.3 meters [m]) long by 10.5 ft (3.2 m) wide and weighs 15,000 pounds (lbs) (6,818 kilograms [kg]) (bare hull weight). The vertical profile of the WindSentinel™, including instrumentation, will be approximately 13.5 ft (4.1 m) from the sea surface to the top of the hull mast. The submerged portion of the hull would measure approximately 8.5 ft (2.6 m) below the sea surface from the water line to the bottom of the mooring yoke. The outer hull is constructed of a corrosion resistant marine grade stainless steel. The hull has also been designed with consideration for avian species. Landing areas have been minimized and anti-perching devices will be installed on the lights and mast.

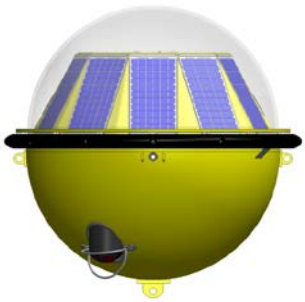

Figure 3-2 TRIAXYS Buoy

The TRIAXYS Buoy is a 3.6 ft (1.1 m) round buoy that measures directional waves & currents as well as water temperature (Figure 3-2). The buoy hull and dome are constructed from stainless steel and impact resistant polycarbonate, respectively. The TRIAXYS Buoy is attached to the seabed using a special floating mooring design. The vertical profile of the TRIAXYS Buoy will be approximately 1.8 ft (0.55 m) from the sea surface to the top of the buoy. The submerged portion of the buoy hull would measure approximately 1.8 ft (0.55 m) below the sea surface from the waterline to the bottom of the buoy. The TRIAXYS Buoy weighs 507 lbs (230 kg).

3.2 Schedule

Bay State Wind LLC plans to deploy the Met Buoys in May 2017. The operational lives of the WindSentinel™ and TRIAXYS Buoy are expected to be two and four years, respectively. The Met Buoys will be decommissioned at the end of the operational life as described in Section 6.

3.3 Site Location

The location of the proposed Met Buoys will fall within three sites that were surveyed and evaluated by Bay State Wind LLC in late-summer/early-fall 2016 (see Figure 3-3, Section 7 and Appendices C, D, and E). These sites are collectively referred to the Installation Areas (Figure 1-1).

For the purpose of the discussion in this SAP, the three Installation Areas where the Met Facilities are proposed to be located have been given unique identifiers. The Installation Area for the WindSentinel™ to be located in the southwest corner of the Lease Area is referenced as F1. The Installation Areas for the Met Buoys to be installed in the northeast corner of the Lease Area are referenced as F2 and B2, respectively. The coordinates for these locations are provided in Table 3-1 and depicted on Figure 1-1.

The Met Buoys will be deployed within the proposed Installation Areas at the coordinates listed in Table 3-1.

Table 3-1 Location of the Met Buoys

Platform	ID	Northing (UTM 19N NAD83)	Easting (UTM 19N NAD83)	Mean Lower Low Water Depth	OCS Lease Block	Aliquot
WindSentinel™	F1	4531687	337506	180.4 ft (55 m)	6021	M
WindSentinel™	F2	4553210	367027	136.5 ft (41.6 m)	6976	F
TRIAXYS Buoy	B2	4552562	366402	135.5 ft (42.2 m)	6976	I

3.4 Mooring Designs, Power Equipment and Instrumentation

The location for the deployment of the proposed Met Buoys as presented in Table 3-1 was based on a review of existing data, information collected during 2016 high resolution geophysical (HRG) surveys conducted within the Lease Area (See Appendix C) and the best available technologies. The following sections provide detailed descriptions of the proposed Met Buoys as well as their associated mooring designs, power equipment and instrumentation.

Figure 3-3 Area of Potential Seafloor Disturbance

3.4.1 WindSentinel™

3.4.1.1 Mooring Design

The WindSentinels™ will be attached to the seafloor by means of a u-mooring design which is comprised of a chain that connects the WindSentinel™ to both a primary and secondary clump anchor as well as a pendant buoy (Figure 3-4). The u-mooring design facilitates recovery of the WindSentinel™ in higher sea state conditions by allowing the mooring to be recovered and the WindSentinel™ to be towed without the need to transfer personnel at sea. The primary and secondary clump weights would weigh approximately 5.5 tons (5,000 kg) and 2.5 tons (2,268 kg), respectively and sit on the seabed for a total area of up to 42 ft^2 (3.9 m^2). The chain would be attached to the base of the hull via the steel mooring yoke. The area of the anchor chain sweep associated with the long-term operation of the WindSentinels™ are anticipated to be approximately 6.9 acres (2.8 hectares [ha]) (based on anchor chain radii of approximately 262.5 ft [80 m], 164 ft [50 m], and 442.9 ft [135 m] connector chain on the sea floor) for F1 and 7.9 acres (3.2 ha) (based on anchor chain radii of approximately 305.1 ft [93 m], 128 ft [39 m].and 442.9 ft [135 m] of connector chain on the seafloor). Vertical penetration of the primary and secondary clump weights into the seabed is anticipated to be approximately 6.6 ft to 9.9 ft (2 m to 3 m) and 3.3 to 6.6 ft (1m to 2 m), respectively.

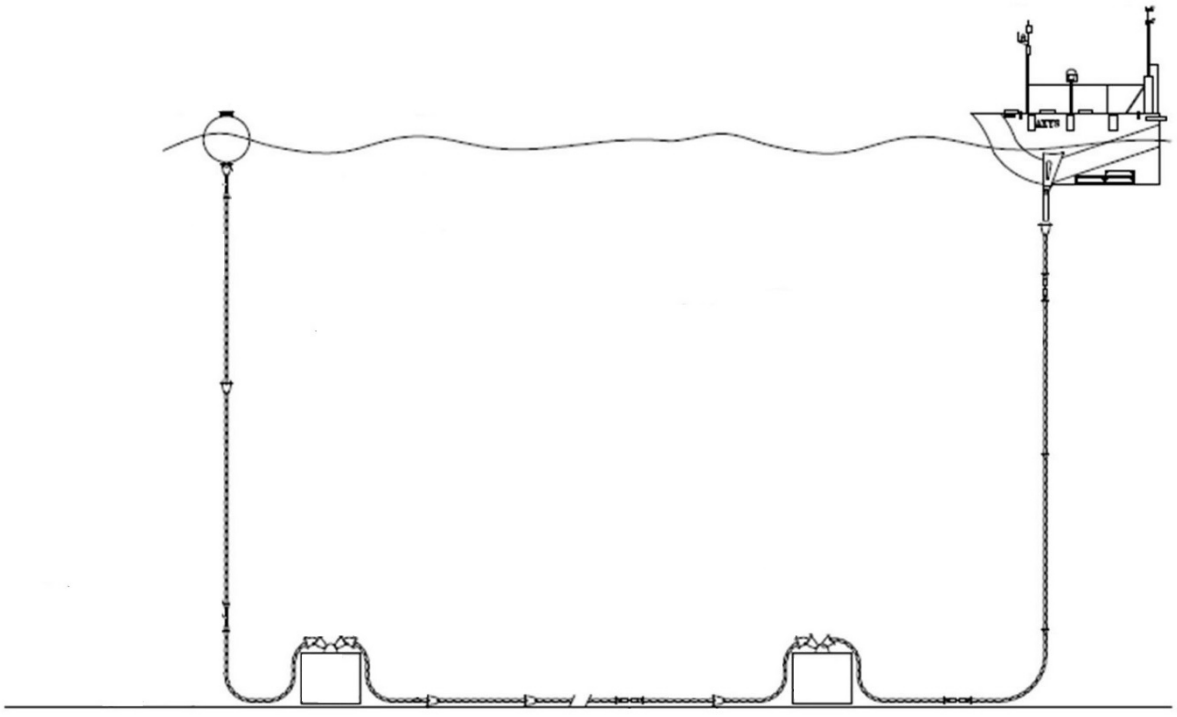

Figure 3-4 FLIDAR WindSentinel™ U-Mooring Design

3.4.1.2 Power Equipment

The WindSentinel™ instrumentation will be powered by 40 100-amp hour lead-acid batteries, primarily charged by a hybrid wind-solar system, with a 3,200 watt diesel generator as a secondary backup battery charging source. Triple redundancy is provided through the use of a 2 by 240-watt solar panel array, which will be mounted on the superstructure to avoid damage by waves, and is available for instances where both

wind and diesel generators are offline. The solar panel system will allow the WindSentinel™ to inform the operator that the main power systems are down and will continue to monitor and track the buoy. A regulator protects the batteries from being damaged by possible overcharging.

In the event of failure of the key power supply systems, the WindSentinel™ instrumentation would be capable of operating at full capacity on battery power alone for up to seven days.

3.4.1.3 Instrumentation Equipment

A dual light detection and ranging (LiDAR) instrumentation package, comprised of ZephIR300 and WINDCUBE® LiDARs, will be installed atop the WindSentinel™. The ZephIR300 and WINDCUBE® units are wind profiling devices capable of remotely measuring and collecting wind speeds and directions up to 984 ft (300 m) and 656 ft (200 m) respectively. The WindSentinel™ would also contain the following equipment:

- an A100 R/K anemometer to measure wind speed and direction;
- a barometric pressure sensor to provide atmospheric pressure;
- a combined PT 100 RTD temperature sensor and Rotronic Hygromer C94 relative humidity sensor;
- a TRIAXYS™ g3 Wave Sensor that contains accelerometers that measure acceleration along each of the three orthogonal axes, three angular rate gyros that measure rotation about the yaw, pitch and roll axes and a magnetic compass. The TRIAXYS Sensor measures significant and maximum wave height, average wave direction, zero mean crossing period, peak period, and directional wave spectrum; and
- integrated wireless communication systems to provide data download and system remote operation via general packet radio service, satellite, or wireless radio or mobile phone connection to shore.

The data acquisition system will acquire and store data using the WatchMan™ 500 controller (WatchMan™). The WatchMan™ has an intelligent, configurable sensor input/output platform with two-way communication, designed for long-term operations in harsh marine environments. The WatchMan™ manages the operation of each sensor in the system and the power equipment, allows for remote adjustments to system performance, and transfers data using a combination of, Iridium Short Burst Data and Inmarsat iSAT data pro satellite telemetry, HSPA/GPRS cellular telemetry, and Bluetooth for the WindSentinel™.

The following supporting systems for navigational aids, position tracking, and remote monitoring will also be installed on the WindSentinel™:

- an Aid to Navigation AIS satellite transmitter for tracking the buoy location;
- a set of navigation light aids to protect the FLIDAR and act as a reference for mariners;
- a Carmanah Light Model M850 Solar LED Marine Lantern;
- a Skywave IDP-690 Inmrsat IsatData Pro satellite transceiver for Global Positioning System data, time synch, and back-up telemetry;
- a 3DM-GX3 miniature Attitude Heading Reference System to provide static and dynamic orientation and inertial measurements;
- a passive EchoMax RADAR Reflector to enhance the systems visibility to near-by vessels;
- a WatchCircle Alert System position verification; and

- two on-board web cameras to support operational performance and security.

Using the maintenance plan described in Section 5.2, equipment on the WindSentinel™ will have a minimum two-year operational lifespan.

3.4.2 TRIAXYS Buoy

3.4.2.1 Mooring Design

The TRIAXYS Buoy mooring design will consist of 4.9 ft (1.5 m) of open link chain which will run from the buoy to a 265.8 ft (81 m) mooring chain. The mooring chain will then be attached to a 1.1 ton (1,000 kg) clump weight that will rest on the seafloor for an area of approximately 10.2 ft^2 (1 m^2) (Figure 3-5). The area of the anchor chain sweep associated with the long-term operation of the TRIAXYS Buoy is anticipated to be approximately 1.3 acres (0.5 ha) (based on anchor chain radii of approximately 132.9 ft [40.5 m], Vertical penetration of the anchor chain into the seabed is anticipated to be approximately 0.5 ft to 1 ft (0.2 m to 0.3 m).

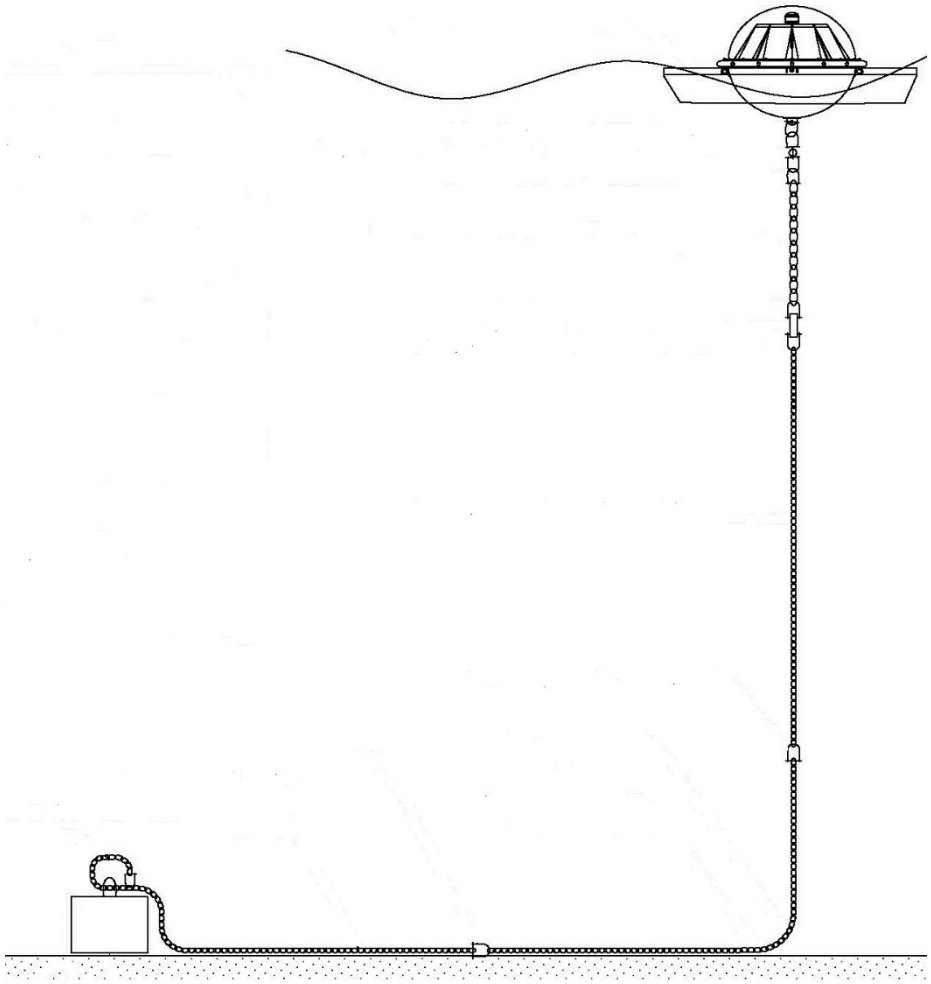

Figure 3-5 TRIAXYS Buoy Floating Mooring Design

3.4.2.2 Power Equipment

The TRIAXYS Buoy instrumentation will be powered by four 10-amp hour sealed lead-acid batteries, charged by a 2 by 240-watt solar panel array. The solar panels are mounted in an array under the protective polycarbonate dome to avoid damage by waves. Due to the surplus of solar power provided by the solar array, the batteries have enough reserve capacity to power the buoy in a standard sampling routine for up to 3 months without being charged. The Maximum Power Point Tracking solar charge controller protects batteries from being damaged by overcharging. The TRIAXYS Buoy also contains a Hydrogen Catalyst pack which will convert free hydrogen gas to water vapor. This system is paired with a large desiccant pack to absorb water in order to ensure safe operation of the buoy.

3.4.2.3 Instrumentation Equipment

The TRIAXYS Buoy is instrumented with the following sensors to provide in-situ monitoring and analysis of wave and current activity:

- a TRIAXYS g3 Directional Wave Sensor;
- a YSI Water Temperature Probe; and
- a Teledyne RDI 600 kilohertz Current Profiler.

Table 3-2 provides a list of the parameters measured by the TRIAXYS Buoy, as well as the resolution and accuracy of the measurements.

The data acquisition system will acquire and store data using the same WatchMan™ system as described for the WindSentinel™ (see Section 3.4.1.3).

The following supporting systems for navigational aids, position tracking, and remote monitoring will also be installed on the TRIAXYS Buoy:

- a SkyWave IDP-690 Inmarsat IsatData Pro satellite transceiver;
- a Fluxgate compass; and
- a WatchCircle Alert System position verification.

Using the maintenance plan described in Section 5.2, equipment on the TRIAXYS Buoy will have a minimum four-year operational lifespan.

Table 3-2 Parameters Measured and Recorded by the TRIAXYS Buoy

Parameter	Definition	Resolution	Accuracy
Time	UTC	0.1 s	±0.1 s
Wave mean direction	The mean wave direction found by weighting the direction by the energy in the directional wave spectrum	1°	±5°
Significant wave height	Calculated as four times the standard deviation of the sea surface elevation in the time domain	0.1 m	Larges of ±0.1 m or 2%
Wave peak period	The period of waves at the peak of the wave energy spectrum	0.1 s	Larges of ±0.1 m or 2%
Wave zero crossing period	The mean period between successive zero crossings	0.1 s	Larges of ±0.1 m or 2%
Current velocity	The current velocities registered for bins up through the water column	0.1 m/s	±0.1 m/s
Current direction	The current direction registered for bins up through the water column with a bin size of one meter	±5°	±5°

Table 3-2 Parameters Measured and Recorded by the TRIAXYS Buoy

Parameter	Definition	Resolution	Accuracy
Water surface temperature		1°C	±1°C
Measuring wave height	The buoy shall be able as a minimum to measure wave higher than 15 m		
Sea surface elevation	Instantaneous elevation of the sea surface	0.01 m	Larges of ±0.01 m or 2%

4. Deployment/Installation

Installation of the Met Buoys is planned over a one- to two-day installation period, barring weather delays. It is anticipated that the deployment activities will be staged out of New Bedford, Massachusetts or a comparable existing port in the northeast.

4.1 Overview of Installation and Deployment Activities

Bay State Wind LLC will notify BOEM, Fleet Forces Atlantic Exercise Coordination Center at Naval Air Station Oceana, the United States Army Corps of Engineers, and the USCG prior to installation mobilization supporting deployment of the Met Buoys. Written notice via email will be provided to the appropriate contact at Fleet Forces Command prior to mobilization in order to avoid potential conflicts with military operations. Bay State Wind LLC will update Fleet Forces Command on the installation schedule following approval of the SAP and detailed planning.

Bay State Wind LLC will notify mariners and other users of the area by submitting a request to the USCG for publication of a Local Notice to Mariners (LNM) two weeks prior to the start of the in-water work. This notice will include the contact names for the installation vessels, channels of communication, and the duration of the work. Copies of all USCG communications will be provided to BOEM as required. Additionally, in accordance with standard maritime practices, the vessel captain(s) will broadcast via VHF radio on Marine Channel 16 notification to mariners of their position and limited mobility during installation activities and submit an application to the USCG for a PATON for the Met Buoys (see Table 1-2).

Following the installation of the Met Buoys, Bay State Wind LLC will prepare an Installation Report and provide a copy to BOEM. This report will include a description of the equipment and the installation, including final coordinates of the installation site and photo documentation of the equipment deployed, the results of all commissioning tests, the plans and schedule for upcoming inspections and maintenance, and any noted problems or issues to be addressed.

4.1.1 WindSentinel™ and TRIAXYS Buoy

A workboat of approximately 92 ft (28 m) length and small support vessel will be used for installation of the Met Buoys. The two WindSentinels™ and TRIAXYS Buoy will be loaded onto the deck of the work vessel and secured for transport to the Met Buoy Installation Areas. The mooring systems will also be stored on the deck of the vessel during transit. Alternatively, the WindSentinel™ may be towed behind the vessel to their deployment location if the vessel configuration does not provide adequate space on deck. The mooring systems for the Met Buoys, inclusive of clump weights, chains, ropes and lines, will be deployed from the work vessel by a crane.

On arrival to the first WindSentinel™ deployment location, the chain will be laid out on the deck of the vessel in a manner that will prevent tangling or twisting while it is let out into the water. The pendant buoy for the WindSentinel™ will be deployed at the same time as the mooring systems. Temporary buoys will be used to secure the WindSentinel™ mooring lines at the sea surface while the equipment is being prepared for connection. The WindSentinel™ will then be connected to the mooring system and the temporary buoys will be recovered. The WindSentinel™ will then be launched and the mooring chain deployed. The second WindSentinel will be deployed in the same manner at the second deployment location.

The vessel will then make its way to the TRIAXYS Buoy deployment location. Upon arrival at the deployment location, the TRIAXYS Buoy mooring chain will be laid out on the deck of the vessel and in a manner that will prevent tangling or twisting while it is let out into the water. The TRIAXYS buoy will then be deployed into the water, the mooring will be streamed out, and the clump weight anchor will be released. (NOTE: Final deployment procedures may be modified depending on the deployment vessel configuration.). No vessel anchoring will take place during installation.

All personnel participating in the installation will attend a pre-installation briefing (See Section 4.3).

4.2 Vessels

Bay State Wind LLC will employ AXYS to transport and deploy the Met Buoys.

It is anticipated that the deployment of the Met Buoys will require the support of both a work boat and support vessel. Bay State Wind LLC is currently proposing to use the NorthStar Commander or a similar vessel as the work boat. The NorthStar Commander is a multi-purpose offshore utility vessel with a twin screw Volvo D125-E 450 hp engine. The vessel measures 92 ft (28 m) in length with a 26 ft (7.9 m) beam and 8.5 ft (2.6 m) draft. The support vessel is anticipated to be a rigid hull inflatable vessel measuring 16 ft to 24 ft (4.9 m to 7.3 m) in length. Depending on vessel availability at the time of installation, Bay State Wind LLC may alternately elect to use a tug and barge with crane and one support vessel. See Appendix G for vessel specifications.

4.3 Pre-Installation Briefing

Prior to the installation of the Met Buoys, all personnel will attend a pre-installation briefing. The pre-installation briefing will include a Tool-Box Talk (Appendix E) as well as HSE and hazard identification presentations. The briefing will occur prior to commissioning and again prior to boarding the vessel. The purpose of this briefing will be to review the HSE requirements and associated emergency response requirements for the proposed work, identify the responsibilities of each person, define the chains of command, discuss communication procedures, and provide an overview of planned installation activities. Additional topics for the briefing will include protected species avoidance, marine trash and debris awareness, and oil spill response procedures.

The Bay State Wind LLC onsite representative will have the authority to stop or delay any of the installation activities, if deemed necessary. If change in personnel is required during installation activities, the new personnel will be briefed as they join the work in progress.

4.4 Protected Species Avoidance

All whales, dolphins, and porpoises in the northeast region are federally protected by the MMPA. In addition many large whales in the area, as well as sea turtles, are further protected under the Endangered Species Act of 1973 (ESA).

The Lease contains specific stipulations to minimize risk to marine species that must be followed. Installation of the Met Buoys will not require pile-driving; accordingly, mitigations to reduce adverse impacts on protected species from pile driving do not apply to this installation. The Lease stipulations summarized in Table 4-1 apply to activities associated with installation, operation and decommissioning of the Met Buoys and must be adhered to.

Table 4-1 Standard Operating Conditions in the Lease Area

Addendum "C" Stipulation	Vessel Operations Conditions
4.1.1 Vessel Strike Avoidance Measures	
4.1.1 Vessel Strike Avoidance Measures	The Lessee must ensure that vessels conducting activity in support of a plan (i.e., SAP and/or COP) submittal comply with the vessel-strike avoidance measures specified in stipulations 4.1.1.1 through 4.1.1.7, except under extraordinary circumstances where complying with these requirements would put the safety of the vessel or crew at risk.
4.1.1.1	The Lessee must ensure that vessel operators and crew maintain a vigilant watch for cetaceans, pinnipeds, and sea turtles and slow down or stop their vessels to avoid striking these protected species.
4.1.1.2	The Lessee must ensure that all vessel operators comply with 10 knot (<18. Km/hr) speed restrictions in any Dynamic Management Area [1]. In addition, the Lessee must ensure that all vessels operating from November 1 through July 31 will operate at speeds of 10 knots (<18.5 km/hr) or less.
4.1.1.3 North Atlantic Right Whales	
4.1.1.3.1	The Lessee must ensure all survey vessels maintain a separation distance of 500 m (1,640 ft) or greater from any sighted North Atlantic right whale.
4.1.1.3.2	The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 500 m (1,640 ft) of any North Atlantic right whale.
4.1.1.3.2.1	If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (<18.5 km/h) or less until the 500 m (1,640 ft) minimum separation distance has been established (except as provided in stipulation 4.1.1.3.2.2).
4.1.1.3.2.2	If a North Atlantic right whale is sighted in a vessel's path, or within 100 m (328 ft) to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. The Lessee must not engage the engines until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m (328 ft).
4.1.1.3.2.3	If a vessel is stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m (328 ft), at which point the Lessee must comply with stipulation 4.1.1.3.2.1.
4.1.1.4 Non-Delphinoid Cetaceans other than the North Atlantic Right Whale ,	
4.1.1.4.1	The Lessee must ensure all vessels maintain a separation distance of 100 m (328 ft) or greater from any sighted non-delphinoid cetacean.
4.1.1.2	The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 100 m (328 ft) of any non-delphinoid cetacean.
4.1.1.4.2.1	If any non-delphinoid cetacean is sighted, the vessel underway must reduce speed and shift. The engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel's path and beyond 100 m (328 ft).
4.1.1.4.2.2	If a survey vessel is stationary, the vessel will not engage engines until the non-delphinoid cetacean has moved out of the vessel's path and beyond 100 m (328 ft).
4.1.1.5 Delphinoid Cetaceans	
4.1.1.5.1	The Lessee must ensure that all vessels maintain a separation distance of 50 m (164 ft) or greater from any sighted delphinoid cetacean.
4.1.1.5.2	The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 100 m (328 ft) of any sighted delphinoid cetacean.
4.1.1.5.2.1	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. The Lessee must not adjust course and speed until the delphinoid cetacean has moved beyond 50 m (164 ft) and/ or the delphinoid cetaceans have moved abeam of the underway vessel.
4.1.1.5.2.2	The Lessee must ensure that any vessel underway reduces vessel speed to 10 knots (18.5 km/h) or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. The Lessee may not adjust course and speed until the delphinoid cetaceans have moved beyond 50 m (164 ft) and/or the abeam of the underway vessel.

Table 4-1 Standard Operating Conditions in the Lease Area

Addendum "C" Stipulation	Vessel Operations Conditions
4.1.1.6 Sea Turtles and Pinnipeds	
4.1.1.6.1	The Lessee must ensure all vessels maintain a separation distance of 50 m (164 ft) or greater from any sighted sea turtle or pinniped.
4.1.1.7 Vessel Operator Briefing	The Lessee must ensure that all vessel operators are briefed to ensure they are familiar with the requirements specified in stipulation 4.1.1.
4.1.2 Marine Trash and Debris Prevention [2]	The Lessee must ensure that vessel operators, employees, and contractors engaged in activity in support of plan (i.e., SAP and/or COP) submittal are briefed on marine trash and debris awareness and elimination, as described in the BSEE NTL No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination") or any NTL that supersedes this NTL, except that the Lessor will not require the Lessee, vessel operators, employees, and contractors to undergo formal training or post placards. The Lessee must ensure that these vessel operator employees and contractors are made aware of the environmental and socioeconomic impacts associated with marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above-referenced NTL provides information the Lessee may use for this awareness training.
Note: 1. A Dynamic Management Area is defined in Section 1.2 of the Lease. Vessel operators may send a blank email to ne.rw.sightings@noaa.gov for an automatic response listing all current Dynamic Management Areas. 2. NTL 2012-G01 had been superseded by NTL 2015-G03. Bay State Wind, LLC. Will comply with the revised NTL.	

4.4.1 Reporting of Injured or Dead Protected Species

During all phases of marine activities, sightings of any injured or dead protected species (sea turtles and marine mammals) will be reported within 24 hours, regardless of whether the injury or death was caused by a vessel as specified in Stipulation 4.4.1 of the Lease. All marine activities will be suspended immediately and the circumstances reported as specified below if a dead or injured right whale is found in any of the Installation Areas. The Lease stipulations summarized in Table 4-2 below apply and must also be adhered to.

Table 4-2 Reporting Requirements in the Lease Area

Addendum "C" Stipulation	Lease Requirement
4.4.1 Reporting Injured or Dead Protected Species	The Lessee must ensure that sightings of any dead or injured protected species (e.g., marine mammals, sea turtles or sturgeon) are reported to 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 of 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 Lessee must use the form included as Appendix A to Addendum C to report the sighting or incident. If the Lessee's activity is responsible for the injury or death, the Lessee must ensure the vessel will assist in any salvage effort as requested by NMFS.
4.4.2 Reporting Observed Impacts to Protected Species	The Lessee must ensure that the observer report any observations concerning impacts to Endangered Species Act listed marine mammals, sea turtles, or sturgeon to the Lessor and NMFS within 48 hours. The Lessee must report any injuries or mortalities using the form included as Appendix A to Addendum C of the Lease. Any observed takes of listed marine mammals, sea turtles, or sturgeon resulting in injury or mortality must be reported within 24 hours to the Lessor and NMFS.

4.5 Marine Trash and Debris Awareness and Elimination

Bay State Wind LLC will comply with and ensure that all employees and contractors are briefed on marine trash and debris awareness elimination, as required in Addendum C, Section 4.1.2 of the Lease and as described in the BSEE NTL No. 2015-G03 or any NTL that supersedes NTL 2015-G03.

4.6 Oil Spill Response

Each WindSentinel™ will carry approximately 227 gallons (858 liters) of diesel to provide fuel for the backup generator. Prior to deploying the Met Buoys, Bay State Wind LLC will submit an Oil Spill Response Plan for review and approval to the Oil Spill Response Division of the BSEE. The plan will demonstrate compliance with 30 CFR 254.22(a), 254.23(a) and 254.23(g)(1).

4.7 Health and Safety

Bay State Wind LLC will implement a project-specific HSE Plan to ensure the health and safety of all personnel involved in the installation, operation, and maintenance, and decommissioning of the Met Buoys. The project-specific plan will be prepared in accordance with DONG Energy's standard corporate HSE policies and procedures. The HSE Plan will also address emergency response and reporting requirements. The HSE plan is included as Appendix F to this SAP.

5. Operations and Maintenance

5.1 Data Collection and Operations for Wind and Metocean Data

As stated in Sections 3 and 4 the Met Buoys will remain moored in position and transmit wind data and metocean measurements autonomously via satellite or cellular telemetry, or a Bluetooth link via the WatchMan™. The WatchMan™ will manage the operation of each sensor and the power supply system according to pre-set operation parameters. The WatchMan™ stores up to 12 months of one-second wind data and ten-minute average data through a combination of on-board memory and compact flash memory. The data can be easily retrieved with above-deck access without opening a hatch and entering the buoy compartment during in-situ service trips should remote telemetries not be available. Using the DMS software suite the operation parameters can be modified remotely to achieve optimum system performance. Ten-minute average data will be updated at least once daily to a secure remote computer accessible to Bay State Wind LLC. Via AXYS-Analytics Portal Services.

5.2 Maintenance Activities

5.2.1 WindSentinel™

Planned on-site maintenance for the WindSentinel™ Buoy is scheduled at 6 and 12 months and will be completed by a vessel comparable to the support vessel used for installation (see Section 4.2). Planned maintenance activities will occur at 6-month intervals and will include replacement of consumables, service of sensors, data retrieval, and cleaning of solar panels and wind turbines, A detailed service, which will include all 6-month activities, as well as cleaning of biofouling and review and maintenance of the mooring system, will be performed at 12-month intervals.

5.2.2 TRIAXYS Buoy

Planned on-site maintenance for the TRIAXYS Buoy is scheduled every 3 months for the first year of operation and will be completed by a vessel comparable to the support vessel used for installation (see Section 4.2). Planned maintenance activities at the first 3-month interval would include cleaning of the ADCP sensor and cleaning of the buoy dome and hull if necessary. The 6-month maintenance will include all three-month maintenance activities, as well as visual inspection of the mooring system. At 12 months the mooring will be recovered and carefully inspected. If required, it will be changed out during the 12-month maintenance period.

5.3 Reporting

A copy of the maintenance and inspection report will be provided to BOEM with Semi-Annual Progress Reports required by the Commercial Lease (Stipulation No. 2.2.1), or upon request.

5.4 Potential Faults or Failures

The Met Buoys will be remotely monitored for the duration of operations, this monitoring will include a range of key indicators such as power level, buoy location, and data quality to provide an insight to the 'health' of the buoy and payload. Unplanned maintenance activities may be required in the event of a power supply failure, hull leak, buoy drift outside of designated area, mooring component failure, or other such event. If any of these problems are suspected, a technical service crew would be promptly dispatched to investigate and repair the issue. The WindSentinels™ are capable of operating at full capacity without renewable power or backup generator supply to the batteries for up to seven days. The and TRIAXYS Buoy has enough reserve power to operate in a standard sampling routine for up to three months without being recharged.

6. Decommissioning

BOEM requires decommissioning of facilities described in the SAP in accordance with § 585.901. Bay State Wind LLC will submit a decommissioning application to BOEM as required by § 585.902(b) prior to decommissioning of the Met Buoys. Following BOEM approval of the decommissioning application, Bay State Wind LLC will notify BOEM at least 60 days prior to vessel deployment.

6.1 Overview of Decommissioning Activities

Upon completion of SAP activities, the Met Buoys will be decommissioned. The decommissioning process will be similar to the installation process but in reverse. Similar types and numbers of vessels used for the installation of the Met Buoys would be used for decommissioning. The work vessel would position itself on-site to detach the hull from the mooring chain and attach float markers to the loose ends of the mooring chain. The Met Buoys would then either be recovered to deck or towed off site. The clump weight would then be connected to the crane or A-frame of the work vessel and recovered to deck. The mooring chain would then be recovered to site.

6.2 Site Clearance

The operation of the Met Buoys is not expected to result in any trash or bottom debris. However, Bay State Wind LLC will ensure that the seafloor has been cleared of all obstructions created by activities on the Lease as required in § 585.902(a)(2). This will be accomplished via photo documentation of all deployed and retrieved equipment. As stated in Section 4.1, Bay State Wind LLC will provide an Installation Report that will contain the final coordinates and photo documentation of the equipment that was deployed. At the completion of decommissioning, similar documentation will be provided to BOEM to confirm that all equipment was retrieved from the site.

6.3 Reporting

As specified in the Lease, Addendum C, Section 2.2, Bay State Wind LLC will submit semi-annual progress reports to BOEM throughout the duration of activities covered by the SAP. At the conclusion of the site assessment activities a Decommissioning Report will be prepared in accordance with §§ 585.900-913 and provided to BOEM with the semi-annual progress reports, or upon request. This report will include a

description of the process and equipment used for decommissioning the Met Buoys and confirmation of site clearance.

7. Affected Environment, Potential Impacts, and Mitigation Measures

A detailed understanding of the biological resources, archaeological resources, and geophysical and geotechnical conditions has been developed through site surveys and analysis that were conducted in August through October 2016 in support of the SAP. The Survey Area covered the three Installation Areas and measure approximately 33 acres (13.4 ha) at each of the WindSentinel™ deployment locations and 2.5 acres (1 ha) at the TRIAXYS deployment location (Figure 1-1). Site surveys and analysis followed a detailed SAP Survey Plan which included protocols, methods, and/or used data that represented the state of industry techniques and knowledge at the time of the study. The SAP Survey Plan, detailing the SAP survey approach, timing, identified surveys, and reporting, was accepted by BOEM on August 10, 2016.

The following sections describe the affected environment, impacts and proposed mitigation measures for resources known to occur within the Met Buoy Installation Area. The Installation Area encompasses the entire SAP Survey Area evaluated during the August through October 2016 survey activities. The analysis focuses on the maximum area of potential disturbance associated with the installation, operation, and decommissioning of the Met Buoys, approximately 16 acres (6.4 ha).

As stated in Section 3.3, the three Installation Areas where the Met Facilitates are proposed be to located have been given unique identifiers. The Installation Area for the WindSentinel™ to be located in the southwest corner of the Lease Area is referenced as F1. The Installation Areas for the Met Buoys to be installed in the northeast corner of the Lease Area are referenced as F2 and B2, respectively. The coordinates for these locations are provided in Table 3-1 and depicted on Figure 1-1.

7.1 Geological Conditions

7.1.1 Affected Environment

The proposed Met Buoy locations are situated on the OCS approximately 52 km (28 nautical miles [nm]) southwest (F1) and 25 km (13 nm) south (F2/B2) of Martha's Vineyard, Massachusetts (Figure 1-1). Water depths at each of these locations are approximately 180.4 ft (55 m) and 138 ft (42 m), respectively. A bathymetric and geophysical survey and sampling operations were conducted by Alpine Ocean Seismic Survey, Inc., a Gardline Group Company (Alpine/Gardline) between the months of August and October 2016. The HRG survey and sampling operations were performed in accordance with BOEM guidelines to evaluate the impact of the Met Buoys on physical and potential cultural resources, as well as to characterize seafloor and sub-seafloor conditions that could affect the proposed installation, operation, and decommissioning activities. The HRG survey and sampling operations included acquisition of the following data:

- **Multibeam echosounder bathymetry**– to determine water depths and topographic features on the seabed and initial review of surficial sediment;
- **Sidescan sonar imagery** – acoustic seabed imagery used to map surficial sediment distributions and bedforms, as well as detect possible natural and anthropogenic hazards on the seabed such as boulders, debris, and shipwrecks;
- **Sub-bottom profiler** – a subsurface investigation using a pinger shallow-penetration sub-bottom profiler to investigate shallow (16 ft/5 m) sediment stratigraphy;

- **Magnetometer** – fluctuations in the magnetic field were measured to detect ferrous items on the seabed that could be potential hazards or cultural deposits, included debris and shipwrecks;
- **Sediment grab samples** – to ground-truth interpretation of the geophysical data; and
- **Underwater video imagery** – collected using a remotely operated camera to identify natural and human-caused obstructions, as well as aid in benthic habitat assessment.

Data from this HRG and sampling effort, along with information from publically-available databases were compiled and reviewed to describe the surface and subsurface geologic conditions in the Installation Areas. Table 7-1 summarizes the water depth, surficial seafloor sediment, and any sidescan or magnetometer contacts with identified avoidance buffers within the Installation Areas.

Table 7-1 Geological Conditions and Anthropogenic Hazards in the Installation Area

Platform Identification	Water Depth (m MLLW)	Surficial Sediment Types	Identified Survey Targets with a recommended avoidance distance
F1	55.0	Unconsolidated sands with ripples and Unconsolidated sands with shell	Magnetometer Contacts: None Side-Scan Sonar Targets: None
F2	41.6	Unconsolidated sands	Magnetometer Contacts: None Side-Scan Sonar Targets: None
B2	42.2	Unconsolidated sands	Magnetometer Contacts: None Side-Scan Sonar Targets: None

7.1.1.1 WindSentinel F1 Installation Area

The F1 Installation Area is situated towards the southern edge of OCS Lease Block number 6021 in aliquot M. Water depths across the area range between 178.5 ft (54.4 m) and 180.4 ft (55.0 m) mean lower low water (MLLW). Water depth at the proposed deployment location is 180.4 ft (55.0 m) MLLW.

The seafloor across the F1 Installation Area is generally flat, displaying gradients of less than 0.5 degrees. The only notable feature is the western edge of a bathymetric high with a maximum gradient of 1.5 degrees orientated northeast-southwest across the site. This is visible in the color-rendered bathymetry and contours for the F1 Installation Area, as presented in Appendix C, Chart 10807.17. As evidenced by both this charted data and supported by the environmental camera and grab samples collected at the site (see Section 7.2 and Appendix E), the site is located in an area of smooth sand with shells and located approximately 16.4 ft (5 m) west of an area of sand with small ripples of centimeter scale. The boundary between the two sediment types is associated with the small slope visible on the bathymetry data.

Seabed Features and a side scan sonar mosaic for the F1 Installation Area are presented in Appendix C Chart 10807.18 and Chart 10807.19, respectively. As evidenced by the charted data are present.

Total magnetic field contours for the F1 Installation Area are presented in Appendix C, Chart 10807.20 and indicate no anomalies are present. Penetration using the shallow-penetration sub-bottom profiler was restricted to approximately 16.4 ft (5 m) below seabed due to the interpreted dense and sandy nature of the shallow soils. However, no coherent horizons were observed.

7.1.1.2 WindSentinel F2 Installation Area

The F2 Installation Area towards the western edge of OCS Lease Block number 6976 in aliquot F. Water depths across the area range between 136.2 ft (41.5 m) and 137.1 ft (41.8 m) MLLW. Water depth at the proposed deployment location is 136.5 ft (41.6 m) MLLW.

Within this area the seafloor is generally flat, displaying gradients of less than 0.5 degrees. The only notable features are a series of trawl scars orientated northeast-southwest through the site. Color rendered bathymetry and contours for the F2 Installation Area are presented in Appendix C, Chart 10807.12. As evidenced by this chart and supported by environmental camera and grab samples collected at the site (see Section 7.2 and Appendix E), the site is located in an area of pitted sand.

Seabed Features and a side scan sonar mosaic for the F2 Installation Area are presented in Appendix C, Chart 10807.13 and Chart 10807.14, respectively. No objects were present in the side scan sonar data.

Total magnetic field contours for the F2 Installation Area are presented as Chart 10807.15. These charts confirm no anomalies are present within the area. Penetration using the shallow-penetration sub-bottom profiler was restricted to approximately 16.4 ft (5 m) below seabed in the F2 Installation Area due to the interpreted dense and sandy nature of the shallow soils. Based on this data however, no coherent horizons were observed.

7.1.1.3 TRIAXYS B2 Installation Area

The B2 Installation Area is situated towards the western edge of OSC Lease Block number 6976 in aliquot I. Water depths across the area range between 137.5 ft (41.9 m) and 138.8 ft (42.3 m) MLLW. Water depth at the proposed deployment location is 138.5 ft (42.2 m) MLLW.

The seafloor within the B2 Installation Area is relatively flat and display gradients of less than 0.5 degrees. The only notable features are a series of trawl scars orientated north-south and northeast-southwest across area. Bathymetry contours for the B2 Installation Area are presented in Appendix C, Chart 10807.2. As evidenced by this chart and supported by environmental camera and grab samples collected at the site (see Section 7.2 and Appendix E) the site is located in an area of pitted sand.

Seabed features and a side scan sonar mosaic for the proposed area are presented in Appendix C, Chart 10807.3 and Chart 10807.4 respectively. No objects were detected in the side scan sonar data within the area.

Total magnetic field contours for the B2 Installation Area are presented in Appendix C, Chart 10807.5. These charts confirm that no anomalies are present in the magnetometer data within the area. Penetration using the shallow-penetration sub-bottom profiler was restricted to approximately 16.4 ft (5 m) below seabed in the B2 Installation Area due to the interpreted dense and sandy nature of the shallow soils. Based on this data however, no coherent horizons were observed.

7.1.1.4 Natural Seafloor and Sub-Seafloor Hazards

The HRG datasets were analyzed for seafloor and sub-seafloor hazards, which could pose a potential risk to the installation, operation, and maintenance of the Met Buoys. The sidescan and multibeam bathymetry datasets were interpreted and found to contain no evidence of the surficial expression of shallow faults, and the sub-bottom profiler data showed no significant offsets of sedimentary bedding indicative of shallow faults. No areas of acoustic whiteouts or other amplitude anomalies were observed in the sub-bottom profiler data, as would be anticipated for any significant accumulation of shallow gas. The sub-bottom profiler records do not contain any bottom simulating reflectors, which are a typical indication of the

presence of hydrates. The generally low relief of the three Installation Areas, along with the lack of observed buried failure planes, slump blocks, or other evidence of mass wasting in the sub-bottom profiler records indicate that slump blocks and slump sediment are not found within the study area. The interpretation of the sidescan sonar, multibeam bathymetry, and sub-bottom profile datasets provide no evidence of ice scour, such as seabed gouging by either icebergs or sea ice pressure ridges. Additionally, no craters or other seabed evidence of strudel scours were noted in any of the datasets.

The HRG datasets were used to determine the presence or absence of additional geological hazards (see Table 7-2). The sidescan sonar, multibeam bathymetry, and sub-bottom profiler datasets were reviewed and do not provide any evidence of seismic activity, such as extensive or regional faulting or slump and mass wasting features. Additionally, no fault zones, nor any other faulting activity, are identified either from seabed data or from the sub-bottom profiler records, as would typically be indicated by offset sedimentary bedding planes in the sub-bottom profiles or linear fault-related features on the seabed. No faults or other sedimentary features indicative of differential compaction or localized seabed subsidence have been identified. As there has been no faulting identified, there has also been no evidence of faulting attenuation effects observed in the geophysical datasets. These results are consistent with the expected nature of the passive continental margin off of Massachusetts.

Table 7-2 Seafloor and Sub-Seafloor Hazards

Hazard	Definition	Identified and Description
Seafloor		
Scarp	An exposed face of soil above the head of a landslide.	None present
Channels	The deepest portion of a body of water through which the main volume or current of water flows.	None present
Ridges	A relatively narrow elevation which is prominent on account of steep angle at which it rises.	None present
Bedforms	Features that develop due to the movement of sediment by the interaction of flowing water; critical angle and forces required for movement are dependent upon many factors.	Sand ripples of centimeter scale and 1.6 ft (0.5 m) high slopes with a maximum gradients of 2 degrees within the F1 Installation Area
Exposed Rocky Area	Surface expression of bedrock outcropping on seafloor.	None present
Boulders	Glacial erratics (boulders) greater than 12 inches in diameter; outcropping coarse till/drift or lag deposit.	None identified at seabed using the bathymetry or side scan sonar data
Buried Boulders	Glacial erratics (boulders) greater than 12 inches in diameter; subsurface coarse till/drift or lag deposits.	None identified using the shallow-penetration sub-bottom profiler data, but boulders may be present due to the ability to identify buried boulders using shallow-penetration sub-bottom profiler data being limited to a narrow corridor along the vessel track the width of which is variable depending on signal frequency and water depth
Pock Marks / Depressions	Craters in the seabed caused by fluids (gas and liquids) erupting /streaming through the seabed sediments.	None present
Seabed Scars / Ice Scour / Drag Marks	Incisions or cuts into the seafloor may be associated with glacial advances/retreats or bottom fishing activity.	None present
Buried Channels	Former fluvial drainage pathways during sea level low stands, usually only deepest portion of the waterway in-filled and preserved. Mark ancestral patterns of glacier meltwater runoff.	None present within the shallow-penetration sub-bottom profiler data
Submarine Canyons	Steep-sided valley cut into the seafloor of the continental slope, sometimes extending well onto the continental shelf.	None present
River Channel	Outline of a path of relatively shallow and narrow body of fluid	N/A

Table 7-2 Seafloor and Sub-Seafloor Hazards

Hazard	Definition	Identified and Description
Exposed Hardbottom Surfaces	Any semi-lithified to solid rock strata exposed at the seafloor; in this area, may include bedrock or a nearly continuous pavement of fragmented rock or boulders.	None present
Shallow Gas	Subsurface concentration of material in gaseous form that has accumulated by the process of decomposition of carbon-based materials (former living organisms).	None present
Gas Hydrates	Subsurface gas deposits that were formed at or near the seafloor in association with hydrocarbon seeps.	None present
Gas/Fluid Expulsion Features	Upward movement of gas/fluid via low resistance pathways through sediments onto the seafloor; may be related to other hazards diapirs, faults, shallow water flows).	None present
Diapiric Structure Expressions	The extrusion of more mobile and ductily-deformable material forced onto the seafloor from pressure below.	None present
Karst Areas	Landscape formed from the dissolution of soluble rocks.	N/A
Faults, Faulting Expression, Fault Activity	Physiographic feature (surface expression) related to a fracture, fault, or fracture zone along which there has been displacement of the sides relative to one another.	None present
Slumping, Sliding Seafloor Features	Large scale structures that result from the downslope movement of sediments due to instability and gravity. In the submarine environment these structures are often found in slope environments along coastal margins.	None present
Steep/Unstable Seafloor Slopes	Large scale feature/stretch of ground forming a natural or artificial incline, with a slope that approaches the angle of repose (maximum angle at which the material remains stable).	None present
Scour/Erosion Features	Erosion of material due to water flow. Often associated with erosion adjacent to larger natural and man-made structures.	None present
Sensitive Benthic Habitats (chemosynthetic communities, submerged aquatic vegetation)	Shallow water habitats of submerged aquatic vegetation including macroalgae and sea grasses	None present

7.1.2 Potential Impacts and Proposed Mitigation Measures

Based on the Bay State Wind Geophysical Site Investigation Survey Report for Site Acquisition Plan (Appendix C), the site conditions are suitable for the installation of the Met Buoys and associated mooring equipment in each of the three Installation Areas. No notable hazards have been identified which would preclude installation at these locations. The rippled seabed may indicate minor seabed currents, but scour due to bottom currents is not anticipated to be a significant issue for the mooring systems.

7.2 Benthic and Fisheries Resources

7.2.1 Affected Environment

Data on the benthic resources located in the proposed Met Buoy Installation Areas were analyzed from several sources, including federal, state, and academic institutions. These datasets provided both general and detailed knowledge of the sediment and infaunal organisms of the Installation Areas. As depicted on Figure 1-1, the FLIDAR-F1 is located in OCS Lease Block 6021. The habitat type in OCS Lease Block 6021 has been classified as depressions, low slopes, and mid to high-position flats at moderate depths (144 ft to 246 ft [44 m to 75 m]) on medium, fine, or very fine sand (Northeast Ocean Council 2015). FLIDAR-F2 and metocean/current buoy-B2 are located in OCS Lease Block 6976; the habitat type in this OCS Lease Block

has been classified as all types of flats at moderately deep depths (144 ft to 456 ft [44 m to139 m]) on fine to medium sand, and mid-position flats at moderate depths (103 ft to 246 ft [31 m to 75 m]) on fine to medium sand (Northeast Ocean Council 2015).

To support the evaluation of the benthic and fisheries resource conditions in the Met Buoy Installation Area, a desktop analysis was performed to gather information on the benthic, demersal, and pelagic species, and substrate types. Published data sources indicated that the benthic habitat both throughout the Met Buoy Installation Areas range from fine-grained to medium- and coarse-grained sand (Greene et al. 2010; Poppe et al. 2014; Northeast Ocean Council 2015). This type of substrate provides habitat for infaunal polychaete annelids and molluscs, and does not support any seagrasses, hardbottom, livebottom, or any other unique or sensitive habitat features.

In May 2012 and September 2013, Umass Dartmouth conducted a Site Characterization Survey of the MAW01 Lease Area (Stokesbury 2013, 2014). Benthic organisms commonly observed in the video survey in the Lease Area were echinoderms (sand dollars and sea stars) and Hydrazoa/Bryozoa; holes present indicate clams and/or polychaetes burrow into the sediment (Stokesbury 2013, 2014). The most abundant commercially important species observed were sea scallops, skates (seven species), hake (red and silver), and flounder (Stokesbury 2013, 2014). Between the two survey years, there was low similarity, which could be due to seasonal variation from natural cycles or other factors (Stokesbury 2013, 2014). Other benthic macroinvertebrates found in sandy bottom habitats off of southern New England in depths of 131 ft to 190 ft (40 m to 58 m), which is the same habitat type and depth range present within the Installation Areas, are polychaetes, bivalves, amphipod crustaceans, anemones, and sea cucumbers, all of which are important food sources to commercially important groundfish (Provincetown Center for Coastal Studies 2005). Other benthic fauna in this habitat area include surf clams, razor clams, gastropods, shrimp, crabs, sand dollars, brittle stars, and tunicates (Provincetown Center for Coastal Studies 2005).

In September 2016 Alpine/Gardline conducted a geophysical survey of the Lease Area (Appendix C), with one grab/video sample collected from each of the three Met Buoy Installation Areas. These sample stations, identified as ENV1, ENV3, and ENV4 in the report (Table 7-3), generally verified the sediment types predicted by Greene et al. 2010 described above.

Table 7-3 Sediment Characterization of Each Sampling Station at each Met Buoy Installation Area.

Station	Corresponding Met Buoy Installation Area	Sediment Characterization
ENV1	F1, WindSentinel FLIDAR	Medium-Coarse sand, shell hash
ENV3	F2, WindSentinel FLIDAR	Fine sand, shell hash
ENV4	B2, TRIAXYS	Fine sand, shell hash

The video footage revealed fine to medium sand with shells and shell hash at all Installation Locations (ENV1, ENV 3, and ENV4). Station ENV1 (F1), was further characterized as yellow brown medium to coarse sand with shell hash and an underlying layer of dark grey/black medium to coarse sand. Station ENV4 (B2) was further characterized as brown fine to medium sand with shell hash with an underlying layer of black / dark brown cohesive clay. Station ENV3 (F2) was further characterized as brown, loose, fine to medium sand with occasional shell hash.

Macrofauna observed in the Installation Area video footage and grab samples include Annelida (indeterminate tubes), Arthropoda (Paguridae, Decapoda, Caridea), Echinodermata (Clypeasteroida, Asteroidea), Cnidaria (*Cerianthus lloydii*, Hydrozoa, possible *Tubularia* sp.), Mollusca (Bivalvia possibly

Mercenaria mercenaria, Gastropoda, Pectinidae, Decapodiformes, egg masses of Naticidae), Chondrichthyes (mermaid's purses), Chordata (Rajidae, including *Leucoraja ocellata*, Pleuronectiformes including *Hippoglossina oblonga,* Triglidae), and Porifera.

Based on the desktop assessment and site-specific data collection described above, bottom conditions within the Installation Areas were categorized by substrate grain size and relief, within the context of the Coastal and Marine Ecological Classification Standard (CMECS) (NOAA 2012). Within the context of CMECS, the range of substrates of the Met Buoy Installation Areas are classified within the following CMECS groups (NOAA 2012), listed in Table 7-4.

Table 7-4 Classifications of Geologic and Biogenic Substrates Encountered in the MAW01 Met Buoy Installation Areas in Accordance with CMECS

CMECS Setting/ Origin	CMECS Class	CMECS Subclass	CMECS Group	Additional Modifiers	Station			
					ENV1	ENV2	ENV3	ENV4
Geologic Substrate	Unconsolidated Mineral Substrate	Coarse Unconsolidated Substrate	Gravel	Boulder, cobble, pebble, granule	1.3%	0.7%	0.2%	0.1%
			Gravel Mixes	Sandy gravel, muddy sandy gravel, muddy gravel				
			Gravelly	Gravelly sand, gravelly muddy sand, gravelly mud				
		Fine Unconsolidated Substrate	Sand	Very coarse sand, coarse sand, medium sand, fine sand, and very fine sand	98.7%	99.3%	99.8%	99.9%
Biogenic Substrate	Shell Substrate	Shell Hash	Clam Hash	Shell Hash/Fragments various species	Present			
Benthic/ Attached Biota	Faunal Bed	Soft Sediment Fauna	Small Surface-Burrowing Fauna	Benthic Infauna various species	Annelida (indeterminate tubes), Arthropoda (Paguridae, Decapoda, Caridea), Echinodermata (*Clypeasteroida, Asteroidea*), Cnidaria (*Cerianthus lloydii),* Mollusca (Bivalvia, Gastropoda, Pectinidae, Decapodiformes)			
			Diverse Soft Sediment Epifauna	Benthic Infauna various species				

Fish and invertebrate abundance and distribution within the Met Buoy Installation Area are influenced by benthic habitat and by physical and chemical characteristics of the water (e.g. depth, temperature, salinity, nutrient concentrations, and ocean currents) (Helfman et al. 2009; Levinton 2009). Other factors, including predator/prey relationships, water quality, and refuge (e.g., physical structure or vegetation cover) may affect fish distribution; however, these factors operate on more regional or local spatial scales (Helfman et al. 2009).

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 as amended mandates the Essential Fish Habitat (EFH) provision, which provides the means to conserve fish habitat. EFH is defined as those waters and seafloor necessary (required to support a sustainable fishery and the managed species) to fish for spawning, breeding, feeding, or growth to maturity (i.e., full life cycle) (16 U.S.C. §1802 [10]). These waters include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may additionally include areas historically used by fish. Benthic and water column habitats

at the Met Buoy Installation Areas include EFH for several federally-managed fish species. A variety of shellfish and molluscs that commonly occur throughout southern New England may occur within the Met Buoy Installation Areas. These species include short finned squid (Illex illecebrosus), long finned squid (*Loligo pealeii*), Atlantic surfclam (*Spisula solidissima*), ocean quahog (*Arctica islandica*), and Atlantic sea scallop (*Placopecten magellanicus*) (Greene et al. 2010).

Fish species that occur throughout the waters of southern New England and have the potential to occur within the Met Buoy Installation Areas can be divided into two groups based upon their habitat preferences: demersal or pelagic. The demersal zone refers to the part of the water column closest to bottom substrate in an aquatic or marine system. Fish within this grouping occupy waters adjacent to bottom areas, feed on benthic organisms, and may have a strong relationship with benthic habitat complexity (e.g., hardbottom, reef), as complex habitats contain greater fish diversity (Malek et al. 2010). Many demersal fish may occur year-round in these waters; however, abundances may vary with both season and life stage. The pelagic zone refers to the surface or mid-water depths. Pelagic fish can be broadly categorized into horizontal and vertical distributions in the water column, with the highest number and diversity occurring where the habitat is most diverse (Parin 1984; Moyle and Cech 1996; Helfman et al. 2009), reflecting the structural complexity (habitat structure/relief, Sargassum patches, etc.), and/or a variety of physical and chemical conditions (currents, upwelling, nutrients, dissolved oxygen, and temperature). Pelagic fish feed on organisms within the water column or near the water surface. Thirty eight demersal and pelagic finfish/shellfish have designated EFH located within the Met Buoy Installation Areas. These species are summarized in Table 7-5 (NOAA EFH Mapper 2014; NOAA-GARFO 2016).

Table 7-5 Demersal Fish and Shellfish with Identified EFH within the Installation Area

Common Name	Scientific Name	Demersal/ Pelagic	Life Stage(s) with Designated EFH at Location	
			F1 southwest	F2/B2 northeast
Atlantic albacore tuna	*Thunnus alalunga*	Pelagic	Juveniles	
Atlantic bluefin tuna	*Thunnus thynnus*	Pelagic	Juveniles, Adults	Juveniles, Adults
Atlantic butterfish	*Peprilus triacanthus*	Pelagic		Larvae
Atlantic herring	*Clupea harengus*	Pelagic	Larvae, Juveniles, Adults	Larvae, Juveniles
Atlantic mackerel	*Scomber scombrus*	Pelagic		Eggs, Larvae
Atlantic skipjack tuna	*Katsuwonus pelamis*	Pelagic	Adults	
Atlantic cod	*Gadus morhua*	Demersal	Larvae, Adults	Eggs, Larvae, Adults
Basking shark	*Cetorhinus maximus*	Pelagic	Juveniles, Adults	
Black sea bass	*Centropristis striata*	Demersal	N/A	Juveniles
Bluefish	*Pomatomus saltatrix*	Pelagic	Adults	Adults
Blue shark	*Prionace glauca*	Pelagic	Juveniles, Adults	Juveniles, Adults
Cobia	*Rachycentron canadum*	Pelagic	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Dusky shark	*Carcharhinus obscurus*	Pelagic	Juveniles	Juveniles
Haddock	*Melanogrammus aeglefinus*	Demersal		Eggs, Larvae, Adults
King mackerel	*Scomberomorus cavalla*	Pelagic	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Little skate	*Leucoraja erinacea*	Demersal	Juvenile, Adults	Juvenile, Adults
Monkfish	*Lophius americanus*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Ocean pout	*Macrozoarces americanus*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Ocean quahog	*Artica islandica*	Demersal	Juveniles, Adults	Juveniles, Adults

Table 7-5 Demersal Fish and Shellfish with Identified EFH within the Installation Area

Common Name	Scientific Name	Demersal/ Pelagic	Life Stage(s) with Designated EFH at Location	
			F1 southwest	F2/B2 northeast
Redfish	*Sebastes fasciatus*	Demersal	N/A	N/A
Red hake	*Urophycis chuss*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Sandbar shark	*Carcharhinus plumbeus*	Pelagic	Juveniles, Adults	Juveniles, Adults
Scup	*Stenotomus chrysops*	Demersal	Juveniles, Adults	Juveniles, Adults
Short finned squid	*Illex illecebrosus*	Pelagic	N/A	N/A
Shortfin mako shark	*Isurus oxyrinchus*	Pelagic	Juveniles, Adults	Juveniles
Silver hake (whiting)	*Merluccius bilinearis*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Spanish mackerel	*Scomberomorus maculatus*	Pelagic	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Spiny dogfish	*Squalus acanthias*	Demersal	Juveniles, Adults	Juveniles, Adults
Summer flounder	*Paralichthys dentatus*	Demersal		Eggs, Larvae, Adults
Surf clam	*Spisula solidissima*	Demersal	N/A	N/A
Thresher shark	*Alopias vulpinus*	Pelagic	Juveniles, Adults	Juveniles, Adults
Tiger shark	*Galeocerdo cuvieri*	Pelagic	Juveniles	
Witch flounder	*Glyptocephalus cynoglossus*	Demersal		Eggs, Larvae
Windowpane flounder	*Scophthalmus aquosus*	Demersal	Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Winter flounder	*Pseudopleuronectes americanus*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults
Winter skate	*Leucoraja ocellata*	Demersal	Juvenile, Adults	Juvenile, Adults
Yellowfin tuna	*Thunnus albacares*	Pelagic	Juveniles, Adults	
Yellowtail flounder	*Limanda ferruginea*	Demersal	Eggs, Larvae, Juveniles, Adults	Eggs, Larvae, Juveniles, Adults

Note:
"N/A" indicates species either have no EFH data available on the designated lifestages, or those lifestages are not present in the species' reproductive cycle.
Source: NOAA EFH Mapper 2014; NOAA-GARFO 2014

The potential locations of Habitat Areas of Particular Concern (HAPC) were also researched using desktop analysis. HAPCs are a discrete subset of EFH that provide specific ecological functions or are especially vulnerable to degradation. Desktop analysis did not identify any HAPCs at the Met Buoy Installation Areas (NOAA EFH Mapper 2016).

7.2.2 Potential Impacts and Proposed Mitigation Measures

Deployment of the Met Buoys in the Installation Areas is not expected to result in significant effects to benthic or fisheries resources or result in significant changes in local community assemblage and diversity, or the availability of habitat and forage items.

Installation and maintenance activities as described in Sections 4.1 and 5.2 would result in the short-term disturbance of the seafloor habitat. Since the Met Buoys will float on the water surface, with only clump weight moorings and chain anchors in contact with the seabed during operations, impacts on the seabed will be limited (Wilhelmsson et al. 2006). It is anticipated that benthic fauna directly within the small footprint of the buoy anchor system will experience mortality. Benthic fauna located at these sites will be particularly

susceptible to harm or mortality if located in the estimated 16-acre (6.4-ha) area of potential impact; however, as BOEM concluded in the MA EA in consultations with NOAA, because impacts are expected to be localized, short-term, and temporary, it is unlikely that loss of benthos during the installation, operation, or decommissioning activities of the Met Buoys would affect the general population or productivity of the surrounding area (BOEM 2014). Additionally, opportunistic species, including polychaetes and amphipods known to occur in the Met Buoy Installation Area, are some of the quickest species to recolonize following physical disturbance to habitats (Newell et al. 2004; Gill 2005). This allows new habitat to be created if the conditions are suitable (Kaiser and Spencer 1996; Gill 2005). BOEM (2014) estimates recovery after disturbance to the soft-bottom habitat similar to those found to dominate the Met Buoy Installation Area typically occurs within one to three years (BOEM 2014).

The Met Buoys may modify a very small portion of the pelagic habitat by providing a structure at the surface and in the water column where none existed before. This structure, albeit a very small feature, may serve as a fish aggregation device, providing refuge and resting areas for some pelagic fish species (Castro et al. 2002). Both benthic and semi-pelagic fishes have been found in high abundances near marine structures, including buoys, so new structures such as the Met Buoys may act as an artificial reef or fish aggregation device in the area (Wilhelmsson et al. 2006).

After completion of site assessment activities, the Met Buoys will be removed and transported by vessel to shore. When the Met Buoys are removed, the areas disturbed by the mooring systems will fill in through natural processes and will ultimately be recolonized with native benthic species (Lundquist et al. 2010). The temporary and isolated disturbance of Met Buoys installation and decommissioning activities is expected to result in negligible impacts to fish and benthos (BOEM 2014).

7.3 Marine Mammals and Sea Turtles

7.3.1 Affected Environment

There are up to 50 species of marine mammals (whales, dolphins, porpoise, and seals) which are known to be present (some year–round, and some seasonally) in the continental shelf waters of the North Atlantic Ocean (Kenney and Vigness-Raposa 2010). Of these 50 species, six are listed as endangered under the ESA. These species include North Atlantic right whale, sei, fin, blue, sperm whale, and the West Indian manatee. These ESA species are highly migratory and do not spend extended periods of time in a localized area. The waters of southern Massachusetts are primarily used as a stopover point for these species during seasonal movements north or south between important feeding and breeding grounds. While the West Indian manatee has been sighted in southern Massachusetts waters, such events have been extremely rare.

The marine mammal species that have been sighted within the waters of Southern New England are listed in Table 7-6. All 36 marine mammal species identified in Table 7-6 are protected by the MMPA. Of these species 12 cetacean species and 2 pinnipeds have the highest likelihood of occurring in the Lease area at least seasonally. In general, the remaining non-ESA whale species listed in Table 7-6 range outside the Lease Area, usually in more pelagic waters, or are so rarely sighted that their presence in is unlikely.

Most of the species identified are migratory and pass through the Lease Area, the adjacent Atlantic Ocean, and the deeper continental shelf waters during annual migrations from feeding grounds to mating grounds. Several recent studies conducted across the Lease Area confirm that the North Atlantic right whale, sperm whale, fin, humpback, sei, blue, and minke all occur throughout the year in the Lease Area with the highest

concentrations during the spring and summer and occasional sightings in the autumn (Kraus et al. 2016; Kenney and Vigness-Raposa 2010). Kraus et al. (2016) found that small cetaceans were sighted during all seasons, particularly in summer and autumn except for the harbor porpoise which predominantly occurred in winter and spring.

Table 7-6 Marine Mammal Potential Occurrence in Survey Area

Common Name	Scientific Name	Seasonality	Status
Odontocetes (Toothed Whales)			
Phocoenidae			
Harbor Porpoise	*Phocoena phocoena*	Year-round	MMPA
Delphinidae			
White-Sided Dolphin	*Lagenorhynchus acutus*	Fall, Winter, Spring	MMPA
Short-beaked Common Dolphin	*Delphinus delphis*	Year-round	MMPA
Bottlenose Dolphin	*Tursiops truncates*	Winter, Spring, Summer	MMPA
Clymene Dolphin	*Stenella clymene*	Unlikely	MMPA
Pan-Tropical Spotted Dolphin	*Stenella attenuata*	Unlikely	MMPA
Atlantic Spotted Dolphin	*Stenella frontalis*	Unlikely	MMPA
Striped Dolphin	*Stenella coeruleoalba*	Unlikely	MMPA
Risso's Dolphin	*Grampus griseus*	Unlikely	MMPA
Spinner Dolphin	*Stenella longirostris*	Unlikely	MMPA
Killer Whale	*Orcinus orca*	Unlikely	Endangered-certain populations
False Killer Whale	*Pseudorca crassidens*	Unlikely	MMPA
Melon-headed whale	*Peponocephala electra*	Unlikely	MMPA
Sperm Whale	*Physeter macrocephalus*	Winter, Fall, Summer	Endangered
Dwarf Sperm Whale	*Peponocephala electra*	Unlikely	MMPA
Pygmy Sperm Whale	*Kogia breviceps*	Unlikely	MMPA
Long-finned Pilot Whale	*Globicephala melas*	Occasional, Year-round	MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	Unlikely	MMPA
Ziphiidae			
Blainville's Beaked Whale	*Mesoplodon densirostris*	Unlikely	MMPA
True's Beaked Whale	*Mesoplodon mirus*	Unlikely	MMPA
Gervais' Beaked Whale	*Mesoplodon europaeus*	Unlikely	MMPA
Cuvier's Beaked Whale	*Ziphius cavirostris*	Unlikely	MMPA
Sowerby's Beaked Whale	*Mesoplodon bidens*	Unlikely	MMPA
Mysticetes (Baleen Whales)			
Balaenopteridae			
Humpback Whale	*Megaptera novaeangliae*	Spring, Summer	MMPA
Fin Whale	*Balaenoptera physalus*	Year- round	Endangered
Sei Whale	*Balaenoptera borealis*	Spring, Summer	Endangered
Minke Whale	*Balaenoptera acutorostrata*	Spring, Summer	MMPA
Blue Whale	*Balaenoptera musculus*	Unlikely, most likely in Winter	Endangered
Bryde's Whale	*Balaenoptera edeni*	Unlikely	MMPA
Balaenidae			
North Atlantic Right Whale	*Eubalaena glacialis*	Winter, Spring,Fall	Endangered

Table 7-6 Marine Mammal Potential Occurrence in Survey Area

Common Name	Scientific Name	Seasonality	Status
Sirenia			
Trichechidae			
West Indian Manatee	Trichechus manatus	Unlikely	Endangered
Pinnipeds			
Phocidae			
Harbor Seal	*Phoca vitulina*	Fall, Winter, Spring	MMPA
Gray Seal	*Halichoerus grypus*	Infrequent Fall, Winter, Spring	MMPA
Harp Seal	*Pagophilus groenlandicus*	Rare January-May	MMPA
Hooded Seal	*Cystophora cristata*	Rare Summer/Fall	MMPA
Ringed Seal	*Pusa hispida*	Unlikely	MMPA
Sea Turtles			
Atlantic hawksbill sea turtle	*Eretmochelys imbricate*	Unlikely	Endangered
Atlantic (Kemp's) ridley sea turtle	*Lepidochelys kempii*	Unlikely, juveniles rarely found in shallow water	Endangered
Green sea turtle	*Chelonia mydas*	Unlikely, juveniles rarely found in shallow water	Endangered
Loggerhead sea turtle	*Carretta caretta*	Occasional Summer, Fall	Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Occasional Summer, Fall	Endangered
Sources: Kraus et al. 2016, Right Whale Consortium 2014, Kenney and Vigness-Raposa 2010			

In addition to marine mammals there are five species of sea turtles listed as threatened or endangered under the ESA that have historically been reported to occur in the waters off the coast of Massachusetts (Table 7-6). These species include the leatherback (endangered), loggerhead (threatened), Atlantic (Kemp's) ridley (endangered), green (endangered), and hawksbill (endangered). A multi-year aerial survey study showed that sighting rates for sea turtles as a group (vs. by species) did not vary significantly from year to year, however variability was statistically significant when compared between months and seasons (Kraus et al. 2016). Sighting rates of all sea turtles combined were highest in the summer and autumn months, with no sightings in winter and almost none in the spring; findings verified that sea turtles, particularly leatherbacks and loggerheads, are present consistently from year to year. The most common sea turtles in the waters off of Massachusetts are the leatherback, followed by loggerheads, Kemp's ridley and green sea turtles (Kenney and Vigness-Raposa 2010). The species most likely to be encountered in offshore waters of the Installation Area are the leatherback and loggerhead. The Atlantic (Kemp's) ridley turtle is expected in low numbers but may be present within the Installation Area. (Kenney and Vigness-Riposa 2010). Leatherback and loggerhead turtles show a seasonal occurrence between May and November, peaking in late summer and early fall, respectively (Kraus et al. 2016). Kemp's ridley were detected in late summer and into September in small numbers Occurrences of hawksbill within the installation area should be rare or absent.

7.3.2 Potential Impacts and Proposed Mitigation Measures

Potential impacts to marine mammals and sea turtles from installation of an environmental monitoring buoy was analyzed in the MA EA (BOEM 2014). Based on BOEM's assessment, the installation of environmental monitoring buoys similar to what is proposed for the Bay State Wind Project are not anticipated to result in any significant or population-level effects to marine mammals or sea turtles. BOEM concluded, and has concurred, that there "are no major impacts" on marine mammals (BOEM 2014).

Activities associated with installation of the Met Buoy that may affect marine mammals or sea turtles include: (1) deployment and decommissioning of the buoy itself; (2) vessel traffic (noise and ship strike potential); and (3) discharges or spills of waste materials and accidental fuel releases. The mooring design consists of chains and anchors, which, according to the 2012 Biological Opinion for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas, do not pose an entanglement risk to marine mammals and sea turtles (NMFS 2012) Population-level impacts are not expected to occur to either marine mammals or sea turtles. Bay State Wind has committed to implementing several BMPs during installation, operation, and decommissioning of the Met Buoys in order to further reduce the potential for interactions with or impacts on marine wildlife. These include protected species avoidance measures and vessel strike avoidance measures as outlined in the Lease (Table 4-2).

Surface vessel noise during buoy deployment, decommissioning, and any subsequent maintenance needs during operation is a potential stressor for marine wildlife. Bay State Wind LLC has estimated that vessels will be on site to support both deployment and decommissioning for a total of approximately one to two days during each event, and will only require two round trips per year of a work boat during the operational period in support of maintenance.

Vessel noise associated with these activities, as analyzed by BOEM in the BOEM MA EA (2014) for standard vessels anticipated to be within an acoustic range of 150 to 170 decibels re 1 micropascal-m, would generally produce low levels of noise at frequencies below 1,000 hertz that would dissipate quickly with distance from the source. In general, exposure of marine mammals and sea turtles to individual vessels would be transient and short term; the noise intensity would vary depending upon the source and specific location. Sea turtles are unlikely to be able to hear ship noise, unlike marine mammals. Reactions of marine mammals may vary from apparent indifference to cessation of vocalizations or feeding activity, or evasive behavior (e.g. turns, diving) to avoid approaching vessels (Richardson et al. 2013; Nowacek and Wells 2001). BOEM (2014) concluded that marine mammal behavior would likely return to normal following passage of the vessel. It is unlikely that such short-term effects would result in long-term population-level impacts for marine mammals. Thus, impacts from vessel noise would be negligible if detectible, and short-term.

Installation and operation of the met buoys will result in a maximum of approximately 16 acres (6.4 ha) of impact to the seabed. For potential benthic habitat impacts that may affect marine mammals and sea turtles, BOEM (2014) concluded that re-suspension of bottom sediment and the ensuing sedimentation that would occur around a recently-deployed buoy would have only minor temporary effects. The re-suspension of sediment could affect habitat and food availability for marine mammals and sea turtles but this is not considered likely due to limited utilization of the benthic environment by these species and the limited impact to the benthos itself from buoy installation, operation, and decommissioning. As described in Section 7.2.2, the installation of the Met Buoy is not expected to result in any changes in local community assemblages or diversity, or to the availability of habitat and forage items for marine mammals and sea turtles.

Vessels associated with buoy installation, operation, and decommissioning are a potential ship strike risk for marine mammals and sea turtles during transit. However, this is considered unlikely and impacts negligible. Given the small number of vessels required to support deployment, operation, and decommissioning, the protected species avoidance measures outlined in the Lease (Table 4-2), the environmental briefing that will be provided to all vessel crews prior to the execution of work (see Section 4.3),the limited spatial and temporal scale of buoy installation/decommissioning, and the project compliance with the vessel strike avoidance measures outlined in the Lease (see Section 4.4), no significant impacts

due to vessel strikes are anticipated. Project related vessel traffic in the area is within the range of existing vessel activity and it is unlikely that the vessel traffic associated with the Met Buoys would increase risk of a strike to marine wildlife during project activities.

BOEM (2014) has also concluded that the limited amount of vessel traffic associated with installation/decommissioning of environmental monitoring buoys would result in infrequent, if any, release of liquid wastes, spills, or accidental discharges. Therefore, impacts to marine mammals and sea turtles from the discharge of waste materials or the accidental release of fuels during Met Buoy installation, operation (maintenance), and decommissioning are expected to be minor, if they occur at all. In addition, as stated in Section 4.3, all support personnel will participate in a pre-installation briefing that will cover topics that not only include protected species avoidance, but also marine trash and debris awareness and oil spill response procedures.

In the unlikely event an interaction with a marine mammal or sea turtle occurs during project activities, Bay State Wind LLC will follow the reporting requirements as described in Section 4.4.1.

7.4 Avian and Bat Resources

7.4.1 Affected Environment

Data on the avian and bat species that could occur the Lease Area were analyzed from several sources, including federal, state, and academic institutions (Winiarski et al. 2012, BOEM 2013a, Veit et al. 2016, Kinlan et al. 2016). These datasets provided both general and detailed knowledge of the species that have the potential to occur in the proposed Installation Areas. According to these recent assessments and studies, the Lease Area provides habitat for approximately 25 waterbird species, including pelagic ducks, loons, scoters, eiders, gulls terns, alcids, gannets, and shorebirds (Winiarski et al. 2012, BOEM 2013a, Veit et. al. 2016). With the exception of gulls, use of the Lease Area by most waterbird species is seasonal. Additionally as depicted on Figure 7-1, data suggests that there may be a greater concentration of waterbird species as well as hot spots for seabirds such as terns and pelagic ducks at the northern end of the Lease Area in proximity to the F2 and B2 Installation Areas than at the F1 Installation area (Veit et al. 2016).

Passerine species, raptors, and other landbirds (e.g., songbirds, falcons, and shorebirds) known to occur along the coast of southern New England also have the potential to migrate through the Lease Area (BOEM 2013a). In addition, since the Lease Area is located within the Atlantic Flyway, it is likely that migratory birds could pass through the Lease Area during both the spring and fall migration (BOEM 2013a, Veit et al. 2016), Flight heights would generally be above the proposed met buoys. However, offshore flight altitudes of shorebirds are more highly variable, with flocks sometimes just above the sea surface. Given the proximity of the F2 and B2 Installations Areas to Martha's Vineyard and Nantucket, there is the potential for these migratory species to transit the proposed Met Buoy locations. However, the risk of collision with the proposed met buoys is not expected.

Three federally listed species including the endangered roseate tern (*Sterna dougallii dougallii*) and the and the threatened piping plover (*Charadrius melodus*) and red knot (*Calidris canutus ssp. rufa*) are known to occur or migrate through the region surrounding the Lease Area (Winiarski et al. 2012, BOEM 2013a, Veit et al. 2016). In addition to their federal status, the roseate tern is a state-listed endangered species, and the piping plover is a state-listed threatened species. The red knot does not have additional state status.

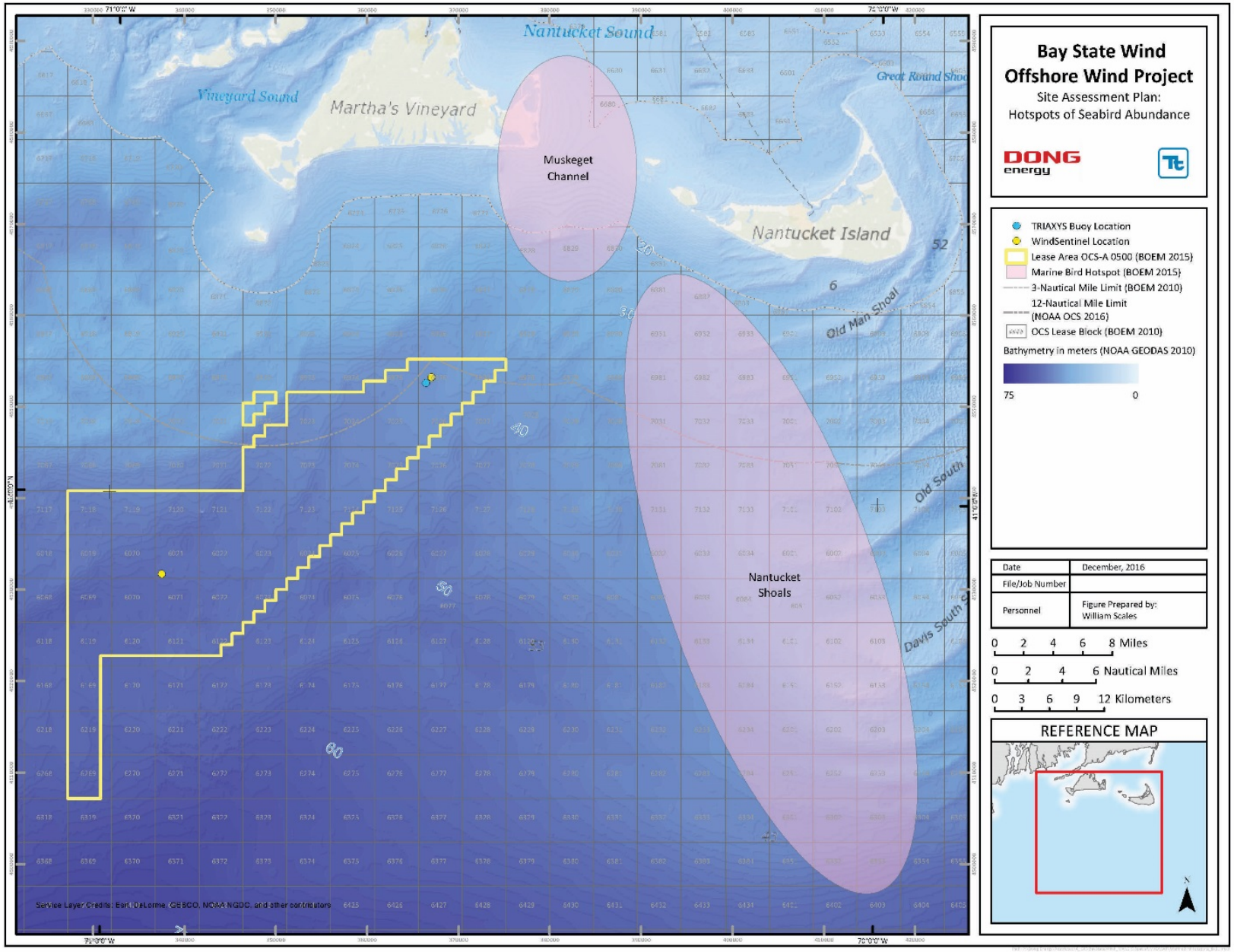

Figure 7-1 Hotspots of Seabird Abundance

Roseate terns nest in colonies on islands located in proximity to the F2 and B2 Installation Areas as well as along Cape Cod. Surveys documented that the Muskeget Channel located over 12 miles north and northeast of the Lease Area (between Martha's Vineyard and Nantucket Island and the western edge of the Nantucket Shoals) is a hot spot for roseate terns as well as other pelagic duck species during nesting and post-breeding staging periods (Veit et al. 2016). Despite the presence of this hotspot, roseate terns generally forage nearshore therefore the potential for roseate turn activity to occur in both the Lease Area and in the proposed F2 and B2 Installation Areas is expected to be minimal (BOEM 2013a, Veit et al. 2016).

Piping plovers breed in Massachusetts, with 689 pairs in 2016 mostly along Cape Cod and coastal islands including Martha's Vineyard and Block Island. A statewide Habitat Conservation Plan for the species was approved by the U.S. Fish and Wildlife Service (USFWS) in July 2016. They use sandy beaches and tidal areas for foraging as well as stopover habitat during the migration season. Piping plovers tend to stay within narrow coastal margins during migration and are not likely to occur in any of the proposed Installation Areas (BOEM 2013a).

Bat occurrence patterns in the Lease Area, and offshore in general, are poorly understood. Bats that are known to currently or historically occur in Massachusetts include big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), tri-colored bat (*Perimyotis subflavus*), silver-haired bat (*Lasionycteris noctivagans*), eastern small-footed bat (*Myotis leibii*), little brown bat (*M. lucifugus*), and northern long-eared bat (*Myotis septentrionalis*) (BOEM 2013a). Northern long-eared bats are a federally listed threatened species. big brown bat, tri-colored bat, eastern small-footed bat, little brown bat, and northern long-eared bat are all cave-dwelling species that do not migrate over the ocean, so they are not expected to be in the Lease Area. Little is known about bat migration or foraging patterns offshore. Recent studies, however, have acoustically detected bats offshore (Peterson 2016, Tetra Tech unpublished data). Bats with the greatest potential to migrate through the Lease Area on their way between breeding and wintering grounds in the spring and fall are the three migratory tree species: eastern red bat, hoary bat, and silver-haired bat (BOEM 2013a). Based on this information it is expected that bat activity would likely be greater near the coastal islands than further offshore; however, based on recent studies there is the potential for bat activity to occur within the F2 and B2 Installation Areas (Tetra Tech unpublished data).

7.4.2 Potential Impacts and Proposed Mitigation Measures

In the MA EA, BOEM concluded, and USFWS has concurred, that there "is no expected threat of significant impact" on avian or bat resources from either site characterization or assessment activities in the Lease Area (BOEM 2013a). The Met Buoys proposed are buoys that are close to the water surface and have minimal equipment, which reduces the likelihood of collisions.

While the impact of the Met Buoys on both avian and bat species are anticipated to be minimal, Bay State Wind has committed to implementing several BMPs during installation, operation, and decommissioning of the Met Buoys in order to further reduce the potential for interactions. Specifically, the Met Buoys have been designed to have rounded rails that will reduce perching. Landing areas have been minimized and anti-perching devices will be installed on the lights and mast. While birds may still perch on equipment, it will not pose a threat to any species.

Artificial lights have also been known to attract birds and bats migrating at night. However, the increase in artificial light from Met Buoys would be negligible compared with other sources of light in the area, including lighting on commercial, recreational, and military vessels. It is anticipated that installation of the Met Buoys will occur during daylight hours and that artificial lighting will not be necessary on the installation vessel(s).

Should any artificial light be deemed necessary on the installation or operational support vessels, Bay State Wind will ensure they are hooded and directed downward when possible.

In the unlikely event that Bay State Wind LLC identifies any fatalities of federal or state-listed avian or bat species during installation or operation, they will be reported within 24 hours to both BOEM and USFWS. In addition, an annual report will be provided to BOEM documenting any dead or injured birds or bats found on vessels and structures during construction, operations, and decommissioning. The report will contain the following information: the name of the species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the U.S. Geological Survey Bird Banding Program at https://www.pwrc.usgs.gov/bbl/.

7.5 Water and Air Quality

7.5.1 Water Quality

The description of baseline water quality conditions provided by BOEM in the MA EA (BOEM 2014), which relied heavily on a field study conducted between October 2009 and July 2010 (Ullman and Codiga 2010) are considered representative of the proposed Installation Areas.

Impacts on water quality from installation, operation, and decommissioning of the Met Buoys will be minor to negligible. The Met Buoys will be self-contained and therefore no discharges are expected. As BOEM describes in the MA EA, operational discharges from installation and service vessels may occur, however the coastal and oceanic circulation and large water volume associated with the surrounding area would disperse, dilute, and biodegrade vessel discharges, so impacts on water quality would be minor (BOEM 2014). The disturbance to the seabed from the Met Buoys (a maximum of approximately 16 acres [6.4 ha]) may cause small and localized increases in suspended sediment concentration; however these suspended sediments would naturally settle back to the seabed resulting in no long term impact to water quality.

Each WindSentinel™ is expected to carry up to 227 gallons (858 liters) of diesel fuel for the emergency generator. The risk of a release of diesel fuel from the buoys is remote; however, to mitigate the potential for impact an Oil Spill Response Plan will be submitted for review and approval to the Oil Spill Response Division of the BSEE. The plan will demonstrate compliance with 30 CFR 254.22(a) and 2544.23(g)(1) (see Section 4.6).

Bay State Wind LLC will comply with BSEE NTL 2015-G03 (see Table 2-1) regarding marine trash and debris prevention. Because the discharge of trash is generally prohibited, BOEM has concluded that no environmental effects are likely to occur as a result of trash discharge, even if some trash or debris is discharged accidentally. As stated in Sections 4.5 and 4.6, Bay State Wind LLC will ensure that all employees and contractors are briefed on marine trash and debris awareness elimination and as appropriate and oil spill response procedures.

7.5.2 Air Quality

7.5.2.1 Affected Environment

Dukes County, Massachusetts (which encompasses Martha's Vineyard and is the closest point of land to the proposed locations for the Met Buoys) has been designated as marginal nonattainment with respect to the 2008 8-hour ozone (O_3) standard in the revised National Ambient Air Quality Standard (NAAQS). The remainder of the state of Massachusetts has been designated as unclassifiable/attainment for the 2008 8-hour O_3 standard, meaning that there is not enough information to make a determination at this time

and/or the state does not need to take additional steps to control emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), the pollutants that react in the atmosphere to form O_3. However, 40 CFR 81 still retains the moderate nonattainment designation for all of Massachusetts for the 1997 8-hour O_3 standard. In addition, the Environmental Protection Agency (EPA) has designated Massachusetts as an unclassifiable/attainment area for the new one-hour NO_2 NAAQS, which were promulgated in 2010, pending the collection of additional monitoring data. A similar designation is expected for the one-hour sulfur dioxide (SO_2) NAAQS. Massachusetts is in attainment of all other NAAQS. Additionally, all of Massachusetts is within the Northeast Ozone Transportation Region as designated by the Clean Air Act of 1970 as amended.

7.5.2.2 Potential Impacts and Proposed Mitigation Measures

The installation, operation, and decommissioning of the Met Buoys has the potential to impact local air quality. Potential emission sources would however be limited to a work boat and a support vessel that could be used for the installation, operation, and decommissioning. Vessels associated with these activities would emit criteria air pollutants (NO_x, carbon monoxide [CO], SO_2, particulate matter less than 10 microns in diameter [PM_{10}], particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]), and VOCs), hazardous air pollutants (HAPs) and greenhouse gasses [GHGs]). Vessels would emit pollutants both in state and federal waters while traveling to and from the Installation Areas throughout the operational lifecycle. Impacts from pollutant emissions associated with these vessels would likely be localized within immediate vicinity of the Met Buoy locations and in the vicinity of vessel activity.

It is anticipated that the installation and decommissioning of the Met Buoys would each be completed over a period of approximately one to two days, for a total of two to four days. Bay State Wind LLC has assumed two round trips per year of a work boat during the operational period, for a total of two round trips during the operations phase. A summary of the air emission estimates is presented in the Table 7-7, and the detailed emission calculations and assumptions are presented in Appendix H.

Table 7-7 Bay State Wind Met Buoys Air Emissions Summary

Met Buoys Activity	VOC	NO_X	CO	PM/PM_{10}	$PM_{2.5}$	SO_2	HAPs	GHG
	tons	tons	tons	tons	tons	tons	tons	tons CO_2e
Installation Activities	0.005	0.17	0.09	0.004	0.004	0.0001	0.001	11.9
Annual Maintenance Activities	0.001	0.04	0.02	0.001	0.001	0.0000	0.000	2.8
Decommissioning Activities	0.005	0.17	0.09	0.004	0.004	0.0001	0.001	11.9
Maximum Annual Emissions [1]	0.01	0.21	0.11	0.005	0.005	0.0001	0.001	14.7

Note:
1. The maximum annual emissions assumes that the annual maintenance activities and either the installation or decommissioning activities occur in the same year.

Emissions associated with the installation, operation, and decommissioning of the Met Buoys would be minor based on the estimate of less than 50 tons per year of NO_X and VOCs, 100 tons per year of the other criteria air pollutants, and 25 tons per year of HAPs or 10 tons per year of any individual HAP. The majority of these emissions would occur within Installation Areas and therefore would not affect local onshore air quality in Massachusetts. Additionally, since the Met Buoys would not be considered an OCS source and the project emissions are associated with mobile sources, an OCS air permit for these activities will not be required.

7.6 Social and Economic Resources

7.6.1 Commercial and Recreational Fishing

7.6.1.1 Affected Environment

There are numerous port and marina locations shoreward of the Lease and associated Installation Areas that can be used by both commercial and recreational fishermen from Massachusetts and other states along the East Coast. New Bedford Harbor, for example, is used for marine shipping, commercial and recreational fishing, boating tourism, and a mix of other commercial, industrial, and recreational uses. In 2010, New Bedford ranked 10th in terms of pounds landed and 1st in terms of dollars landed out of all United States ports. For the New England Region, this port was ranked 1st in both pounds and dollars landed (National Ocean Economics Program 2014). These statistics are driven by the lucrative, offshore sea scallop fishery.

Commercial fishing is generally segregated into either mobile or fixed gear fishing. Mobile gear fisheries are those in which fishing gear such as an otter trawl, mid-water trawls, purse seins, dredges, and rod and reel are deployed while in motion aboard a vessel, while fixed gear fisheries use gear such as lobster pots, fish traps, and gillnets, which are set in one location and then checked or retrieved later. The “mixed species” otter trawl fishery that occurs throughout the year in southern Massachusetts waters targets some combination of squid, butterfish, scup, and whiting (RI Ocean SAMP 2010). In the federal waters of southern New England, mid-water trawlers, as well as purse seiners from Massachusetts, Rhode Island, and New York target herring and mackerel during the fall and winter months (RI Ocean SAMP 2010). HRG survey data collected in 2016 showed marks on the seabed indicative of trawling activity at the met buoy locations F2 and B2. From 2000 to 2010, the top commercial fish species by pounds landed has varied by state and by year, alternating between Atlantic herring and mackerel in Massachusetts, squid and Atlantic herring in Rhode Island, and quahogs and squid in New York. The most economically valuable species landed during the same period ranged from quahogs in New York, American lobster in Rhode Island, and sea scallops in Massachusetts (NOAA 2014). BOEM has evaluated the spatial distribution of commercial fishing by species in the Lease Area. As depicted in Figure 7-2, the two most valuable fisheries to Massachusetts and Rhode Island (sea scallops and lobster) are generally not fished within the proposed Installation Areas (BOEM 2013b)

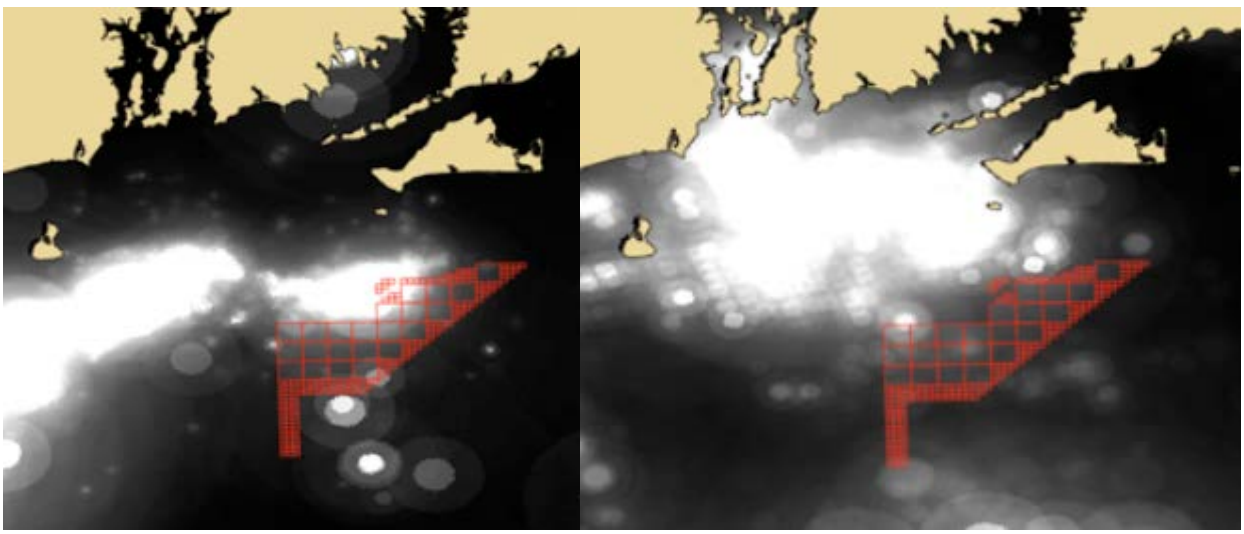

Figure 7-2 Spatial distribution plot of commercial sea scallop (L) and American lobster (R) catches between 2007 and 2012

Recreational fishing in the region occurs year-round, but is most intensive from April through November. Recreational fishing vessels operate out of numerous ports located in Rhode Island, New York, Connecticut, and southeastern Massachusetts, including the Elizabethan Islands, Nantucket and Martha's Vineyard. The most commonly targeted recreational species include Atlantic bonito, Atlantic cod, black sea bass, bluefish, scup, striped bass, summer flounder, winter flounder, tautog, sharks, yellowfin tuna, and bluefin tuna (NOAA Fisheries 2015). There are three types of saltwater recreational fishing activities common in offshore and along the coasts of southern New England, including shore-based fishing, fishing by private vessels, and fishing by charter vessels. Massachusetts recreational fishing activities in 2013 was comprised mostly of party/charter (52 percent), while private vessels and shore-based fishing comprised only 21 and 27 percent, respectively (NOAA Fisheries 2015). Massachusetts hosts approximately 44 tournaments that target a variety of different species, including: cod, black sea bass, bluefish, striped bass, haddock, tuna and fluke in the waters of Southern New England (Northeast Regional Planning Body 2015). The Lease Area is in the midst of several known sport fishing areas (Figure 7-3), including "The 31 Hole" just southeast of the Lease Area, the dumping ground at the southern edge of the Lease Area referred to as "The Dump", as well as "The Fingers", "The Claw", "The Star" and "Gordon's Gully" (NAVIONICS 2016). Fishermen targeting these areas could potentially transit and/or troll through the proposed Installation Areas.

7.6.1.2 Potential Impacts and Proposed Mitigation Measures

Potential impacts to commercial and recreational fishing from installation of an environmental monitoring buoy was analyzed in the MA EA (BOEM 2014). Based on BOEM's assessment, the installation of the Met Buoys is not anticipated to result in any significant effects to fishing activities. The potential effects associated with installation of the Met Buoys that may affect commercial and recreational fishing activities can be grouped into two broad categories: (1) displacement of fishing activities and (2) target species availability/species disturbance.

It is anticipated that installation and decommissioning of the Met Buoys would take approximately two to four days and only require the support of two to three vessels. Given the limited extent of these activities, BOEM concluded that the increase in vessel traffic and activities related to the installation/operation of an environmental monitoring buoy would not measurably impact commercial or recreational fishing activities, the total catch of fish and shellfish, or navigation over any substantial period of time. Additionally, based on BOEM any impacts on localized fishing displacement and/or target species availability within the Met Buoy Installation Area are expected to be temporary, and to result in negligible impacts on fishing (BOEM 2014).

While no specific stipulations concerning interactions with commercial and recreational fishing are provided in the Lease, as recommended in BOEM's October 20, 2015 Fisheries Social and Economic Conditions guidance document (BOEM 2015), Bay State Wind LLC has developed a Fisheries Communication Plan as well as hired a Fisheries Liaison Officer, Mr. John Williamson, and Fisheries Industry Representative, Mr. Steve Welch, who was on board the HRG survey vessel during the SAP survey activities. As necessary, Mr. Williamson will conduct outreach with the surrounding commercial and recreational fishing communities prior to buoy deployment. Outreach with commercial and recreational fishermen will continue throughout the site assessment term. In addition, Bay State Wind LLC will notify commercial and recreational fishermen, as well as other users of the area about the proposed activities via a LNM and broadcasts on Marine Channel 16 prior to installation and decommissioning. Bay State Wind LLC will also submit an application to the USCG for a PATON for the Met Buoys (see also Section 4 and Table 1-2).

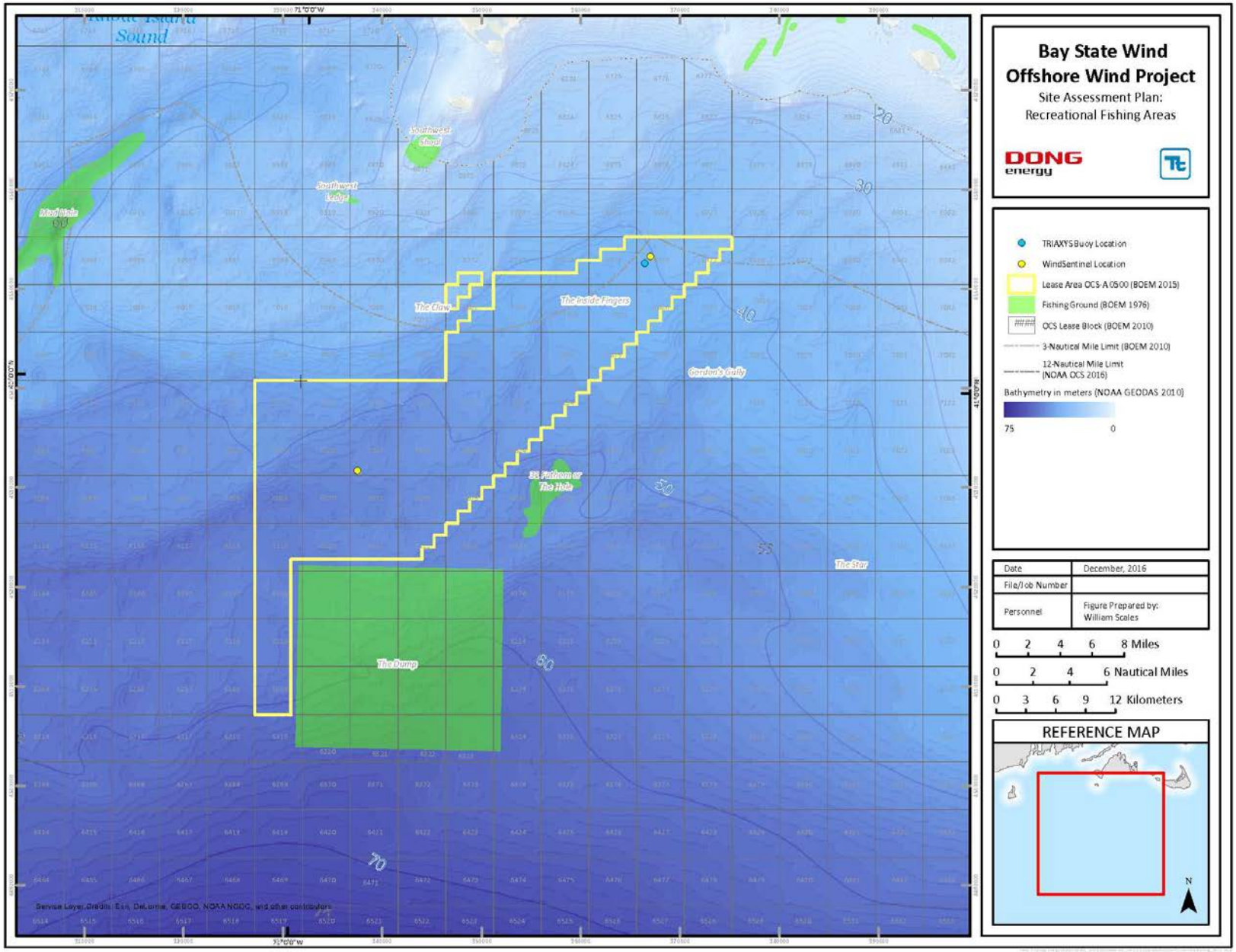

Figure 7-3 Recreational Fishing Areas

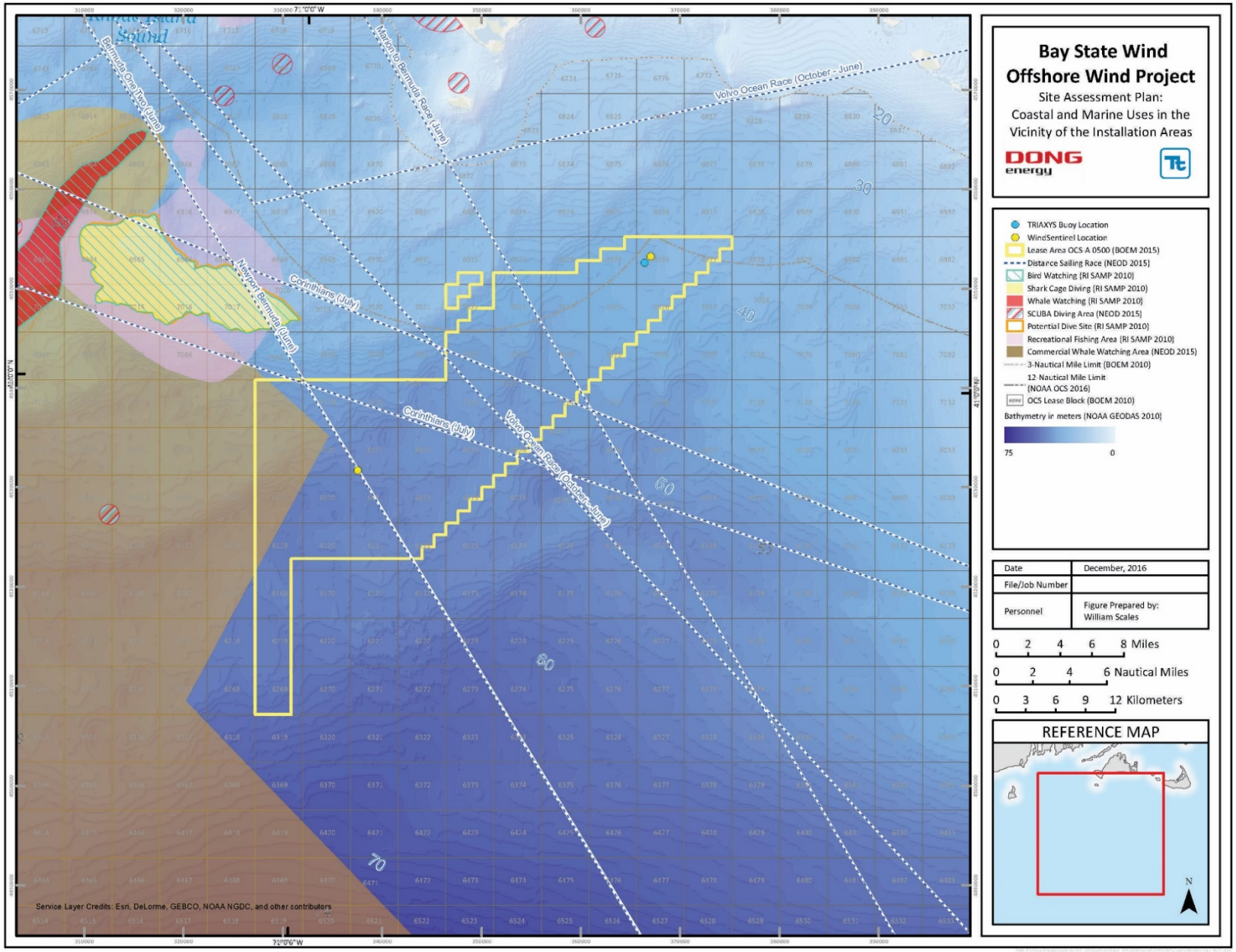

Figure 7-4 Coastal and Marine Uses in the Vicinity of the Installation Areas

With regard to species disturbance, BOEM concluded that impacts related to installation, operation, and decommissioning of the Met Buoys are expected to be minor and are not expected to result in changes in local community assemblage and diversity (BOEM 2014)(see also Section 7.2.1). As such, these activities are not expected to have population-level impacts that would affect fisheries and the availability of fish to catch during or between fishing seasons.

7.6.2 Coastal and Marine Uses

7.6.2.1 Affected Environment

In addition to commercial and recreational fishing, other coastal and marine uses such as seasonal tourism associated with beaches, sport fishing, and other coastal activities such as water sports and wildlife viewing are important to the local economies of southern Massachusetts communities.

While the majority of recreational boating takes place in state waters within 3 nm (5.6 km) of the coastlines, there are several long-distance sailboat racing routes that traverse near the Installation Areas (Figure 7-4). The entirety of the Lease Area is also located within the Narragansett Bay Naval Operating Area but is not within areas restricted by the military. In addition, the Met Buoys avoid designated areas for commercial vessel traffic including fairways and recommended vessel routes, traffic separation schemes, deepwater routes, and precautionary and caution areas (Figure 7-4).

7.6.2.2 Potential Impacts and Mitigation Measures

Due to the limited spatial extent of the Met Buoys, as well as the limited amount of activities necessary to support installation, operation and decommissioning; there will be no significant impact to offshore social and economic resources including military uses, commercial shipping, recreational boating, sailboat racing and wildlife viewing (BOEM 2014). Adherence to the International Regulations for Preventing Collisions at Sea 1972 and the “Rule of Good Seamanship” by vessel operators will mitigate risks that the Met Buoys may pose to safe navigation. Bay State Wind LLC will notify mariners and other users of the area about the proposed activities via a LNM and broadcasts on Marine Channel 16 prior to installation and decommissioning. Bay State Wind LLC will also coordinate with the U.S. Department of Defense (see also Section 2, Table 2-1) and submit an application to the USCG for a PATON for the Met Buoys (see also Section 4 and Table 1-2). Additionally, the navigational lighting will notify vessels of the FLIDAR Buoy so it can be safely avoided.

7.7 Archaeological Resources

7.7.1 Affected Environment

Installation of the Met Buoys has the potential to affect submerged archaeological resources that may relate to the prehistoric and historic time periods. Documentary and field research show the submerged installation area to have high potential for human activity, with the exception of the Late Archaic and Woodland prehistoric periods which present low sensitivity as in these periods the coastal plain was submerged.

During the prehistoric era, habitation of the exposed coastal plain was possible beginning around 13,000 years ago. From an archaeological perspective the area was only subaerial from approximately 13,000 to approximately 11,100 years ago, during the Paleoindian period (12,500 – 10,000 years Before Present) and Early-Middle Archaic period (10,000 – 5,000 Before Present). By the subsequent Late Archaic period the exposed coastal plain was inundated due to rapid marine transgression. To date, no previously

identified pre-contact archaeological sites have been documented in the Met Buoy Installation Area (Schmidt et al. 2016).

Historic period archaeological sites that could occur within offshore portions of the survey area are predominantly related to marine activity, such as historic shipwrecks from the 17th to 20th centuries (BOEM 2013). Background research indicates that there have been numerous vessel wrecks in the Lease Area but none are located within or in close proximity to the proposed Installation Areas (see Appendix D).

In 2016 R. Christopher Goodwin & Associates, Inc. conducted an archaeological assessment of the HRG survey data with Alpine/Gardline. The HRG survey and archaeological analysis were performed in accordance with the Bay State Wind Offshore Wind Farm SAP Survey Plan, BOEM's guidelines and associated SOCs for cultural resources as defined in both the Lease (OCS-A 0500) and the MA EA. The detailed Marine Archaeological Resources Assessment for the Massachusetts Commercial Offshore Wind Lease Area, Met Buoy Installation Area, Official Protraction Areas, Providence NK19-07 and Block Island Shelf NK19-10, OCS Blocks 6021 (F1) and 6979 (F2/B2) Offshore Massachusetts, is provided in Appendix D. The survey area consisted of a detailed review of the three 328 x 328 ft (100 x 100 m) Installation Areas centered on each of the proposed Met Buoys deployment locations (see Table 3-1). To achieve the required site characterization data, the HRG survey provided 100 percent coverage of the entire geographic area (horizontal and vertical extents) that could be physically disturbed by project activities.

The HRG survey utilized numerous remote survey methods including: marine magnetometer, side scan sonar, subbottom profiler, and multibeam echosounder. Archaeological resources review of the data focused on areas of planned bottom-disturbing activities within the Installation Areas that have the potential to impact submerged archaeological resources. Review of remote sensing data identified no magnetic anomalies and no side scan sonar contacts within the three Installation areas. Sub-bottom profiler data was collected and analyzed to identify paleolandscape features. This data indicated that no paleo-landforms are present that may preserve inundated archaeological sites.

7.7.2 Potential Impacts and Proposed Mitigation Measures

Based upon the results of the 2016 marine archaeological investigations, no potential submerged cultural or archaeological resources were identified within Installation Areas as such the installation and operation of the proposed Met Buoys would result in no impacts to marine archaeological resources. However, in compliance with 30 CFR 585.802 Bay State Wind LLC will develop an Unanticipated Discoveries Plan prior to the start of met buoy deployment activities. In the case of an inadvertent discovery of a cultural resource, Bay State Wind LLC's Unanticipated Discoveries Plan will be implemented to prevent further disturbance of the resource.

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Appendix A
Permits and Consultations

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Appendix B

Equipment Specifications and Modelling Results

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Appendix C

Site Characterization Report

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Appendix D

Marine Archaeological Resource Assessment Report in Support of the Bay State Wind Offshore Wind Farm

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Appendix E

Benthic Assessment

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Appendix F

Health And Safety Plan

(To be Provided Prior to Construction)

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Appendix G
Vessel Specifications

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Appendix H
Air Quality Emissions Calculations

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