VINEYARD NORTHEAST

SITE ASSESSMENT PLAN

JANUARY 2022

PREPARED BY:

Epsilon ASSOCIATES INC.

SUBMITTED BY:

VINEYARD NORTHEAST LLC

VINEYARD OFFSHORE

Vineyard Northeast Site Assessment Plan (SAP)
for Metocean Buoy(s)
Lease OCS-A 0522

Prepared by:
Epsilon Associates and Geo SubSea LLC

Prepared for:
Vineyard Northeast LLC

January 2022

Note: This Site Assessment Plan was initially submitted by Vineyard Wind LLC, the original lease holder of Lease Area OCS-A 0522. In late 2021, Lease Area OCS-A 0522 was assigned to Vineyard Northeast LLC. While the Proponent name has been updated to Vineyard Northeast LLC, some graphics still retain the Vineyard Wind logo.

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1.0 EXECUTIVE SUMMARY

Vineyard Northeast LLC (the Proponent) seeks Site Assessment Plan (SAP) Approval from the Bureau of Ocean Energy Management (BOEM) to install, maintain, operate, and decommission up to two "non-complex" meteorological and/or oceanographic (metocean) buoys on its Lease Area OCS-A 0522 (522); the installation of the met buoy(s) is referred to as "the Project." The purpose is to gather Lease-specific wind and ocean current data to support development of offshore renewable wind energy facilities in Lease Area OCS-A 0522. This future development of offshore wind energy generation facilities is referred to as Vineyard Wind Northeast. Installation of the met buoy(s), which will be conducted without anchoring of installation vessels to minimize seafloor impacts, is planned for the second quarter (Q2) of 2022. The proposed metocean buoy(s) will be Ocean Tech's EOLOS FLS200 Light Detection and Ranging (LiDAR) buoy; this buoy type has already been approved by BOEM (for the US Wind SAP).

This submission presents the information required by applicable SAP-related regulations and BOEM guidance, as detailed in Section 3.0. The metocean buoy(s) will be non-complex scientific measuring devices proven to reliably operate in open ocean conditions to support offshore wind energy projects. The floating measurement buoy will be secured to the seafloor by a single chain and a single mooring weight (also referred to as an "anchor") to minimize bottom disturbance and the risk of entanglement or entrainment of marine biota. Details of the buoy system performance standards and compliance with Lease stipulations and other requirements are provided in Section 4.0 and 9.0. Installation, operation, maintenance and decommissioning activities and reporting requirements are presented in Sections 5.0, 6.0, and 7.0 respectively.

The Proponent has conducted the required comprehensive field surveys and investigations to assess seafloor and shallow subsurface conditions within the two 300 meter (m) by 300 m (984 feet [ft] by 984 ft) study areas (named SAP-1 and SAP-2) within the Lease that have been selected to site the metocean buoy(s). These field surveys are described in Section 8.0 and related appendices. The field investigations were part of the Proponent's 2019 geophysical, geotechnical, and environmental surveys for the Lease Area.

Evaluation of the field survey data specific to the SAP areas, including review by a Qualified Marine Archaeologist (QMA), have confirmed that conditions within both SAP study areas are suitable for deployment and operation of metocean buoy(s). Field methodology and results are presented in Sections 8.0 and 9.0, and cited appendices.

In brief, evaluation of the survey data in each SAP study area found no evidence of natural seafloor and shallow subsurface geohazards; no man-made hazards suggestive of shipwrecks, debris, abandoned fishing gear, cables, pipelines and potential ordnance; no evidence of sensitive habitats; no evidence of historic properties; and no evidence of shallow subsurface paleo features that could be indicative of former glacial meltwater streams or fluvial channels. Vibracore samples did not recover any peat layers that could be indicative of potential terrestrial soils. The QMA recommended a determination of "no historic properties" affected (36 CFR 800.4).

2.0 INTRODUCTION

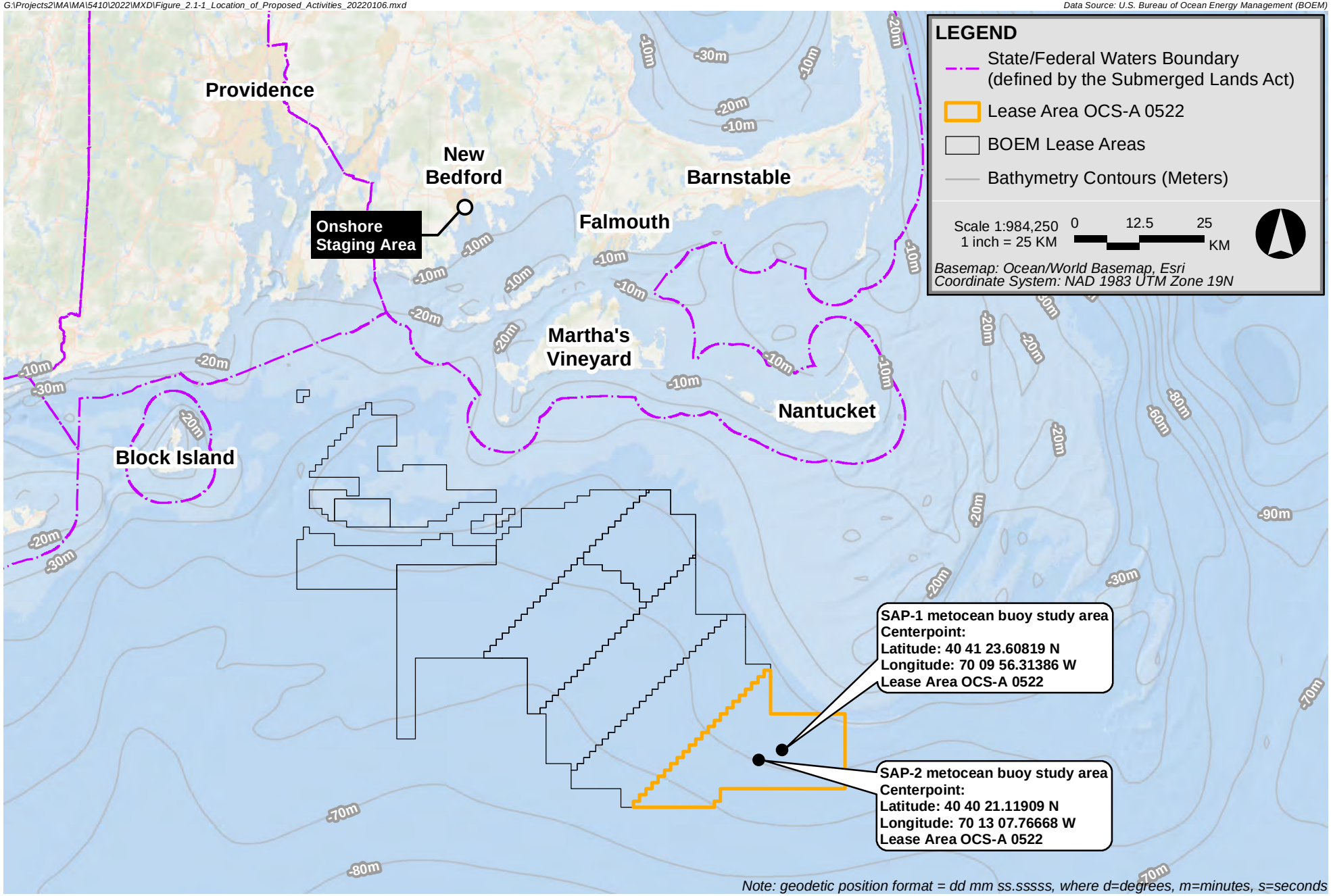
2.1 Summary of Proposed Activities

The Proponent proposes to install up to two metocean buoys in Lease Area OCS-A 0522 within the Massachusetts Wind Energy Area (MA WEA) of the Atlantic Ocean, as designated by the Bureau of Ocean Energy Management (BOEM). The Lease Area is located in federal waters of the Outer Continental Shelf (OCS) seaward of U.S. Territorial Seas, southeast of Martha's Vineyard and south of Nantucket, Massachusetts.

Data to be collected from the metocean buoy(s) will support development activities in the Lease Area. The locations of proposed metocean buoy activities (SAP-1 and SAP-2) on the Lease are shown on Figure 2.1-1. Up to two buoys will be deployed, either one in each SAP area or both in the same SAP area. In addition to initial buoy installation, the activities proposed could include recovery and/or replacement at the same location of one or more buoys if circumstances require such action (e.g. buoy damage or loss).

The information collected from the metocean buoy(s) will be used to further assess the wind resources and ocean conditions on the Lease, to supplement existing metocean measurement data available in the vicinity of the MA WEA. Historical and ongoing collection of meteorological and oceanographic data in the region will inform the Construction and Operations Plan (COP) submittal and engineering of the wind turbine generators (WTGs) in support of development activities on the Lease Area. The metocean buoy(s) decommissioning date has not yet been determined by the Proponent. Duration of deployment has not yet been determined, but is anticipated to be approximately 5 years, coinciding with the site assessment term of the Lease.

The devices to be deployed on Lease Area OCS-A 0522 are anticipated to be Ocean Tech's EOLOS FLS200 Light Detection and Ranging (LiDAR) buoy (see Section 4.0 for more information). These buoys minimize impacts compared to meteorological towers. The buoy system will be comprised of a "simple and non-complex" device proven to operate effectively in open ocean conditions in support of offshore wind projects; the specific buoy used has already been approved by BOEM (for the US Wind SAP). The buoy(s) will be moored to the seafloor using a single chain to avoid entanglement, in compliance with entanglement avoidance stipulations in Lease Section 4.1.4 (see Section 4.1). Further performance standards for the equipment are described in Sections 4.0 and 9.0.



Lease Area OCS-A 0522 SAP

VINEYARD WIND

Figure 2.1-1

Location of Proposed Activities

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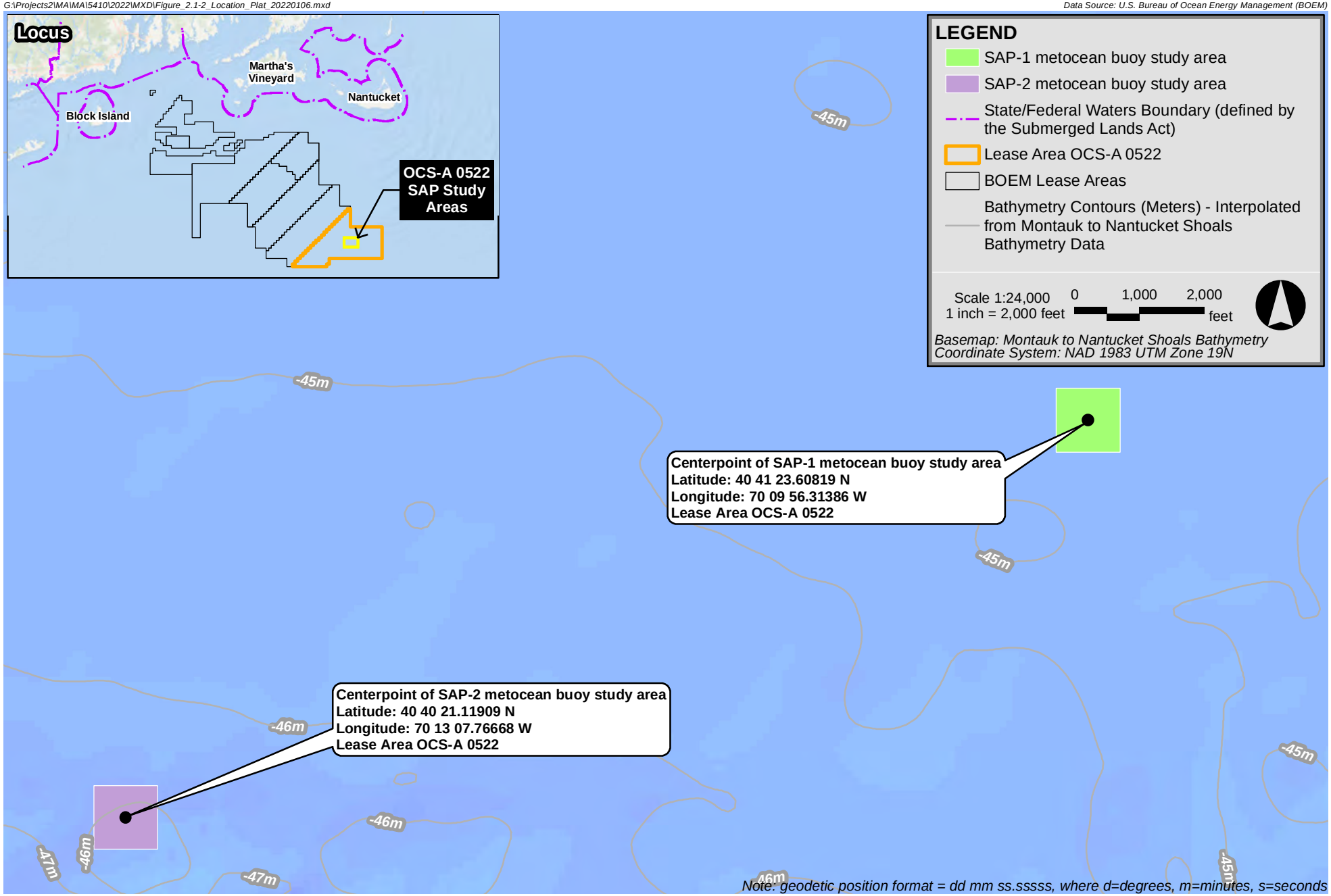
Data Source: U.S. Bureau of Ocean Energy Management (BOEM)



Lease Area OCS-A 0522 SAP

VINEYARD WIND

Figure 2.1-2

Location Plat

2.2 Locations and Schedule

Two 300 meter (m) by 300 m (984 ft by 984 ft) study areas within which the metocean buoy(s) (SAP-1 and SAP-2) will be located are shown on Figure 2.1-2, Location Plat. Pre-construction comprehensive marine field investigations have been conducted in the study areas to identify and characterize seafloor features, potentially sensitive habitats, and potential marine resources, to ensure the selected locations of the buoy(s) minimize impacts in accordance with approved survey plans and Lease requirements (see Sections 3.0, 8.0, 9.0 and related appendices).

Coordinates and water depths at the center point of each study area are presented below.

SAP-1 (northeast)	SAP-2 (southwest)
Latitude: 40 41 23.60819 N	Latitude: 40 40 21.11909 N
Longitude: 70 09 56.31386 W	Longitude: 70 13 07.76668 W
Depth: 45.0 m (147.6 ft) MLLW	Depth (m): 46.6 m (152.9 ft) MLLW

Note: geodetic position format = dd mm ss.sssss, where d=degrees, m=minutes, s=seconds

A geodatabase/shapefile for the Location Plat (Figure 2.1-2), compliant with BOEM's guidelines, is provided separately with the SAP submission.

Installation of the metocean buoys(s) is planned for Q2 of 2022. The installation process is expected to take up to two weeks, from arrival and onshore testing of the equipment and testing at the Onshore Staging Area in the Port of New Bedford (shown on Figure 2.1-1) to the time the buoy(s) are deployed at the location(s) and mooring weights are placed on the seafloor. No modifications of the Onshore Staging Area are required. The total duration of the metocean buoy(s) offshore deployment for data collection has not yet been determined, but is anticipated to be approximately 5 years, coinciding with the site assessment term of the Lease.

2.3 Authorized Representative and Designated Operator

Rachel Pachter, Chief Development Officer, Vineyard Northeast LLC
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New Bedford, MA 02740
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The Proponent intends to be the sole operator of the metocean buoy(s) and will comply with the applicable stipulations stated in the Lease and regulations, as described in Section 3.0, as they relate to the BOEM-approved Site Assessment Survey Plan and proposed SAP activities.

2.4 Certified Verification Agent (CVA)

The type of metocean buoy selected by the Proponent is a standardized, proven, widely used and commercially available device that has previously been approved by BOEM (for the US Wind SAP) and has been successfully deployed and operated in support of offshore wind projects in similar and harsher oceanic conditions than on Lease Area OCS-A 0522 . The buoy type uses the best

available and safest technology, does not require multi-point moorings or include new or uncommon technology, and therefore will not be "complex or significant" as defined on page 8 of BOEM's *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan (SAP)*, revised June 2019. These guidelines are referred to hereafter as BOEM's 2019 SAP Guidelines. The mooring design has been checked and assessed by the Proponent. In addition, all installation and maintenance activities will be performed under supervision by key experts representing the Proponent.

Because the design, fabrication, installation, operation, maintenance, and decommissioning of standardized and proven metocean buoys are not considered "complex or significant" activities, in the Proponent's opinion, the nomination of a Certified Verification Agent (CVA) is not required for this SAP activity. The Proponent hereby requests a waiver of the CVA requirement according to 30 CFR §585.610(a)(9) and 585.705(c).

2.5 Financial Assurance Information

In compliance with BOEM regulations at 30 CFR §585.610(a)(15), prior to SAP approval the Proponent will provide a Surety Bond issued by a primary financial institution or other approved security, as required in 30 CFR §585.515 and 30 CFR §585.516, to guarantee the commissioning obligation.

3.0 CONFORMANCE WITH APPLICABLE REGULATIONS, SAP GUIDANCE AND COMMERCIAL LEASE

3.1 Regulatory Framework

This SAP has been prepared and activities will be conducted by the Proponent in conformance with the following:

- Applicable regulations at 30 CFR §Part 585, entitled *Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf;*
- BOEM's *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan (SAP)* dated June 2019;
- Applicable terms of the Lease issued by BOEM for Lease Area OCS-A 0522;
- Guidance from BOEM at a pre-survey meeting held on March 22, 2019; and
- The Vineyard Wind OCS-A 0522 Construction and Operations Survey Plan: 522 Windfarm and Cable Routes, 2019 Campaign (submitted February 12, 2019, revised April 2, 2019 and May 1, 2019) and approved by BOEM on May 21, 2019.

In 2019, the Proponent completed field surveys across its Lease Area OCS-A 0522 (see Section 8.0 and related appendices). The surveys were conducted in accordance with a pre-survey meeting with BOEM and the Proponent's BOEM-approved COP Survey Plan for the 2019 campaign on Lease Area OCS-A 0522, referenced above. The 2019 field investigations gathered data within two 300 m x 300 m (984 ft by 984 ft) study areas selected to site the subject metocean buoy(s), denoted as Site Assessment Plan (SAP) activities, once BOEM approval of this SAP is obtained. The field surveys specific to the SAP study areas which will contain the metocean buoy(s) are detailed in Section 8.0 and related Appendices; results of applicable resource assessments are summarized in Section 9.0 and relevant appendices.

The Proponent will conduct its proposed site assessment activities for the metocean (buoy(s) in compliance with 30 CFR §585.606(a)(2 through 4) in a manner that conforms to all applicable laws, regulations, and Lease provisions for OCS-A 0522; is safe; does not reasonably interfere with other uses of the OCS; does not cause undue harm, to the extent practicable, to natural resources, life, property, the environment, or resources of historical or archaeological significance; uses BOEM's SAP best available and safest technology; uses best management practices (see Table 9.8-1); and uses properly trained personnel.

The Proponent will take suitable measures, including briefing all SAP offshore support staff, to prevent unauthorized discharge of pollutants including marine trash and debris into the offshore environment. Furthermore, the Proponent will comply with BOEM's applicable federal regulations (Table 3.1-1), applicable Lease stipulations (Table 3.1-2), BOEM's SAP Best Management Practices (Table 9.8-1) and BOEM's 2019 SAP guidelines as referenced throughout this document. Table 3.1-1 below lists relevant BOEM regulations and where the corresponding information can be found in this SAP.

Table 3.1-1 Lease Area OCS-A 0522 SAP Regulatory Crosswalk Table

Regulatory Requirement	Location in SAP for Metocean Buoy(s)
30 CFR §585.605(a,b,&d)	
585.605(a) Describe the activities you plan to perform for the characterization of your commercial lease, including your project easement, or to test technology devices.	Section 2.1 Sections 4.0 through 8.0
585.605(a)(1) The SAP must describe how you will conduct your resource assessment	Section 8.0 and cited Appendices
585.605(b) Include data from physical characterization surveys and baseline environmental surveys	Sections 8.0 and 9.0 and cited Appendices
585.605(d) If the facilities are complex or significant, you must also comply with the requirements of subpart G of this part and submit your Safety Management System as required by § 585.810.	The metocean buoys are not "complex or significant".

Table 3.1-1 Lease Area OCS-A 0522 SAP Regulatory Crosswalk Table (Continued)

Regulatory Requirement	Location in SAP for Metocean Buoy(s)
30 CFR §585.606	
585.606(a)(1) The project conforms to all applicable laws, regulations, and lease provisions of your commercial lease;	Section 3.1
585.606(a)(2) The project is safe;	Section 3.1
585.606(a)(3) The project does not unreasonably interfere with other uses of the OCS, including those involved with National security or defense;	Section 3.1 and Table 3.3-1
585.606(a)(4) The project does not cause undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance;	Sections 3.1 and 9.0 and cited Appendices
585.606(a)(5) The project uses best available and safest technology;	Sections 2.4, 3.1
585.606(a)(6) The project uses best management practices;	Sections 3.1, Table 9.8-1
585.606(a)(7) Uses properly trained personnel.	Section 3.1
585.606(b) Your site assessment activities will collect all information needed for your COP	Section 3.1
30 CFR §585.610(a)(1-16)	
585.610(a)(1) Contact Information	Section 2.3
585.610(a)(2) The site assessment or technology testing concept	Section 2.1
585.610(a)(3) Designation of operator, if applicable	Section 2.3
585.610(a)(4) Commercial lease stipulations and compliance	Table 3.1-2, Section 9.8; Table 9.8-1
585.610(a)(5) A location plat	Section 2.2 Figures 2.1-1 and 2.1-2
585.610(a)(6) General structural and project design, fabrication, and installation	Section 2.1 Section 4.0 Section 5.0 Appendix A
585.610(a)(7) Deployment activities	Section 5.0
585.610(a)(8) Your proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	Sections 4.1, 4.2 and 4.4 Sections 5.2, 6.3, 7.2 Section 9.0 and Table 9.8-1
585.610(a)(9) CVA nomination, if required	Section 2.4; the Proponent requests a waiver of the CVA requirement

Table 3.1-1 Lease Area OCS-A 0522 SAP Regulatory Crosswalk Table (Continued)

Regulatory Requirement	Location in SAP for Metocean Buoy(s)
30 CFR §585.610(a)(1-16)	
585.610(a)(10) Reference information	Section 10.0
585.610(a)(11) Decommissioning and site clearance procedures	Section 7.0
585.610(a)(12) Air quality information (refers to 585.659: comply with EPA Clean Air Act and implementing regulations)	Section 9.7
585.610(a)(13) A listing of all Federal, State, and local authorizations or approvals required to conduct site assessment activities on your lease	Sections 3.1, 3.3 Table 3.3-1
585.610(a)(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	Section 3.0: 3.2, 3.3, 3.4
585.610(a)(15) Financial assurance information	Section 2.5
585.610(a)(16) Other information	None
30 CFR §585.610(b)(1-5)	
585.610(b)(1) Geotechnical – The results from the geotechnical survey with supporting data	Sections 8.0, 9.2 Appendix C
585.610(b)(2) Shallow hazards – The results from the shallow hazards survey with supporting data	Sections 8.0, 9.6 Appendix C
585.610(b)(3) Archaeological – The results from the archaeological survey with supporting data, if required	Sections 8.0, 9.5 Appendix D
585.610(b)(4) Geological survey – The results from the geological survey with supporting data	Sections 8.2, 9.2 Appendix C
585.610(b)(5) Biological survey – The results from the biological survey with supporting data	Sections 8.2, 9.4 Appendix E
30 CFR §585.611 NEPA	See Table 9.8-1 for measures to minimize impacts to categorically excluded resources per BOEM's 2019 SAP Guidance
585.611(b)(1) Hazard information	Section 8.0 Section 9.0
585.611(b)(2) Water quality	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).

Table 3.1-1 Lease Area OCS-A 0522 SAP Regulatory Crosswalk Table (Continued)

Regulatory Requirement	Location in SAP for Metocean Buoy(s)
30 CFR §585.611 NEPA	See Table 9.8-1 for measures to minimize impacts to categorically excluded resources per BOEM's 2019 SAP Guidance
585.611(b)(3) Biological resources	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b); Addressed in Sections 8.5 and 9.4 and Appendix E under 30 CFR §585.610(b)(5)
585.611(b)(4) Threatened or endangered species	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).
585.611(b)(5) Sensitive biological resources or habitats	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b). Addressed in Sections 8.5 and 9.4 and Appendix E.
585.611(b)(6) Archaeological resources	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b). Addressed in Sections 8.4, 9.6 and Appendix D under 30 CFR §585.610(b)(5)
585.611(b)(7) Social and economic conditions	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).
585.611(b)(8) Coastal and marine uses	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).
585.611(b)(9) Consistency Certification	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).
585.611(b)(10) Other resources, conditions, and activities	See Section 3.2: Categorically excluded per BOEM 2019 Guidance and 30 CFR §585.611(b).

Table 3.1-2 demonstrates compliance with the commercial stipulations relevant to this SAP in BOEM's *Commercial Lease of Submerged Land for Renewable Energy Development on the Outer Continental Shelf* for Lease Area OCS-A 0522 (effective Date April 1, 2019). Lease stipulations pertaining to minimizing impacts to marine resources are listed in Section 9.8 and Table 9.8-1. The Proponent will comply with the Lease stipulations below, in Section 9.8, and in Table 9.8-1.

Table 3.1-2 Lease Area OCS-A 0522 Commercial Lease Stipulations and Compliance

Stipulation	Compliance
Section 4(a): The Lessee must make all rent payments to the Lessor in accordance with applicable regulations in 30 CFR Part 585, unless otherwise specified in Addendum "B."	The Proponent has made and will continue to make all rent payments in accordance with applicable regulations, unless otherwise specified in Addendum "B".
Section 4(b): The Lessee must make all operating fee payments to the Lessor in accordance with applicable regulations in 30 CFR Part 585, as specified in Addendum "B.	The Proponent will make all operating fee payments in accordance with applicable regulations.
Section 5: The Lessee may conduct those activities described in Addendum "A" only in accordance with a SAP or COP approved by the Lessor. The Lessee may not deviate from an approved SAP or COP except as provided in applicable regulations in 30 CFR Part 585.	The Proponent will conduct activities as described in the SAP.
Section 7: The Lessee must conduct, and agrees to conduct, all activities in the leased area and project easement(s) in accordance with an approved SAP or COP, and with all applicable laws and regulations.	The Proponent will conduct all activities in the leased area in accordance with the SAP and all applicable laws and regulations.
Section 10: The Lessee must provide and maintain at all times a surety bond(s) or other form(s) of financial assurance approved by the Lessor in the amount specified in Addendum "B."	The portions of the Lease development activities in federal waters will be covered by financial assurance in amounts and within time frames approved by BOEM and in accordance with Addendum "B", Section IV of the Lease. See Section 2.5.
Section 13: Unless otherwise authorized by the Lessor, pursuant to the applicable regulations in 30 CFR Part 585, the Lessee must remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by activities on the leased area and project easement(s) within two years following lease termination, whether by expiration, cancellation, contraction, or relinquishment, in accordance with any approved SAP, COP, or approved Decommissioning Application, and applicable regulations in 30 CFR Part 585.	Preliminary decommissioning plans are described in Section 7.0. The decommissioning will be in accordance with the applicable regulations.

Table 3.1-2 Lease Area OCS-A 0522 Commercial Lease Stipulations and Compliance (Continued)

Stipulation	Compliance
Section 14: The Lessee must: a. maintain all places of employment for activities authorized under this lease in compliance with occupational safety and health standards and, in addition, free from recognized hazards to employees of the Lessee or of any contractor or subcontractor operating under this lease; b. maintain all operations within the leased area and project easement(s) in compliance with regulations in 30 CFR Part 585 and orders from the Lessor and other Federal agencies with jurisdiction, intended to protect persons, property, and the environment on the OCS; and c. provide any requested documents and records, which are pertinent to occupational or public health, safety, or environmental protection, and allow prompt access, at the site of any operation or activity conducted under this lease, to any inspector authorized by the Lessor or other Federal agency with jurisdiction.	(a) The Proponent will maintain all places of employment in compliance with applicable standards. (b) The Proponent will maintain all operations in the leased area in compliance with applicable regulations. (c) The Proponent will provide any requested documents and records.
Section 15: The Lessee must comply with the Department of the Interior's non-procurement debarment and suspension regulations set forth in 2 CFR Parts 180 and 1400 and must communicate the requirement to comply with these regulations to persons with whom it does business related to this lease by including this requirement in all relevant contracts and transactions.	The Proponent will comply with the applicable Department and suspension regulations.
Section 16: During the performance of this lease, the Lessee must fully comply with paragraphs (1) through (7) of Section 202 of Executive Order 11246, as amended (reprinted in 41 CFR 60-1.4(a)), and the implementing regulations, which are for the purpose of preventing employment discrimination against persons on the basis of race, color, religion, sex, or national origin.	The Proponent will fully comply with paragraphs (1) through (7) of section 202 of Executive Order 11246, as amended.
Addendum "B", Section III (Payments): Unless otherwise authorized by the Lessor in accordance with the applicable regulations in 30 CFR Part 585, the Lessee must make payments as described below.	The Proponent will make payments as stipulated in Addendum "B", Section III.

Table 3.1-2 Lease Area OCS-A 0522 Commercial Lease Stipulations and Compliance (Continued)

Stipulation	Compliance
Addendum "C", Section 2 (Site Characterization):	
Addendum "C", Section 3 (National Security and Military Operations): The Lessee must comply with the requirements specified in stipulations 3.1, 3.2, and 3.3 when conducting site characterization activities in support of plan (i.e., SAP and/or COP) submittal.	The Proponent will comply with the requirements in stipulations 3.1, 3.2, and 3.3 of Addendum "C".
Addendum "C", Section 4 (Standard Operating Conditions)	The Proponent will comply with the applicable Standard Operating Conditions in Addendum "C", Section 4.
Section 4.1: General	
4.1.1: Vessel Strike Avoidance Measures The Lessee must ensure all vessels conducting activities in support of the SAP comply with vessel strike avoidance measures, using specific transit speeds, visual and database monitoring, separation distances and other measures. And that vessel operators are briefed.	See Section 9.8-1: stipulation subclauses are listed in Measures to Reduce Impacts to Marine Mammals and Sea Turtles
4.1.2: Marine Trash and Prevention The Lessee must ensure all offshore SAP staff are briefed on marine trash and debris awareness and elimination, to ensure no trash and debris is discharged into the marine environment.	See Sections 3.1 and 9.8.1
4.1.3 Fisheries Communication Plan (FCP) and Fisheries Liaison The Lessee must develop a publicly available FCP to communicate with fisheries stakeholders prior to and during SAP activities and designate a point of contact.	See Section 9.8.2: Measures to Reduce Impacts to Fisheries
4.1.4 Entanglement Avoidance The Lessee must ensure that devices attached to the seafloor for longer than 24 hours use the best available mooring systems to minimize risk of entanglement or entrainment of marine mammals, manta rays, and sea turtles.	See Section 4.2.1: stipulation subclauses are listed in Mooring Design Standards
4.2 Archaeological Survey Requirements Lessee must provide the results of an archaeological survey with its plans, prepared by a Qualified Marine Archaeologist (QMA)	See Sections 8.4, 9.5 and Appendix D
4.2.3 Tribal Pre-Survey Meeting Lessee must hold a pre-survey meeting inviting involved tribal representatives, to inform them of planned SAP activities	See Section 3.4 Regulatory Consultations Tribal pre-survey meetings were held in April 2019.
4.2.4-4.2.6 QMA Review before Disturbance Lessee must only conduct geotechnical activities where analysis of geophysical survey has been completed and reviewed by a QMA to assess the presence/absence of potential historic properties prior to ground disturbance.	See Sections 8.4, 9.5 and Appendix D

Table 3.1-2 Lease Area OCS-A 0522 Commercial Lease Stipulations and Compliance (Continued)

Stipulation	Compliance
4.2.7 Post-Review Discovery Lessee must follow a specific notification process if unanticipated potential archaeological resources are discovered during SAP activities	See Sections 8.4, 9.5 and Appendix D
4.4 Reporting Requirements	
4.4.4 Reporting Injured or Dead Protected Species The Lessee must ensure that sightings of any injured or dead protected species (see below) are reported to BOEM, NMFS and the NMFS Greater Atlantic (Northeast) Region's Standing Hotline (866-755-6622 or current) within 24 hours of sighting. If the Lessee is responsible for the injury or death, the Lessee's vessel much assist in any salvage effort as requested by NMFS.	See Section 9.8, Table 9.8-1, and reporting forms in Appendix B.
4.4.5 Reporting Observed Impacts to Protected Species The Lessee must report any observed takes of listed marine mammals, sea turtles, sturgeon, or giant manta ray resulting in injury or mortality within 24 hours to BOEM and NMFS.	See Section 9.8, Table 9.8-1, and reporting forms in Appendix B.

3.2 SAP Format and Categorical Exclusions for Portions of NEPA Analysis

The SAP is in general conformance with the recently issued BOEM SAP report template specifically for "non-complex" metocean buoys (in Attachment C of BOEM's 2019 SAP Guidelines).

In 2014, BOEM completed a Revised Environmental Assessment (EA) for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts (OCS EIS/EA BOEM 2014-603), which is referred to herein as the "Massachusetts EA." In accordance with 30 CFR §585.611(b), BOEM's 2019 SAP Guidelines (at page 21) note that the NEPA analyses conducted by BOEM as part of the Massachusetts EA included within its scope of site assessment activities for up to 10 metocean buoys (or a lesser number of the higher impact meteorological towers) on leases to be issued within the WEA:

> **Metocean Buoys:** If a lessee is proposing the installation and operation of metocean buoy(s) in an area where BOEM has previously analyzed such activities under NEPA, then regulatory requirements in 585.611(b)(2 through 10) will likely not be applicable. Regulatory requirements in 585.611(b)(1) may be applicable for BOEM technical review outside of NEPA.

The Massachusetts EA resulted in a Finding of No Significant Impact for the activities under the EA's purview.

Per 30 CFR §585.611(b), the categories and resources in 30 CFR §585.611(b)(2 through 10), which are listed below, can be excluded from duplicative analyses in areas "in which BOEM has previously considered site assessment activities under applicable Federal law (e.g., a NEPA analysis and CZMA consistency determination for site assessment activities)"…subject to a BOEM determination that "impacts are consistent with those previously considered":

- Water quality (Note: sediment transport for the subject metocean buoy(s) is described in Sections 8.0 and 9.0);
- Biological resources; (Note: seafloor community is described and assessed in Sections 8.5 and 9.4 and Appendix E);
- Threatened or endangered species; (Note: protected species avoidance measures in Section 9.8.1 and Table 9.8-1);
- Sensitive biological resources or habitats; (Note: described and assessed herein in Sections 8.0 and 9.0, and Appendix E);
- Archaeological resources; (Note: described and assessed herein in Sections 8.0 and 9.0, and Appendix D); Social and economic conditions;
- Coastal and marine uses; and
- Consistency certification.

As shown in Table 3.2-1, the potential impacts from the proposed metocean buoy(s) are consistent with the anticipated impacts of the site assessment activities previously analyzed by BOEM as part of the Massachusetts EA.

Table 3.2-1 Consistency of Proposed SAP Components with Massachusetts EA

Component	Massachusetts EA	SAP	Consistency
Number of Buoys	1-2 buoys per lease.	1-2 buoys.	The number of buoys proposed are consistent with what was evaluated in the EA.
Meteorological Buoy Height	Generally, less than 12 m above sea level.	Approximately 5.3 meters above sea level.	The height is consistent with the expected height evaluated in the EA.

Table 3.2-1 Consistency of Proposed SAP Components with Massachusetts EA (Continued)

Component	Massachusetts EA	SAP	Consistency
Meteorological Buoy Mooring Weight (Anchor) Weight	Boat shaped and discus shaped buoy: approximately 6,000 - 10,000 lbs (2,721 – 4,536 kg). Spar-type buoy: approximately 165 tons (149,685 kg).	Approximately 11,023 lbs (5,000 kg).	The weight of the anchor proposed is similar to that evaluated in the EA.
Meteorological Buoy Mooring Weight (Anchor) Footprint	Boat shaped and discus shaped buoy: approximately 6 SF (0.5 m^2). Spar-type buoy: approximately 676 SF (62.41m^2).	Approximately 19.38 SF (1.8 m^2).	The proposed anchor footprint is comparable to that evaluated in the EA.
Mooring Weight (Anchor) Sweep Area	Boat shaped and discus shaped buoy: 8.5 acres. Spar-type buoy: 100 acres (based on a 357 m radius anchor sweep).	With a 74.4-meter radius, the anchor sweep area is estimated to be approximately 4.3 acres	The anchor sweep area is within the sweep area evaluated in the EA.
Anchoring During Meteorological Buoy Installation	The EA assumed additional seafloor impacts from vessel anchoring during installation.	No vessel anchoring is proposed during installation.	The amount of seafloor disturbance is less than what was evaluated in the EA.
Data Collection & Transmission	Assumed a small, tethered buoy with Acoustic Doppler Current Profilers (ADCP). LiDAR, Sonic Detection and Ranging (SODAR), and Coastal Ocean Dynamic Applications Radar (CODAR) technologies could be used.	The buoy(s) will use LiDAR and ADCP.	The data collection and transmission requirements are consistent with what was assumed in the EA.

Table 3.2-1 Consistency of Proposed SAP Components with Massachusetts EA (Continued)

Component	Massachusetts EA	SAP	Consistency
Installation and Decommissioning	Estimated to take approximately 1-2 days to install and remove using a barge, tug, or similar vessel assuming a vessel speed of 4.5 knots during a 10-hr day.	Estimated to require one 24-hr day with one work boat for installation and decommissioning assuming a vessel speed of 9-10 knots.	The proposed timeline is comparable to what was evaluated in the EA.

Further, as required in 30 CFR §585.611(b)(1) and further specified for metocean buoys in Table 2 of BOEM's 2019 SAP Guidance, Section 8.0 and relevant appendices describe the field surveys conducted in the two 300 m x 300 m (984 ft by 984 ft) metocean buoy deployment study areas to identify potential hazards and resources listed below. Sections 8.0 and 9.0 of this SAP describe existing conditions and assess potential impacts from the proposed metocean buoy(s) on the following:

- **Hazard information:** meteorology, oceanography, sediment transport, geology, and shallow geological or manmade hazards.

Additional resources listed below are also addressed herein, including archaeological and biological resources, as required under 30 CFR §585.610(b)(1-5) and further specified for metocean buoys in Table 2 of BOEM's 2019 SAP Guidance. Locations of required information in this SAP report are presented in Table 3.1-1.

- **Archaeological resources**

- **Biological survey** "The level of biological information collected should be commensurate with the potential impacts from the proposed SAP activity. For example, metocean buoys may have few impact-producing factors that affect protected species or critical habitat due to their limited environmental footprint. Any activity that has several impact-producing factors, such as pile driving, may require more information regarding impacted biological resources and habits" (Table 2, BOEM's 2019 SAP Guidance); and

- **Geotechnical surveys** "Geophysical surveys with shallow sampling methods, such as vibracores or grab samples, may be sufficient for metocean buoys."

3.3 Regulatory Permits and Approvals

The Proponent will apply for the following approvals and/or authorizations shown in Table 3.3-1 to conduct site assessment activities (metocean buoy installation, operation, and decommissioning):

Table 3.3-1 Lease Area OCS-A 0522 SAP Permitting Plan

Permitting Agency	Applicable Permit or Approval	Statutory Basis And Implementing Regulations	Status
BOEM	Site Assessment Plan (SAP) Approval BOEM will conduct National Historic Preservation Act Review & State Historic Preservation Act Consultation	30 CFR § 585.600-618-	Filed March 2020
US Army Corps of Engineers (USACE)	Section 10/404 Permit via Nationwide Permit 5: Scientific Collection Device	Clean Water Act 33 U.S.C. 134 33 CFR § 320	Expected filing date January 2021
US Coast Guard (USCG)	Private Aid to Navigation	14 U.S.C 81; 33 CFR § 66	Expected filing date February/ March2021

3.4 Regulatory Consultations

The Proponent has conducted or will conduct outreach with the following local, state, and federal agencies via meetings and/or correspondence. This outreach will address planned site assessment and development activities in the Lease Area, including the proposed metocean buoy(s). These agencies include:

- BOEM
- National Marine Fisheries Service (NMFS)
- USACE
- USCG, District Commander
- Department of Defense (DoD), US Navy – Fleet Forces

Prior to conducting SAP survey activities (as specified in the Lease), the Proponent held a pre-survey meeting on April 8 and 9, 2019 and invited members of the federally recognized Wampanoag Tribe of Gay Head/Aquinnah, the Mashpee Wampanoag Tribe, the Narragansett Indian Tribe, the Mashantucket Pequot Tribal Nation, the Mohegan Tribe of Indians of Connecticut, and the Shinnecock Indian Nation.

The Proponent and their subcontractors consulted with the Fleet Forces Atlantic Exercise Coordination Center (FFAECC), which coordinates all regional military/other agency activities (both sea and air) for the Narragansett Bay operating area (OPAREA) and ensures events are de-

conflicted. FFAECC does not need any official documentation or notification of a buoy deployment, as it is stationary. Mobile vessels conducting activities related to this SAP will notify FFAECC of their planned operations.

4.0 PROJECT EQUIPMENT

The following sections describe the performance standards and constraints that the metocean buoy equipment will meet.

4.1 Equipment Performance Standards

The Proponent has selected a proven multi-purpose metocean buoy, that has previously been approved by BOEM (for the US Wind SAP), tailored for the renewable energy industry and open Atlantic Ocean conditions. The buoy will accurately measure and collect wind profiles (speed and direction) at different heights within a vertical measurement cone projected above the buoy. Within the cone, wind data can be obtained at varying heights, including heights of the blade spans of the planned offshore wind turbines. The buoy is equipped with oceanographic sensors that can obtain ocean wave height and direction data, and current profiles from the sea surface to the seabed. This information will be utilized to assess site-specific wind resources and assist in developing engineering design criteria for the development activities in the Lease Area.

The mooring chain is designed to resist abrasion and corrosion to last through the five-year planned deployment period. Regular maintenance will include inspection of the mooring chain, similar to USCG's inspection routines every two years. The Proponent has selected a metocean buoy that is non-complex and meets or exceeds all performance standards set by BOEM for this type of marine measuring device.

The metocean buoy will not utilize fuel oil to avoid the risk of accidental release and emissions into the environment. The buoy will be easily deployed and relocated, either by towing or lifting on-board support vessels. The metocean buoy will conform to applicable USCG standards for special purpose buoys and will have a yellow hull.

The metocean buoy(s) that will be deployed in Lease Area OCS-A 0522 are the Ocean Tech EOLOS FLS200 LiDAR Buoy(s) (EOLOS buoy or EOLOS). A diagram of the EOLOS FLS200 buoy system is shown on Figure 4.2-1. Specifications for the mooring design are provided in Appendix A. In summary, the EOLOS is made of polyethylene, aluminum, and stainless steel, with a buoy weight of approximately 4,062 kg. The buoy has a modular hull for easy assembly and transport, an overall height of 5.3 m, is 4 m in length and width, and an overall mast height above water of 4.2 m. The buoy has 4 GB of data storage; a real-time operating system; flexible data acquisition software; full on-board processing of all measured data; and real-time data transfer. The EOLOS buoy is powered by renewable energy, specifically solar panels and wind turbines, and is equipped with back-up batteries.

Height: 5.3 meters
Width and Length: 4 x 4 meters
Buoy Weight: 4,062 kilograms

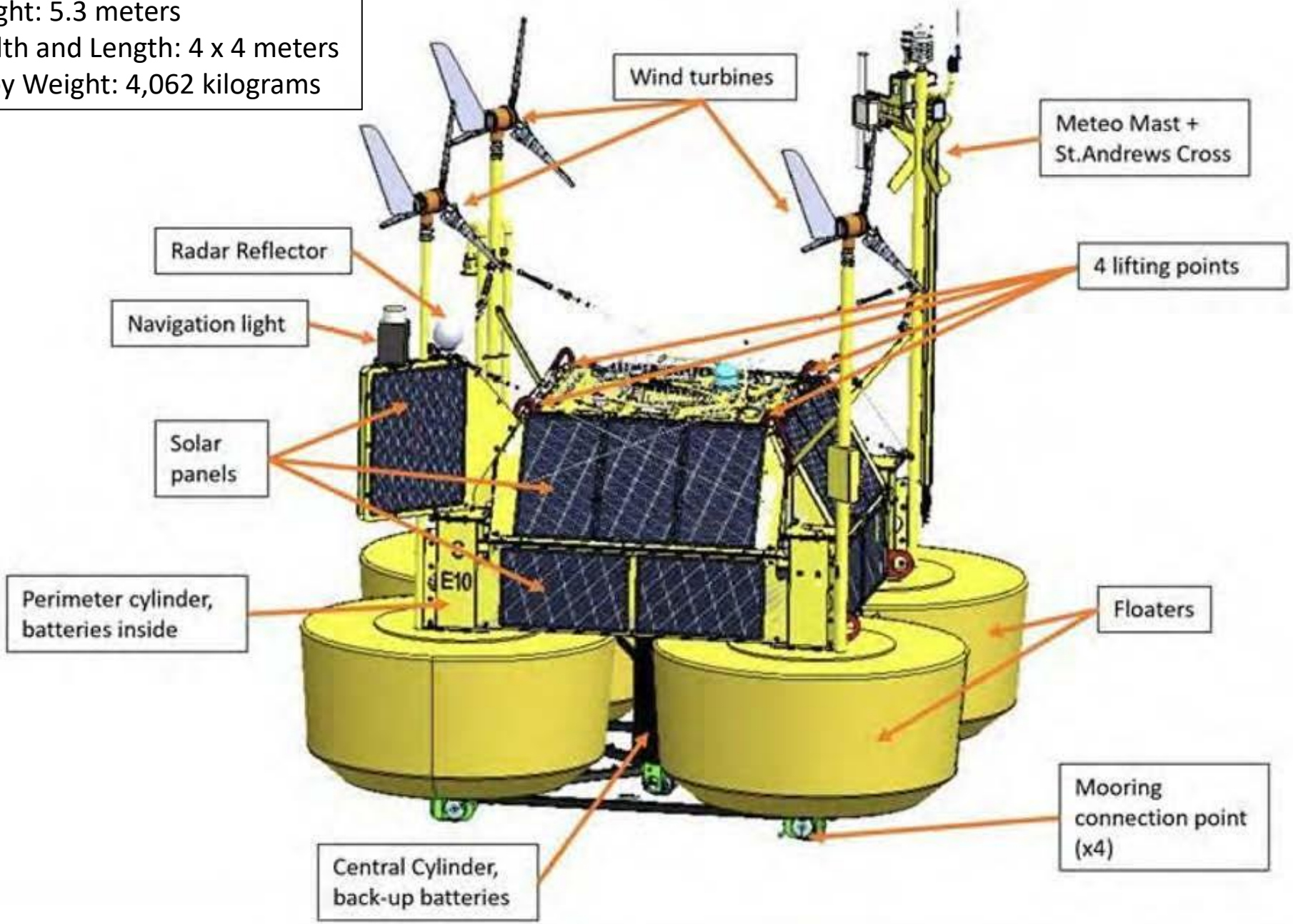


Figure 4.2-1
EOLOS FLS200 Buoy Diagram

The buoy(s) will be equipped with the proper safety lighting, markings, and signal equipment per USCG Private Aids to Navigation (PATON) requirements. Tracking of the buoy(s) will be done by means of Global Positioning System (GPS) and Automatic Identification System (AIS) devices. The location of the buoy(s) will be monitored daily. In addition, there are three locator beacons that send alarms to the EOLOS data center when they are outside the designated buoy watch circle. The Proponent will maintain a list of known and pre-validated vessel providers to assist. If immediate emergency recovery is necessary, the closest suitable recovery vessel will be contacted. Additional information should an emergency recovery be needed is provided in Section 6.2.

The buoy system will be moored to the seafloor using a gravity-based single mooring weight. Typical mooring weights consist of a cement, cast iron, or steel weight linked to the floating buoy by a single chain to limit impacts to the seafloor (see Section 4.3). The proposed buoy(s) will use a cast iron mooring weight.

4.2 Mooring Design Standards

The met ocean buoy(s) utilize an appropriate mooring design that complies with applicable Lease stipulations to reduce the risk of entanglement; utilizes best management practices; is compatible with regional oceanic conditions to operate safely and securely (see Section 8.3); and limits bottom disturbance (see Section 4.3).

The Proponent is utilizing the best available mooring system to ensure the safety and security of the selected metocean buoy and to comply with BOEM's requirements under OCS-A 0522 Lease, Addendum C, Stipulation 4.1.4 entitled *Entanglement Avoidance* (containing the four subclauses below) to minimize the risk of entanglement or entrainment of marine mammals, manta rays, and sea turtles. The Proponent, as Lessee, will ensure that the subject SAP activities will comply as follows:

> *Subclause 4.1.4.1:* The Lessee must ensure that any structures or devices attached to the seafloor for continuous periods greater than 24 hours use the best available mooring systems for minimizing the risk of entanglement or entrainment of marine mammals, manta rays and sea turtles, while still ensuring the safety and integrity of the structure or device. The best available mooring system may include, but is not limited to, vertical and float lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs.
>
> *Subclause 4.1.4.2:* All mooring lines and ancillary attachment lines will use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables, or similar equipment types that prevent lines from looping or wrapping around animals or entrapping protected species.
>
> *Subclause 4.1.4.3:* Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose.

Subclause 4.1.4.4: If an entangled live or dead marine protected species is reported, the Lessee must provide any assistance to authorized stranding response personnel as requires by BOEM or NMFS.

The selected met buoy is consistent with the lease requirements. The proposed mooring "line" is a mooring chain and is expected to be under tension, which reduces entanglement risk. The length of the mooring chain utilized depends on the water depth but is the shortest possible, while still reliably securing the buoy system. The mooring chain is designed to resist abrasion and corrosion to last through the five-year planned deployment period and will be regularly inspected for signs of abrasion and corrosion (see Section 6.2).

4.3 Bottom Disturbance

The total seafloor impacts of each proposed buoy system will be caused by a combination of the mooring weight, the mooring chain sweep zone; and the limited deep-water shallow marine sediments temporarily displaced below the mooring weight.

Mooring Weight: For each metocean buoy, the cast iron mooring weight will occupy an expected seafloor footprint of approximately 1.2 m x 1.5 m, resulting in an area of 1.8 m^2 (19 SF). Upon placement on the seafloor, the mooring weight is expected to vertically penetrate the deep-water fine silty sands and silts to a depth of approximately 2.5 m (8 feet), displacing approximately 10 m^3 (13 cubic yards) of deep-water marine sediments.

As described in Section 9.2, the absence of any size of mobile seafloor features (ripples, megaripples, sand waves) suggests minimal bottom currents are operating in the area, and therefore scour around the weight is expected to be minimal.

Mooring Chain Sweep Zone: The majority of the mooring chain from the mooring weight will traverse the water column to secure the floating buoy. A varying length of the mooring chain will likely rest at times upon the seafloor and sweep around the mooring weight as the floating buoy is moved at the surface by winds, tides, and currents. The maximum length (radius) of mooring chain for each buoy that could rest on the seafloor is estimated at 74.4 m (244 feet).

It should be noted that the seafloor impact of the mooring chain may not be fully radial around the mooring weight, as the buoy will be preferentially directed by prevailing seasonal patterns. However, assuming the entire circumference is affected, the maximum estimated radial mooring chain sweep of seafloor that could be surficially and temporarily affected for each buoy as the single chain moves across it is approximately 17,381 m^2 (187,000 SF; 4.3 acres). The sweep zone will be within the 300 m x 300 m (22 acre) (984 ft by 984 ft) study area assessed for each buoy deployment location.

No seafloor impacts will result from buoy support vessels as activities will be conducted without anchoring. The seafloor is expected to recover naturally from these minimal impacts; no mitigation is necessary.

4.4 Oil Spill Response Measures

As described in Section 4.1, the selected metocean buoy(s) will not use fuel oil. Vessel trips to support the buoy system will be minimal and fuel spills are not expected, as vessels will be expected to comply with USCG regulations at 33 C.F.R. § 151 relating to the prevention and control of oil spills.

If a vessel spill did occur, it is likely to be small. According to the Bureau of Transportation Statistics (2018), between 2000 and 2017 the average oil spill size for vessels other than tank ships and tank barges in all U.S. waters was 368 liters (97 gallons). Because a diesel fuel or similar fuel spill of this size is expected to dissipate rapidly and evaporate within days, impacts to any affected resources would be short-term and localized to the vicinity of the spill.

The Proponent has identified three Oil Spill Response Organizations (OSROs) located in the vicinity of the Lease that are available to execute planned response measures, in the event of a release. While not under contract, in compliance with the SAP Guidance, these organizations are:

- Marine Spill Response Corporation (www.msrc.org)
- US Ecology (www.usecology.com)
- T&T Marine Salvage, Inc. (www.teichmangroup.com)

In the event of an oil spill, the Proponent's designated point of contact (POC) for the SAP activities will be Health, Safety, and Environmental Manager Geoffrey Neild (contact information 407-616-4760; gneild@vineyardwind.com).

An alternative POC will be Marine Liaison Jeannot Smith (contact information 904-613-0134; jsmith@vineyardwind.com).

Within 24 hours of learning of an oil spill related to the SAP activities, the Proponent POC will contact the POCs identified at BOEM, the contracted OSRO, the captain of the subject vessel, if applicable, and any other appropriate officials or personnel. Efforts will be made to respond and minimize impacts of the spill in accordance with applicable laws. Appropriate documentation, including all relevant contact information and records of any oil spills, will be kept at the Proponent's office at 700 Pleasant Street, Suite 510, New Bedford, Massachusetts 02740.

Annually, the Proponent POC and alternate POC will conduct a notification drill to test the ability of the POCs to communicate pertinent information regarding the emergency situation and the necessary response measures to an OSRO and to BOEM.

5.0 DEPLOYMENT / INSTALLATION

5.1 Overview of Installation and Deployment Activities

It is anticipated that the deployment activities will be conducted from New Bedford Harbor, Massachusetts, or a similar suitable port in the area (see Figure 2.1-1). No modifications to existing facilities at the selected port are anticipated.

Deployment and installation activities for the metocean buoy(s) that will operate on Lease Area OCS-A 0522 are expected to require one 24 hour day with one work boat making a single roundtrip. No vessel anchoring is expected. Mobilization is expected to occur at New Bedford Harbor. The buoy is expected to be lifted off the quay and onto the deck of the deployment vessel and secured with chain binders for transit. The mooring weight and mooring chain are expected to be secured onto the center deck of the vessel.

Transit time to the Lease Area OCS-A 0522 will require a distance of 75 NM and will take about 8 hours, one-way, at speeds of 9-10 knots. At the deployment location, the buoy will be lifted off the deck of the vessel into the water, and the mooring weight will be lowered to its planned location on the seafloor. Confirmatory GPS measurements of the buoy system will be obtained.

5.2 Reporting Requirements

The Proponent will report deployment and installation information about the metocean buoy(s) to BOEM as required in 30 CFR §585.615(a) and as specified in the SAP approval, when issued by BOEM. These include:

1) notifying BOEM in writing within 30 days of completing installation activities;

2) preparing and submitting an annual report to BOEM on November 1 of each operational year summarizing the site assessment activities and results; and

3) annual submission of a certification of compliance with certain terms and conditions of the SAP, as identified by BOEM, and other information listed in 30 CFR §585.615I such as identified measures that were not effective and recommendations for new measures.

The Proponent will also provide notifications as required (i.e. to BOEM, USCG) during deployment of the metocean buoy(s).

6.0 OPERATIONS AND MAINTENANCE

6.1 Data Collection and Operations for Metocean Data:

During operation, the location of the buoy will be tracked by GPS located on the top cover of the attached buoy. In addition to this, there are three locator beacons that send alerts to the EOLOS buoy data center when they are outside of the designated buoy watch circle.

The proposed buoy will be lit by an amber flashing LED light with a 3-4 nautical mile (NM) range. The expected model to be used is the solar-powered Carmanah model, also used by the US Coast Guard (USCG), and the anticipated flash pattern is dictated by the USCG approved PATON application: typically a 5 second flash with a flash period of 20 seconds.

The buoy is expected to carry sensors to accurately measure and collect wind profiles (speed and direction) at different heights within a vertical measurement cone projected above the buoy. Within the cone, wind data can be obtained at varying heights, including heights of the blade spans of the planned offshore wind turbines. The buoy will also likely be equipped with oceanographic sensors that can obtain ocean wave height and direction data, and current profiles from the sea surface to the seabed.

The buoy is expected to have on-board data storage, a real-time operating system, and flexible data acquisition software. All measured data is typically processed on-board and accessed through a two-way communication link for data transfer. This information will be utilized to assess site-specific wind resources and assist in developing engineering design criteria for the development activities in the Lease Area.

6.2 Maintenance Activities

The Proponent will conduct safety and equipment inspections of the metocean buoy system in accordance with applicable requirements in 30 CFR Parts 585.615 and 585.824 (a,b). These will include comprehensive annual on-site inspections of all metocean buoy components and completion of a Certificate of Compliance with Conditions of SAP Approval, each submitted to BOEM. The inspections will also comply with manufacturer's guidance to test and maintain the specific buoy system.

Buoy maintenance activities typically include pre-deployment inspections and testing of components, and once deployed, routine battery changes, replacement of worn or damaged parts, and checks of mechanical, electrical, and sensor systems. The mooring chain will be inspected for abrasion and corrosion consistent with routine USCG inspections for similar mooring chains. Buoy performance will also be monitored remotely on a daily basis, based upon satellite-transmitted data, to continually assess the power systems and sensors on the buoy.

Scheduled on-site maintenance activities of the metocean buoy(s), such as battery replacements, will be conducted in accordance with the manufacturer's guidelines, using a vessel comparable to the support vessel used for installation, with sufficient lift capacity as needed. Any device that suffers from malfunction or collision will be replaced with a similar device. I

Maintenance activities could include recovery and/or replacement at the same location of a buoy with the same or similar type if circumstances require such action (e.g. buoy damage or loss).

For recovery operations, either during normal maintenance or in an emergency situation, after confirming the location and visually sighting the metocean buoy, the vessel will be positioned adjacent to the mooring for a visual inspection by the crew and safety toolbox talk, including details of the recovery procedure.

Once the crew has been briefed on the most suitable method for retrieval for the given site conditions, the captain will commence the operation by repositioning the vessel appropriately. An A-frame and winch will be attached to the recovery line of the buoy. This line will be pulled up to reach the main mooring line. The full mooring will be pulled from the water onto the deck of the vessel. The mooring weight will be lifted off the seafloor in one motion and raised high enough so that it does not drag and cause added bottom disturbance. The buoy will then be lifted out of the water onto the deck of the vessel using the A-frame and winch. Once fully retrieved, the mooring system and buoy will be secured to the vessel for safe travel back into the harbor.

Unscheduled maintenance, if required, will be conducted as soon as it is safe and practicable to access the buoy.

6.3 Reporting

The Proponent will report operations and maintenance information about the metocean buoy(s) to BOEM as required in 30 CFR §585.615 and as specified in the SAP approval, when issued by BOEM. Reporting will include submission of an annual report to BOEM on November 1 of each year, summarizing activities and results. The Proponent will also submit an annual certification of compliance as directed by BOEM and as provided under 30 CFR §585.113 and 30 CFR 613e(1).

The certification will also identify any mitigation measures and monitoring methods, and their effectiveness. If measures were found not effective, recommendations for new mitigation measures or monitoring methods will also be included.

The Proponent will also continue to provide notifications to other federal agencies as required (e.g. to USCG) during operation and maintenance of the metocean buoy(s).

7.0 DECOMMISSIONING

7.1 Decommissioning Activities

Decommissioning is expected to be the reverse of deployment and installation activities described in Section 5.1. As stipulated, all facilities will be removed to a depth of 15 feet below the mudline, unless otherwise authorized by BOEM.

Duration of deployment has not yet been determined, but is anticipated to be approximately 5 years, coinciding with the site assessment term of the Lease. Before decommissioning occurs, the Proponent will submit a decommissioning application for approval by BOEM. The application will contain the information required by 30 CFR §585.906, including a schedule for removal, a description of the removal methods and procedures, the types of equipment, vessels and

moorings that will be used, and plans for transportation and disposal or salvage. Planned measures to protect archaeological and sensitive biological features during removal (if any) and to prevent unauthorized discharge of pollutants, trash, and debris during removal will also be included in the application.

Following approval of the application, the Proponent will submit a decommissioning notice at least 60 days prior to commencing decommission activities, in accordance with 30 CFR §585.908.

Device recovery will be undertaken by vessels similar to those used during commissioning. The recovery of the metocean buoy(s) will typically proceed by decoupling the buoy from the mooring and conducting a standard marine mooring recovery process.

The metocean buoy(s) and all related cables and moorings will be removed, in accordance with 30 CFR §585.902. All metocean buoy facilities will be removed to a depth of 15 feet (4.6 m) below the mudline, unless otherwise authorized by BOEM under 30 CFR 595.910. The seafloor will be cleared of all obstructions. The buoy will then be moved to shore and decommissioned.

If any archaeological resources are discovered during decommissioning activities, bottom-disturbing activities will be halted immediately within 1,000 feet (304.8 m) of the discovery and reported to BOEM for guidance within 72 hours, in accordance with 30 CFR §585.902e.

7.2 Reporting

The Proponent will report decommissioning information about the metocean buoy(s) to BOEM as required in 30 CFR §585.912 and as specified in the SAP approval upon issuance by BOEM. Within 60 days of removal of the metocean buoy(s) and related equipment, the Proponent will submit a report to BOEM summarizing the removal activities, describing mitigation measures taken, and including a statement by an authorized representative that explosives used, if applicable, were consistent with those described in the approved decommissioning application.

The Proponent will also provide notifications to other federal agencies as required (e.g. to USCG) prior to decommissioning of the metocean buoy(s).

8.0 FIELD INVESTIGATIONS AND STUDIES IN THE SAP STUDY AREAS

This section and the Appendices referenced herein describe the site-specific SAP field surveys conducted in two 300 m x 300 m (984 ft by 984 ft) deployment study areas (SAP-1 and SAP-2) that are expected to be occupied by the metocean buoy(s) on Lease OCS-A 0522, as shown on Figures 2.1-1 and 2.1-2. Each 22-acre study area constitutes the maximum Affected Environment of each metocean buoy, in that the buoy could be located anywhere within its study area. Resources and hazards identified by the surveys in the study areas are described in Section 9.0. Impacts are assessed and measures to avoid, minimize or mitigate are also described in Section 9.0. The following site-specific field surveys were conducted to assess the Affected Environment of each metocean buoy:

- Geophysical survey of each 300 m x 300 m (984 ft by 984 ft) SAP study area, to identify and assess seafloor conditions and shallow hazards;

- Shallow geotechnical survey to collect sediment samples from each study area for information on potential sediment dispersion and the presence or absence of benthic organisms;

- Archaeological resource survey utilizing the geophysical datasets, to assess the presence or absence of potentially significant shipwrecks and other archaeological resources; and

- Biological survey to identify the benthic community in sediment samples and along video transects.

In addition, oceanographic and meteorological information has been compiled from existing scientific literature and online data sources referenced herein. Once the metocean buoy(s) are deployed, site specific metocean data collection will commence.

8.1 Geophysical and Shallow Geotechnical Surveys and Geologic Characteristics

Geophysical and shallow geotechnical field investigations in the Lease Area OCS-A 0522 SAP areas took place on select days between 31 May and 31 December 2019 as part of the coordinated 2019 field campaign that addressed scopes in both Lease Area OCS-A 0522 and OCS-A 0501. Details of these investigations in the SAP areas are included in the survey summary and operations reports in Appendix C.

Two 300 x 300 m (984 ft by 984 ft) square areas were investigated in Lease Area OCS-A 0522, centered on the proposed met-ocean buoy deployment locations. A full geophysical suite of instruments was employed along a series of 11 primary lines spaced 30 m apart (W-E direction) and one perpendicular tieline through the center (N-S orientation). Systems included a multibeam echosounder, side scan sonar, gradiometer (dual magnetometers), subbottom profiler, and single channel seismic profiler. For ground truthing the acoustic data and assisting with surficial sediment and biological and benthic habitat characterization as well as shallow subsurface sediment identification, one vibracore, one to two sediment grab samples, and one underwater video transect were acquired near the center of each SAP area. Figure 8.1-1 shows the tracklines and sample locations in SAP-1 and Figure 8.1-2 illustrates the same for the SAP-2 site. Figure 8.1-3 shows the video transect and grab sample locations at SAP-1 (northeast) and SAP-2 (southwest).

Results and interpretations of the data are presented in the following paragraphs.

The Lease Area OCS-A 0522 SAP areas are located on the OCS south of Cape Cod and the islands, due south of Nantucket and southwest of Nantucket Shoals, in a region classified as primarily a depositional environment. The seabed is dominated by a combination of recent marine

sediments (Holocene age) and reworked glacial and fluvial deposits (Pleistocene). Limited bedforms suggest minimal seabed mobility in the area. Grain size tends to decrease toward the southwest into deeper water portions of Lease Area OCS-A 0522.

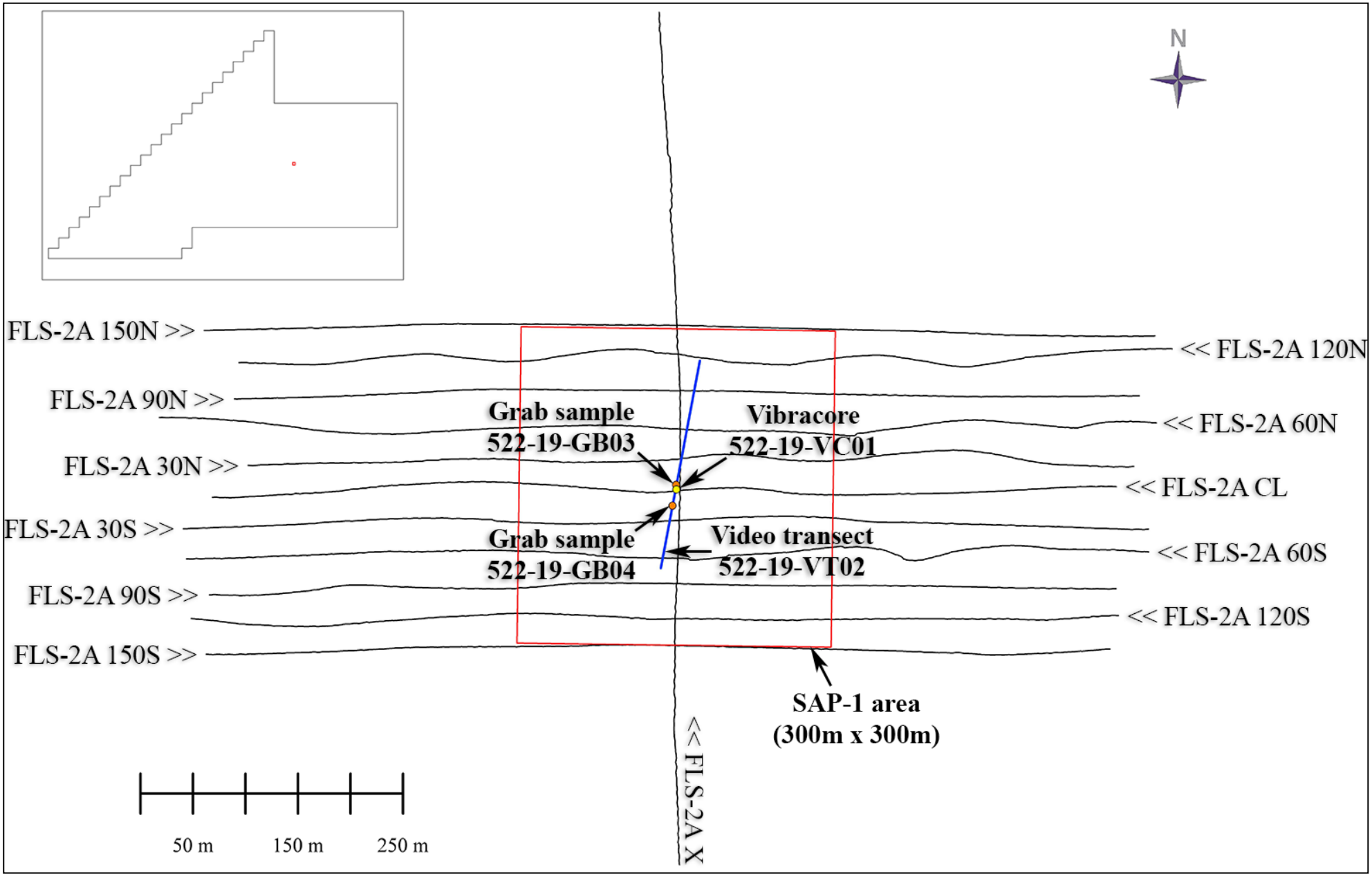
The combination of all remote sensing (geophysical and video) and sampling (benthic grab and vibracore) datasets have helped to define the local geologic characteristics of the SAP sites in the areas potentially impacted by the met-ocean buoy installation. While a 300 m by 300 m (984 ft by 984 ft) square area was surveyed, the actual footprint of the buoy mooring weight and associated chain sweep are much smaller in comparison.

Table 8.1-1 SAP Site Geologic Characteristics

	SAP 1	SAP 2
Water Depth (MLLW)	45.0 m	46.6 m
Surface geology	Fine sand with silt and patches of abundant shell material	Fine sand with silt
Subsurface geology	Fine sand with silt, pockets of shell material (to 2.7 m bsb; VC01)	Fine sand with silt, pockets of shell material (to 3.2 m bsb; VC02)
Unique features	Concentrated shell material in elongate, shallow depressions oriented in a WNW-ESE direction	None

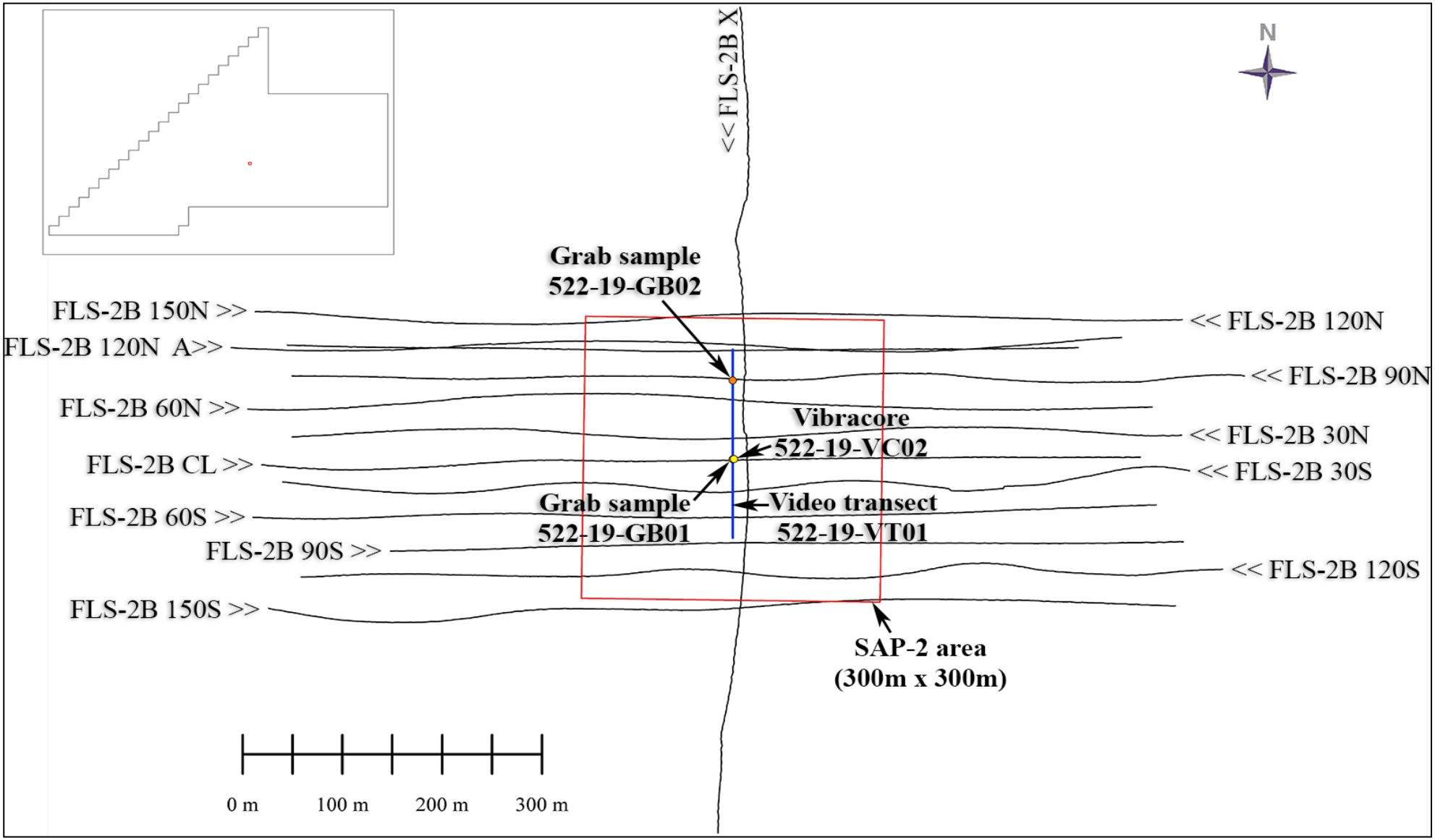
Fine grained sediments exist on the seafloor, mainly fine sand and silt (silty sand based on the Unified Soils Classification System [USCS]), with minor morphological and textural variation. A slight increase in percent silt is apparent in the grain size results for SAP-2. In SAP-1, shallow depressions (up to 50 m long, 5 m wide, and 0.15 m deep) filled with abundant shells are present (Figure 8.1-4) while in SAP-2 the seafloor exhibits small pockmarks (up to 2.5 m long, 2.5 m wide, and 0.1 m deep). These features could be the result of bottom current flow and/or benthic faunal activity. Relief associated with all localized seafloor morphology is less than 0.2 m.

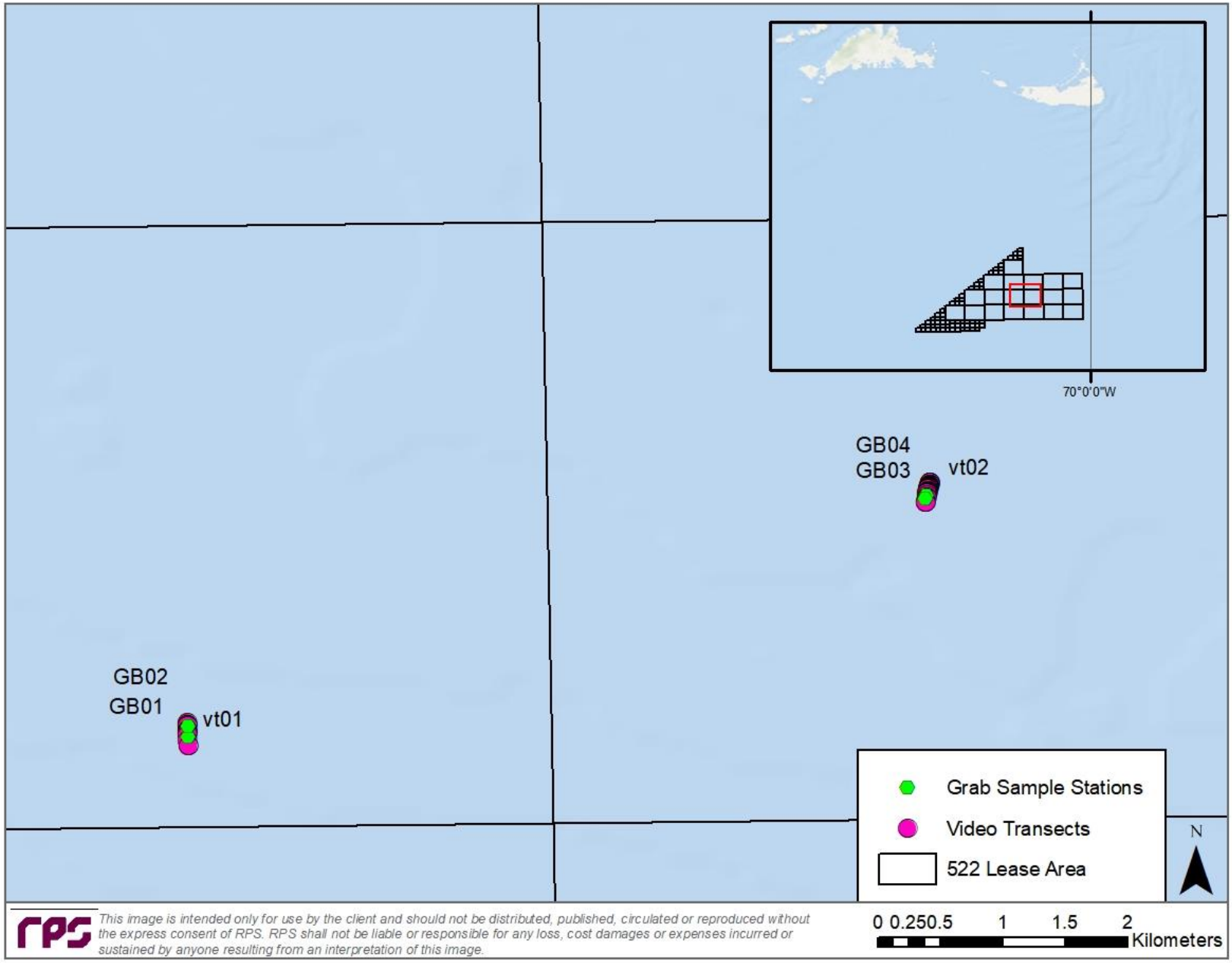
Uniform conditions persist in the subsurface as the geophysical and vibracore information reveal silty sand present in the upper 3 m below the seabed (bsb). No other sediment layers were recovered in the core samples. Lab results indicate relatively competent sediment/soil that is not overly soft (loose, high water content).



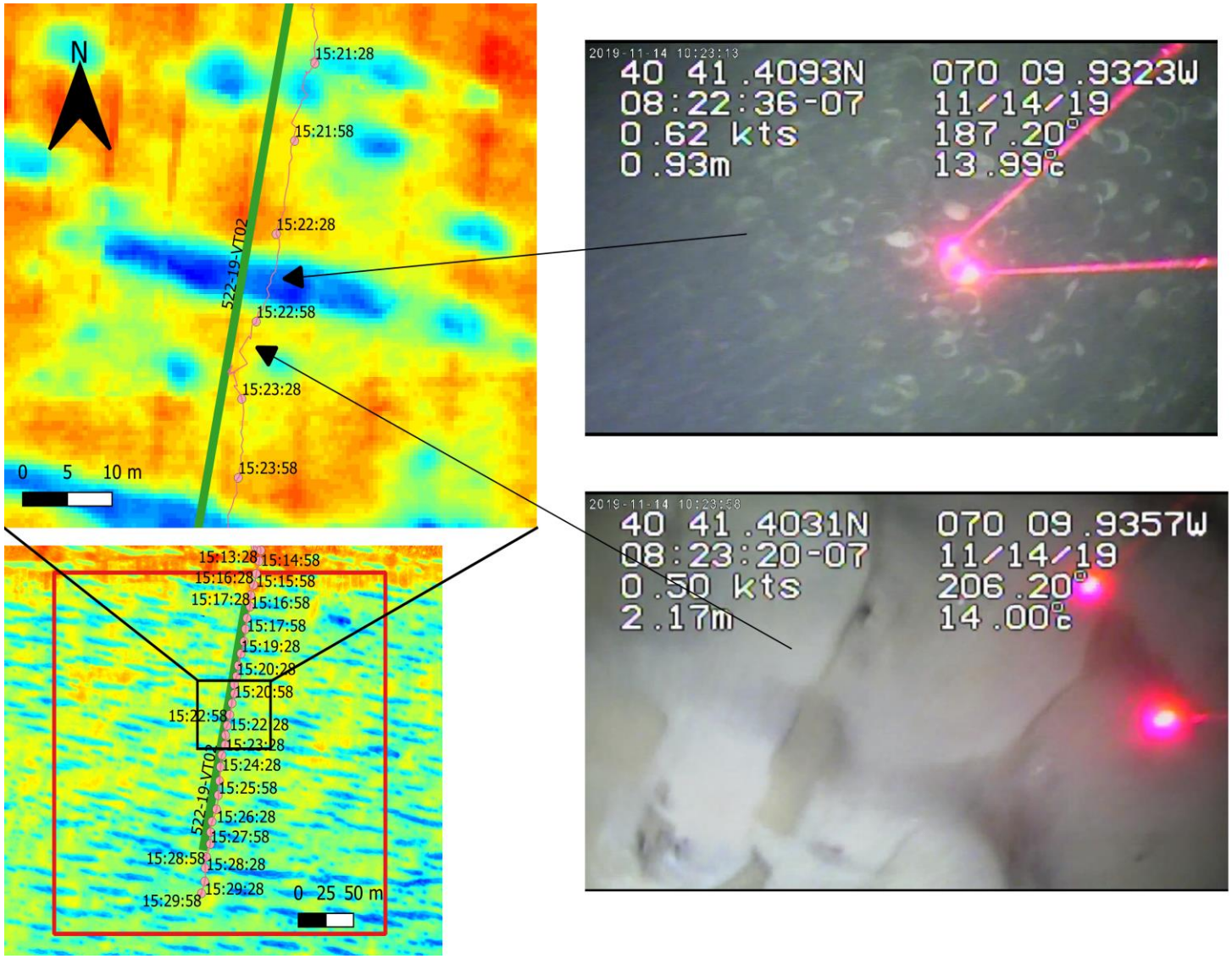
Lease Area OCS-A 0522 SAP

Figure 8.1-1
Location Map of SAP-1 Field Surveys


N
<< FLS-2B X
Grab sample
522-19-GB02
FLS-2B 150N >>
FLS-2B 120N A>>
FLS-2B 60N >>
FLS-2B CL >>
FLS-2B 60S >>
FLS-2B 90S >>
FLS-2B 150S >>
<< FLS-2B 120N
<< FLS-2B 90N
Vibracore
522-19-VC02
<< FLS-2B 30N
<< FLS-2B 30S
Grab sample
522-19-GB01
Video transect
522-19-VT01
<< FLS-2B 120S
SAP-2 area
(300m x 300m)
0 m
100 m
200 m
300 m



Map of 522 lease area SAP underwater video transects VT01 and VT02 (pink circles) and grab sample stations GB01, GB02, GB03, and GB04 (green octagons).



(Left) Color shaded relief of the MBES seafloor surface showing an overview (lower image) and close up/inset (top image) of the underwater video trackline with time tags through observed surficial features;

(Right) Screen captures of the recorded video showing algal mats (lower image) and the concentrated shell material (top image).

Laser point separation is 7.5 cm.

8.2 Shallow Hazards

Review of the geophysical data was performed to specifically assess the SAP sites for the presence of shallow hazards exhibiting surficial or subsurface expression on the records. The data were interpreted and then evaluated for the following hazards:

- Organics/gaseous sediments, surface seeps
- Boulders, coarse deposits
- Shallow faults
- Bedforms, slope instability
- Mobile sediments, scour
- Buried channels
- Sensitive benthic habitats
- Man-made debris, obstructions, potential ordnance
- Cultural resources (shipwrecks, paleofeatures)

The only features identified on or below the seafloor in the vicinity of the SAP areas were several side scan sonar targets and magnetic anomalies. In SAP-1 only three small sonar targets exist within the 300m by 300m area limits, S19-T224, S19-T225, and S19-T227 (Figure 8.2-1). All three targets are less than 2 m in maximum size with little to no relief and no associated magnetic signatures. None of the magnetic anomalies (all less than 9 nT amplitude) are located within the SAP-1 area limits. Target dimensions are reported in Appendix C-1, Appendix C (Geo Subsea LLC report) and Appendix D (Goodwin & Associates, Inc. report).

In SAP-2 only one small acoustic target exists, S19-T236, that is positioned within the 300m by 300m SAP-2 area boundaries (Figure 8.2-2). The target is less than 2.2 m in maximum size with estimated relief of 0.32 m. No magnetic anomalies were measured in or near the SAP-2 area.

While the lack of associated magnetic anomalies suggests the targets could have natural origins, no boulders are suspected in this area due to the known character of the seafloor and subsurface geology from detailed review of geophysical datasets covering the SAP areas and surrounding areas (see Appendix C-1, Section 4.4 and Appendix C).

The target size and distance from the center of the SAP areas where the buoy weight(s) would be placed thus indicates there are no hazards in the deployment areas. The absence of bedforms of any significant relief indicate relatively low bottom currents and thus limited sediment mobility within the SAP areas. For more information refer to the survey summary report in Appendix C-1.

The four targets were also assessed by the Qualified Marine Archaeologist (QMA) at Goodwin Associates and determined to be debris not found to have cultural significance nor warrant avoidance (see SAP Appendix D, Table V-1 of Goodwin report).

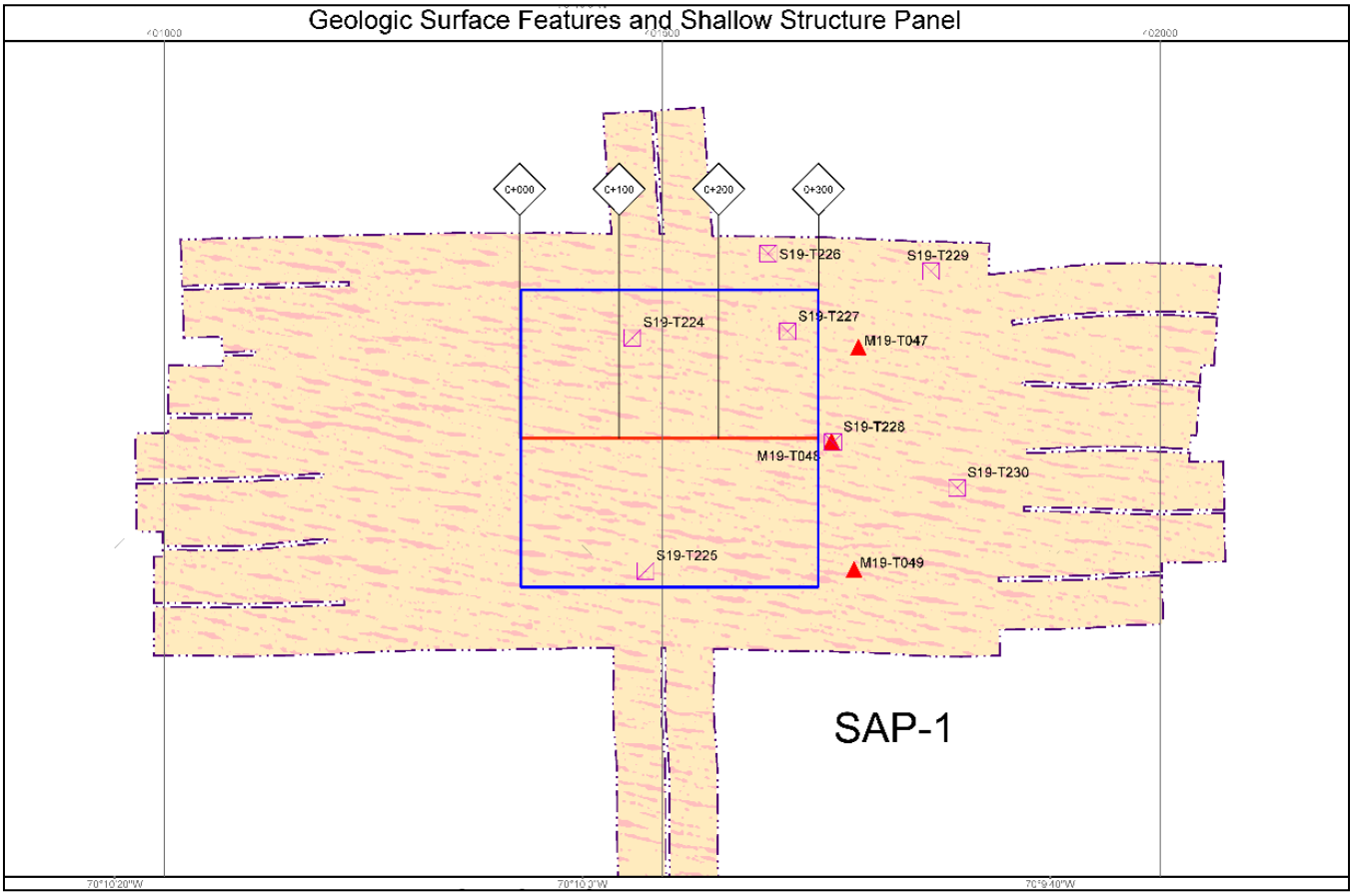
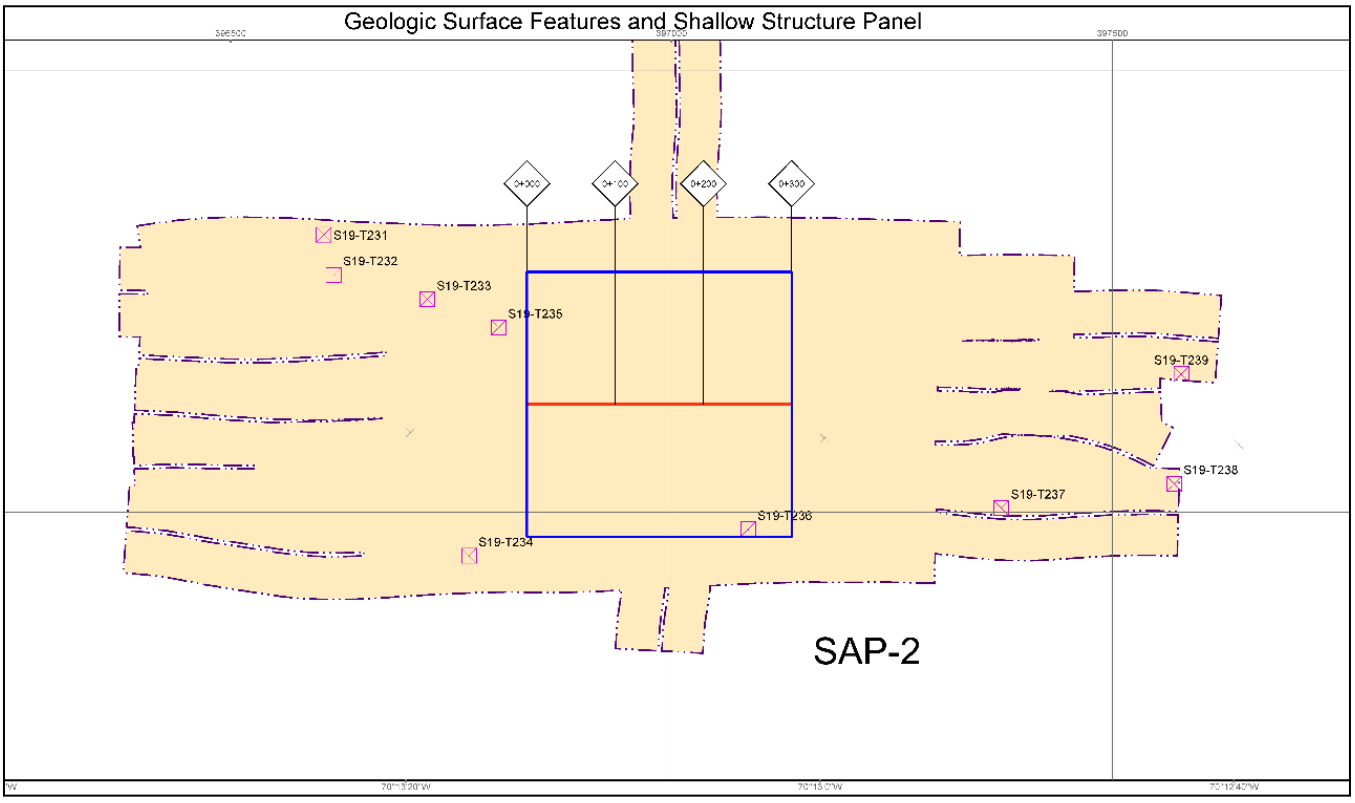


Figure 8.2-1

SAP-1 Seafloor Features. Blue box marks the 300 m square area boundary.



Lease Area OCS-A 0522 SAP

Figure 8.2-2

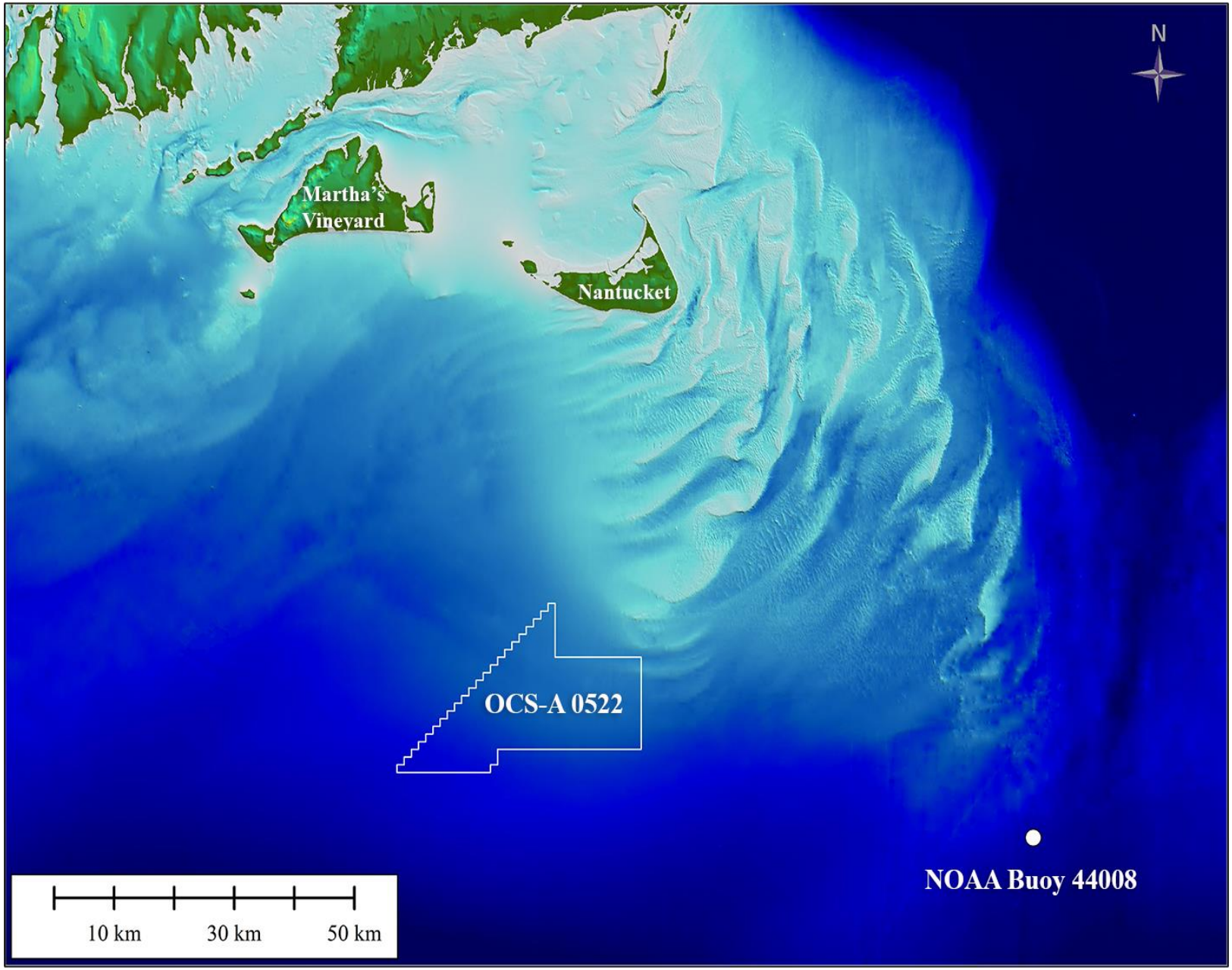
SAP-2 Seafloor features. Blue box marks the 300 m square area boundary.

8.3 Meteorological and Oceanographic Conditions

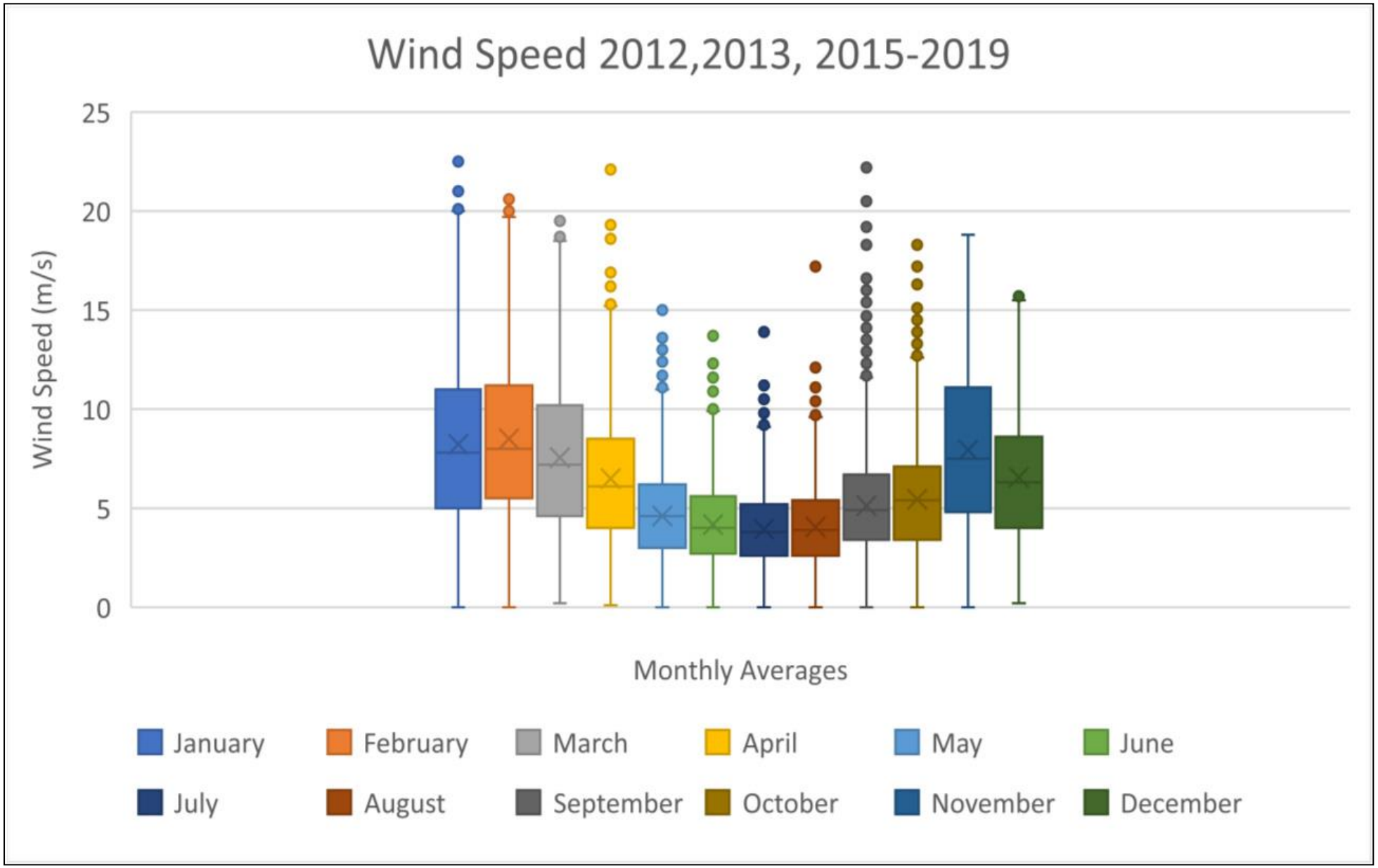
As metocean data is scarce near Lease Area OCS-A 0522, historical data from NOAA Buoy 44008 southeast of Nantucket Shoals have been referenced to provide the general background of wind and wave conditions in the region and expected at the SAP sites. The buoy is located approximately 80 km east-southeast of the Lease Area and 100 km southeast of Nantucket (Figure 8.3-1). The 2012, 2013, and 2015-2019 data sets were assessed, though some time periods of data were missing or erroneous.

In general, and certainly normal for the continental shelf off New England, wind speeds and wave heights at the buoy were higher during winter and tapered off into summer (Figures 8.3-2 and 8.3-3). The prevailing wind direction was around 200º. Waves generally traveled to the east, southeast, and south, with a prevailing wave direction of approximately 180º.

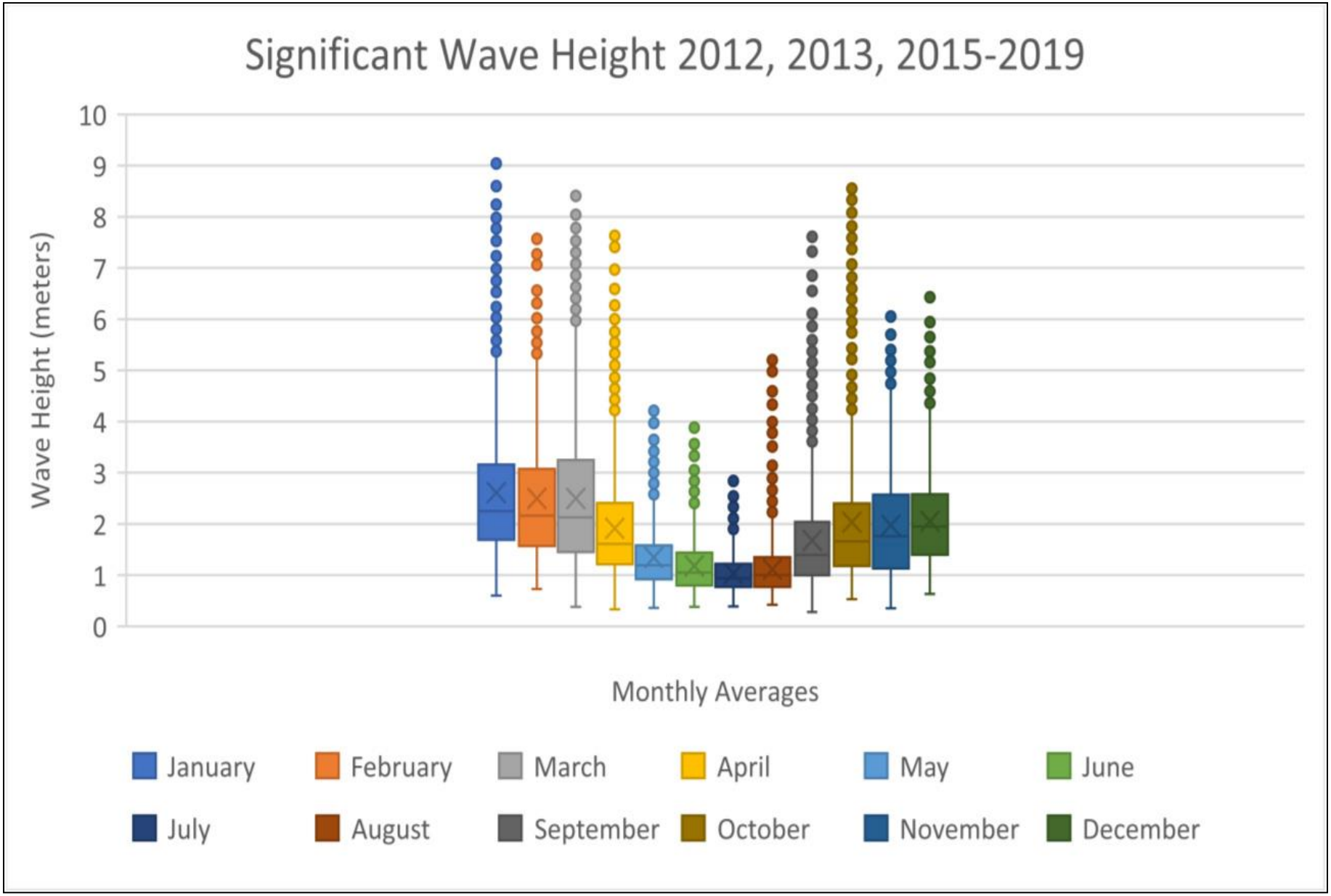
Extreme wind and wave conditions during major storms significantly impact water conditions and sedimentation in the Lease Area OCS-A 0522 region (Twichell, McClennen, Butman 1981). The storms near the Lease Area typically travel up along the east coast toward the north-northeast, as seen by the tracks of major hurricanes between 1979 and 2016 in Figure 8.3-4. Buoy 44008 shows wind speeds and significant wave heights can increase on the order of four times their typical range during the extreme weather events (Tables 8.3-1 and 8.3-2).



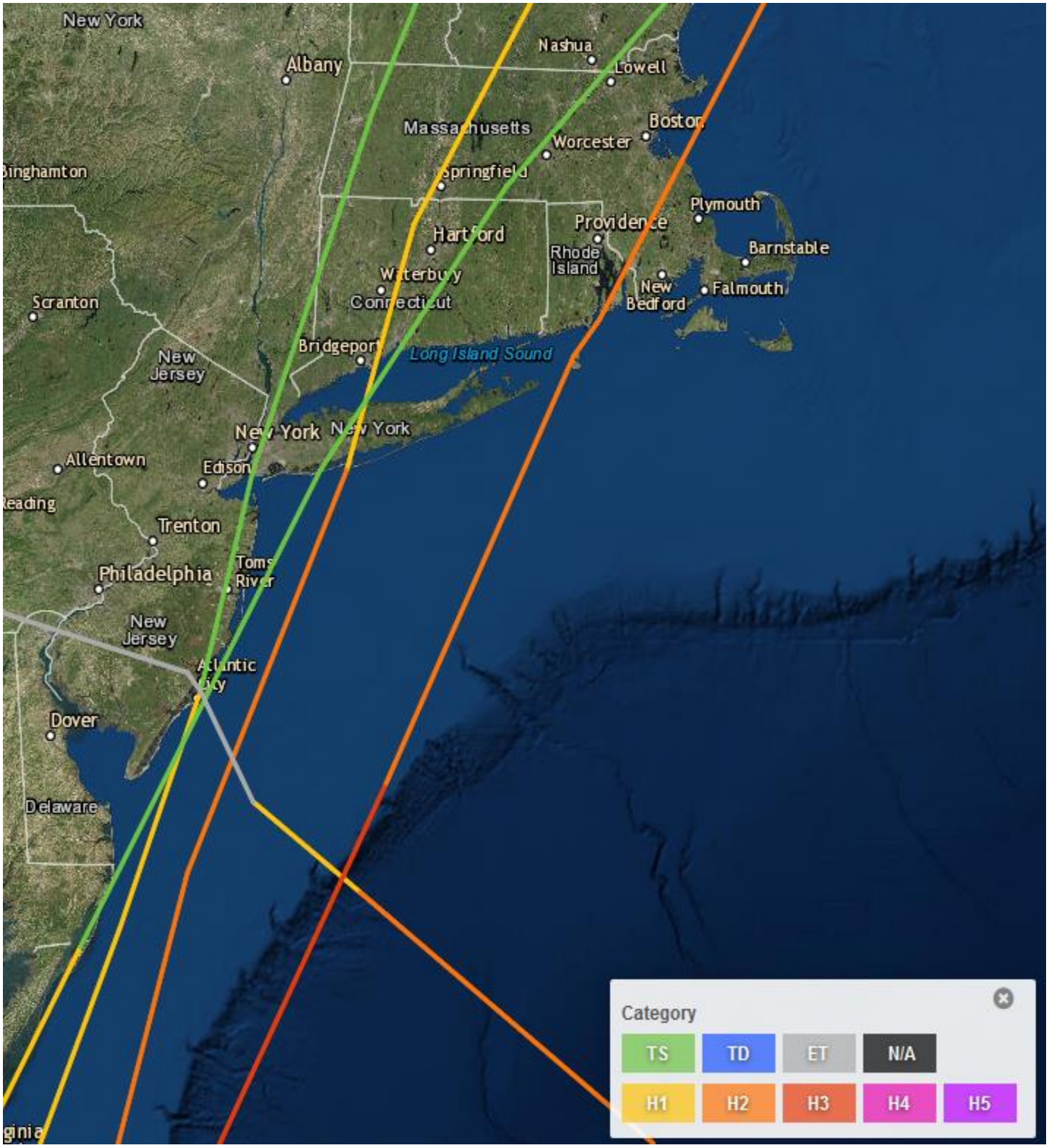
Location map showing the position of NOAA Buoy 44008 relative to Lease OCS-A 0522 and the islands south of the Cape.



Average monthly wind speeds at Buoy 44008. Boxed areas are average speeds, dots are outlying data points.



Average monthly significant wave heights at Buoy 44008. Boxed areas are average speeds, dots are outlying data points.



Tracks of the major hurricanes during September 1979 – December 2016.

Table 8.3-1 Major storms with highest significant wave heights since 1985

Hurricane/ Storm	Year	Largest Significant Wave Height (m)
Gloria	1985	12.0
Bob	1991	8.0
Irene	1991	9.9
Floyd	1999	9.3
Sandy	2012	9.1

Table 8.3-2 Normal versus storm conditions at NOAA Buoy 44008 during 2012, 2013, and 2015-2019.

Condition Type	Wind speed (m/s)	Significant Wave Height (m)
Typical conditions	~5	~2
Extreme conditions	~23	~10

8.4 Archaeological Surveys

The geophysical surveys conducted in the two SAP sites on 522 met BOEM guidelines for data acquisition and coverage. The geophysical survey data within a 180 m square area around each SAP area centerpoint were reviewed and assessed for cultural resources prior to the vibracore sampling. The lack of archaeological findings allowed the areas to be cleared for sampling.

A Qualified Marine Archaeologist (QMA) at RC Goodwin & Associates further analyzed the geophysical data for historical and pre-contact cultural resources to the full lateral extent of SAP site data coverage, comprising the 300 m by 300 m area (22 acres) (984 ft by 984 ft) of the seafloor and shallow subsurface in each SAP study area. No sonar targets or magnetic anomalies possibly indicative of historic shipwrecks or artifacts are present and no seismic reflectors suggestive of buried paleofeatures are apparent in the subbottom profile data. No man-made hazards, including acoustic targets or magnetic anomalies suggestive of shipwrecks, debris, abandoned fishing gear, cables, pipelines and ordnance were apparent in either SAP study area.

The QMA found no evidence in the data of shallow subsurface paleo features that could be indicative of former glacial meltwater streams or fluvial channels. Vibracore samples did not recover any peat layers that could be indicative of potential terrestrial soils.

The QMA recommended a determination of “no historic properties” affected (36 CFR 800.4) for the two SAP areas, SAP-1 and SAP-2.

For more detailed information regarding the cultural resource assessment of the SAP sites refer to the RC Goodwin report in Appendix D.

8.5 Benthic Survey

To characterize surficial sediment conditions and identify benthic habitat in the SAP study areas, sediment grab samples were collected, and towed underwater video transects were run in late 2019 by Alpine Ocean. Locations are shown on Figures 8.1-1 to 8.1-3.

The grab sediments were processed, analyzed, and interpreted for benthic infaunal community characteristics by RPS Ocean Science of South Kingstown, Rhode Island. Methodology, sampling and laboratory protocols, and results are detailed in Appendix E.

The video transects recorded bottom conditions and macrofauna at sizes >4 cm, which were limited to a total of 15 organisms, primarily *Cancer spp.* crabs, snails, and skates. Figure 8.5-1 is a representative image of bottom conditions characterized as sand/mud along the VT01 transect in SAP-1, with no evident macrofauna. Figure 8.5-2 is a representative image from VT02 on SAP-2 showing a *Cancer spp* crab. Bottom conditions along VT02 also consisted of san/mud, with varying amounts of shell rubble or hash.

The benthic community analysis was conducted on three grab samples. Multiple sediment sampling attempts were incomplete at one location (GB03 on SAP-1) due to the presence of clam shells. Analysis indicated primarily worm hash and amphipods.

Review of underwater video transects, vibracores photographs and analyses of sediment grab samples at and around the planned buoy deployment locations found no evidence of sensitive or complex habitats, no evidence of sensitive macrofaunal communities and only limited epifaunal activity. No aquatic vegetation, evidence of fishing activity, encrusting or colonial organisms, and anthropogenic debris were observed in the still images examined from the video transections.

Benthic habitat classifications (CMECS) along the underwater video transects in the Lease Area OCS-A 0522 SAP study areas have been overlain on sonar imagery (MBES depth surface, slope gradient, and side scan mosaic) to show the correlation of the datasets. These maps are provided in Appendix D of the Survey Summary Report, which is included as Appendix C-1 of the SAP.

As noted in the Survey Summary Report (in Appendix C-1 of the SAO), classification of the habitats observed on the video and in the grabs correlates very well with the sonar reflectivity evident on the imagery. Within the troughs, the video and grab samples show higher concentrations of shell substrate, classified in CMECS as Biogenic Shell Rubble or Hash, atop a sandy substrate. Outside of the troughs, only fine grain sand and mud substrate was present, classified as Fine Sand/Mud.

9.0 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

BOEM's regulations at 30 CFR §585 entitled *Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf* and BOEM's 2019 SAP Guidelines recognize that metocean buoys in particular have fewer impact-producing features on marine resources due to their limited environmental footprint than many other activities under its regulatory purview. As

Representative still image of video transect data from VT01: sand/mud with no evident macrofauna.

Representative screenshot from VT02 showing a Cancer sp. crab below and to the right of the lasers.

previously described in Section 3.2, because the NEPA analyses conducted by BOEM in 2014 for the entire WEA included as part of its scope potential impacts from up to 10 metocean buoys (or a lesser number of the more impact-producing meteorological towers) on leases to be issued within the WEA:, some resource categories (water quality; biological resources; threatened or endangered species; sensitive biological resources or habitats; archaeological resources; social and economic conditions; coastal and marine uses; consistency certifications, and Other resources, conditions and activities) which have already undergone previous NEPA analysis by BOEM do not need to be re-analyzed in this SAP. These categories and resources, listed in Section 3.2, are considered categorical exclusions and are not re-assessed here.

The categories and resources in the following sections are assessed within the 300 m by 300 m (984 ft by 984 ft) deployment study area of each metocean buoy proposed for Vineyard Wind Northeast in Lease Area OCS-A 0522.

9.1 Categories to Be Assessed

As required in 30 CFR §585.611(b)(1) and further specified for metocean buoys in Table 2 of BOEM's 2019 SAP Guidance, the following sections describe existing conditions based upon the field surveys described in Section 8.0 in these subject areas:

> **Hazard information: meteorology, oceanography, sediment transport, geology, and shallow geological or manmade hazards**

Additional resources are also addressed herein, including archaeological and biological resources, as required under 30 CFR §585.610(b)(1-5) and further specified for metocean buoys in Table 2 of BOEM's 2019 SAP Guidance.

> **Geotechnical surveys:** Geophysical surveys with shallow sampling methods, such as vibracores or grab samples, may be sufficient for metocean buoys.
>
> **Biological survey:** The level of biological information collected should be commensurate with the potential impacts from the proposed SAP activity. For example, metocean buoys may have few impact-producing factors that affect protected species or critical habitat due to their limited environmental footprint. Any activity that has several impact-producing factors, such as pile driving, may require more information regarding impacted biological resources and habitat (Table 2, BOEM's 2019 SAP Guidance).
>
> **Archaeological resources**
>
> **Air quality** is also addressed below as required in 30 CFR §585.610(a) and 30 CFR §585.659(2).

Potential impacts to these resources from proposed SAP activities and measures to avoid, minimize or mitigate these impacts are described below.

9.2 Surficial and Shallow Subsurface Geology

For both SAP areas, based on the sediments found on and below the seafloor in the upper 3 m (homogenous fine sand with silt and variable shell content), there will be negligible to minor impact from installation and operation of the buoy(s). These impacts include (1) some typical settling of the mooring weight into the seabed, (2) minor scour possible around the weight, and (3) chain sweep on the seafloor around the weight. The absence of any size of mobile seafloor features (ripples, megaripples, sand waves) suggests minimal bottom currents are operating in the area, so scour is expected to be minimal.

Total area of direct impact from installation of the system is estimated at up to 1.8 m^2 (19.38 SF). Vertical linear depth of impact is estimated at up to 2.5 m (8 ft) based on the existing fine-grained relatively compact deep-water marine sediments and potential total weight used to hold the mooring.

Estimated volume of sediments that would be temporarily displaced due to settlement of the mooring weight is expected to be 10 m^3 (13 cubic yards).

Area of surficial seafloor impact due to chain sweep, estimated at an approximate 74.4 m (244 ft) radius around the weight, is approximately 17,381 m^2 (187,000 SF or 4.3 acres).

9.3 Shallow Hazards

None of the surficial or subsurface features identified within the SAP site limits are considered hazards due to their minimal sizes and locations relative to the proposed buoy weight deployment positions. As there are no hazards identified on or below the seafloor in either SAP area, there will be no impact from installation of the buoy. Furthermore, there are no anticipated hazardous or adverse conditions that could significantly impact the buoy system.

9.4 Benthic Resources

Direct, minor impact on the benthos from installation of the buoy system would include some injury and possibly mortality of epifauna and infauna from the mooring weight sinking into the seabed. This will consolidate and displace benthic habitats forcing organisms into surrounding areas. Indirect impacts from suspended sediment on the surrounding seafloor immediately after mooring weight placement are expected to be negligible due to very little expected resuspended material.

Some habitat alteration may occur, as a new hard substrate is introduced where a relatively soft sediment seabed existed previously. Sessile benthic communities (encrusting) adapted to deep water hard bottom areas may develop.

Operational impacts from the mooring chain sweep are anticipated to be negligible to minor, as the chain does not sink very far into the seabed but will create a dynamic equilibrium at the sediment-water interface due to the periodic scraping of the seafloor. The area of impact will be controlled by the tidal current flow and/or ocean circulation.

Finally, direct, minor impact from removal of the buoy system is expected in the form of injury or mortality to epifaunal communities attached to the mooring weight when it is removed from the seafloor. Subsequent recolonization of the underlying unconsolidated sediment by original epifaunal and infaunal organisms will occur fairly rapidly, given the limited area of impact and the large surrounding area of undisturbed habitat. Similar to installation, mooring removal will have negligible impact due to very little resuspended sediments mobilized into the water column.

In summary, the overall small area of impact compared to the large source area of similar undisturbed habitat adjacent to it, is expected to result in rapid recovery of benthic resources following removal of the met-ocean buoy, as has been observed following temporary physical disturbance in similar habitats (e.g., Guerra-García et al. 2003, Schaffner 2010). Thus, potential long-term impacts to benthic resources from SAP activities are anticipated to be negligible, if any.

9.5 Oceanography and Meteorology

The placement of a metocean buoy in either of the SAP areas will not significantly affect the ocean current circulation or wind and wave patterns locally or regionally. The footprint of the mooring weight, diameter of the mooring cable, and size of the buoy are not large and will not cause significant impact to the flow of air or water.

The only negligible-minor impact will be slight turbulent flow created from the mooring weight just above the bottom and the resultant localized and limited scour around the weight. While there are no measurements of bottom current speed and direction in the SAP areas or Lease Area OCS-A 0522, the seafloor features present are not indicative of fast-moving currents. Therefore, only a minor amount of scour around the mooring weight is predicted.

9.6 Archaeological Resources

Since no recorded or potential historic or pre-contact submerged cultural resources have been identified within either of the SAP areas, there is no impact to assess.

9.7 Air Quality

EPA has air quality jurisdiction over the portion of the Outer Continental Shelf (OCS) where the proposed SAP activities will take place (see 30 CFR §585.659). However, EPA's Outer Continental Shelf Air Regulations, which establish federal air pollution control requirements for OCS sources[1], do not apply to the proposed activities (see 40 CFR §55). That is because the metocean buoy(s) will not contain any combustible fuel and will not have the potential to emit any criteria air pollutants. Instead, the buoy(s) will be powered by clean, renewable energy (e.g. batteries, solar, wind, and/or fuel cells). In addition, the vessels used for the deployment, maintenance, and recovery of the metocean buoy(s) will not attach to the seafloor (i.e. anchor) or securely attach to the buoy(s) for the purposes of maintaining their position. Therefore, none of the equipment or vessels involved in the proposed activities will become OCS sources subject to regulation under 40 CFR §55.

Although the proposed activities are not regulated under 40 CFR §55, there will be emissions from the main propulsion engines, auxiliary engines, and auxiliary equipment on marine vessels that are used to deploy, maintain, and recover the metocean buoy(s). In order for BOEM to assess impacts to air quality resulting from the proposed activities, a conservative estimate of emissions was developed based on the following assumptions:

- Installation of each metocean buoy at the SAP site will take approximately four hours and will require one vessel trip from New Bedford Harbor.
- Annually, O&M of the buoy(s) will require approximately one vessel trip from New York Harbor and two vessel trips from Woods Hole, Massachusetts, with each maintenance activity lasting approximately one eight-hour day (at the SAP site).
- The metocean buoy(s) will be deployed for five years.
- Decommissioning of each metocean buoy at the SAP site will take up to approximately 24 hours and will require one vessel trip from New Bedford Harbor.

The table below provides an estimate of the total tons of nitrogen oxides (NO_x), volatile organic compounds (VOC), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$, particulate matter with a diameter less than or equal to 10 and 2.5 µm, respectively), sulfur oxides (SO_X), carbon dioxide equivalent (CO_2e), and hazardous air pollutants (HAPs) emissions.

[1] An OCS source is defined as "any equipment, activity, or facility which: 1) Emits or has the potential to emit any air pollutant; 2) Is regulated or authorized under the Outer Continental Shelf Lands Act ("OCSLA") (43 U.S.C. §1331 et seq.); and 3) Is located on the OCS or in or on the waters above the OCS. This definition shall include vessels only when they are: 1) Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom, within the meaning of Section 4(a)(1) of OCSLA (43 U.S.C. §1331et seq.); or 2) Physically attached to an OCS facility, in which case only the stationary sources aspects of the vessels will be regulated." See 40 CFR §55.2.

Table 9.7-1 Air Emissions from SAP Metocean Buoy Activities

Activity	Air Emissions (US tons)							
	NOx	VOC	CO	PM_{10}	$PM_{2.5}$	SO_2	CO_2e	HAPs
Deployment	0.39	0.01	0.09	0.01	0.01	0.00	27	0.00
Maintenance	5.58	0.10	1.34	0.19	0.18	0.02	382	0.02
Decommissioning	0.51	0.01	0.12	0.02	0.02	0.00	35	0.00
Total	**6.49**	**0.12**	**1.56**	**0.22**	**0.21**	**0.02**	**444**	**0.02**

Air emissions associated with the installation, operation, and decommissioning of the metocean buoy(s) will only occur periodically for very short durations throughout the Site Assessment term. Since the SAP Study Areas are approximately 62 km (34 NM/39 mi) at their closest (SAP-1) from the nearest landmass, the Study Areas are situated to the southeast of the mainland, and prevailing winds are from the northwest, the emissions within the SAP Study Areas are unlikely to have any effect on onshore areas. Furthermore, the low level of additional vessel traffic from the proposed activities will likely contribute only a small fraction of air pollution that is already caused by marine vessel traffic within the region. Measures to minimize emissions from vessels used during deployment, maintenance, and decommissioning of the metocean buoy(s) will be consistent with industry standard, area-wide measures for marine vessels (e.g. the use of low sulfur fuels and internal combustion engines that are in compliance with applicable air quality regulatory standards). Thus, the potential impacts of the proposed activities to ambient air quality are expected to be negligible, if any.

9.7.1 Mitigation Measures

The Proponent will use metocean buoy(s) that do not contain any combustible fuel and will not have the potential to emit any criteria air pollutants. Instead, the buoy(s) will be powered by clean, renewable energy (e.g. batteries, solar, wind, and/or fuel cells). Measures to avoid, minimize, and mitigate emissions from vessels will be consistent with industry standard, area-wide measures for marine vessels. For example, air emissions from vessels will be minimized through the use of low sulfur fuels and through the use of internal combustion engines that are in compliance with applicable air quality regulatory standards.

9.8 Additional Avoidance, Minimization, and Mitigation Measures

9.8.1 Measures to Reduce Impacts to Marine Mammals, Sea Turtles and Other Protected Species

The Proponent will comply with applicable regulations in Table 3.1-1, applicable Lease stipulations in Table 3.1-2, and implement best management practices in Table 9.8-1 to eliminate or minimize the potential for adverse environmental impacts to protected species and other significant

resources during buoy installation, operation, and decommissioning. These will include measures to avoid and prevent accidental events such as fuel spills (see Section 4.4), to ensure that any unavoidable impacts are negligible.

The Proponent will comply with applicable BOEM Standard Operating Conditions (SOCs) on reducing impacts to marine mammals, sea turtles and protected species included in Section 4 of Addendum C in the Lease for OCS-A 0522 unless otherwise directed by BOEM. These include:

Vessel Strike Avoidance

Except under extraordinary circumstances, or if a waiver is granted, the Proponent will adhere to the vessel strike avoidance measures included in the SOCs, which are summarized as follows:

- The Proponent's vessel operators and crews will maintain a vigilant watch for marine mammals, sea turtles, and giant manta rays, and slow down or stop their vessel to avoid striking these protected species.

- All vessel operators will comply with the 10 knot speed restriction in any Dynamic Management Area (DMA); vessels 19.8 m (65 ft) in length or longer will operate at speeds no greater than 10 knots from November 1 through July 31; and all vessel operators will reduce speed to 10 knots when mother/calf pairs, pods, or large assemblages of marine mammals are observed near a transiting vessel.

- Vessel operators will monitor NMFS's North Atlantic right whale reporting systems from November 1 through July 31 and whenever a DMA is established where vessels operate.

- 100 m (328 ft) or greater separation distance will be maintained between all transiting vessels and any sighted ESA-listed whales or humpback whales.

- Specific to North Atlantic right whale [NARW], 500 m [1,640 ft] or greater separation distance will be maintained between all transiting vessels and any sighted NARW or unidentified large marine animal.

- If a whale is observed within 100 m (328 ft) of a transiting vessel, the vessel will shift its engines to neutral and will not re-engage its engines until the whale has moved out of the vessel path and beyond 100 m (328 ft).

- Transiting vessels will maintain a separation distance of 50 m (164 ft) from sea turtles, pinnipeds, and dolphins, except for bow-riding dolphins and pinnipeds that approach the vessel.

In accordance with the SOCs, the Proponent will also ensure that vessel operators, employees, and contractors involved in the proposed activities are briefed on the above vessel strike avoidance measures as well as their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment.

Entanglement Avoidance

These measures are described in Project Equipment Section 4.1. The Proponent will utilize the best available mooring system to comply with BOEM's requirements in the OCS-A 0522 Lease, Addendum C, Stipulation 4.1.4 entitled Entanglement Avoidance, to minimize the risk of entanglement or entrainment of marine mammals, manta rays, and sea turtles.

Reporting Observed Impacts to Protected Species

In the event that any takes are observed during SAP activities of listed marine mammals, sea turtles, sturgeon, or giant manta ray resulting in injury or mortality, these impacts will be reported by the Proponent within 24 hours to BOEM and NMFS. Vessel operators and offshore SAP support staff will be briefed on these requirements.

Reporting Injured or Dead Protected Species

The Lessee must ensure that sightings of any injured or dead protected species (see below) are reported to BOEM, NMFS and the NMFS Greater Atlantic (Northeast) Region's Standing Hotline (866-755-6622 or current) within 24 hours of sighting. If the Lessee is responsible for the injury or death, the Lessee's vessel much assist in any salvage effort as requested by NMFS. In the event reporting is necessary, reporting forms provided in the Lease Addendums will be used. Copies are in Appendix B.

9.8.2 Measures to Reduce Impacts to Fisheries

In accordance with Lease Stipulation 4.1.3, the Proponent has developed a publicly available Fisheries Communication Plan (FCP) that describes the ways the Proponent will communicate with fisheries stakeholders potentially affected by the development of the Proponent's offshore wind projects (including activities pertaining to metocean buoys). The document continues to evolve with continuous feedback and guidance from fishermen, fishing organizations, and regulatory agencies. The FCP includes contact information for individuals retained by the Proponent as its primary point(s) of contact with fisheries stakeholders (i.e. the Fisheries Liaison(s)). The current version of the FCP can be found at the following website link: https://www.vineyardwind.com/fisheries.

9.8.3 Measures to Reduce Impacts to Marine Navigation

As listed on Table 9.8-1 under **Transportation and Vessel Traffic**, the metocean buoy(s) will be equipped with the proper safety lighting, markings, and signal equipment per USCG Private Aids to Navigation (PATON) requirements, including USCG Navigation and Vessel Inspection Circular 01-19. Coordination with the USCG will occur prior to deployment (see Table 3.3-1).

The metocean buoy(s) will be sited within the MA WEA, which, after public comment, was developed to avoid shipping lanes and USCG-designated Traffic Separation Schemes.

The metocean buoy(s) will be located beyond FAA jurisdiction, will not exceed 61 m (200 ft) in height and therefore do not require any aviation obstruction lighting per BOEM's (2021) *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development*.

9.8.4 Measures to Reduce Impacts to Birds and Bats

As noted in Sections 4.2.2.1.3 (birds) and 4.2.2.2.3 (bats) in BOEM's 2014 EA for the MA WEA, due to the low height and simple design of metocean buoy(s), there are few opportunities for avian species to perch or nest. BOEM found metocean buoys in the WEA would have negligible impacts on bird and bat species. Additional findings are presented under Avian Resources in Table 9.8-1.

9.8.5 Best Management Practices

The SAP activities will comply with BOEM's best management practices (BMPs) outlined in Attachment B of BOEM's (2019) *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan (SAP)*. Table 9.8-1 identifies how the SAP activities will address or adhere to all of BOEM's BMPs that are applicable to buoys. However, it is important to recognize that the SAP activities will implement additional avoidance, minimization, and mitigation measures beyond those prescribed by BOEM (as described above throughout Section 9).

Table 9.8-1 BOEM's SAP Best Management Practices

Best Management Practices: BOEM 2019 SAP Guidance	SAP Activities
Preconstruction Planning	
Lessees shall minimize the area disturbed by preconstruction site monitoring and testing activities and installations.	This SAP proposes the use of up to two metocean buoys to obtain Lease-specific data. Buoys minimize disturbed areas as compared with meteorological towers. Similarly, the Proponent's preconstruction geophysical and geotechnical survey work is designed to minimize impacts in accordance with approved survey plans and lease requirements. Wildlife studies have employed minimally invasive techniques for observing species and habitat presence.
Lessees shall contact and consult with the appropriate affected Federal, state, and local agencies early in the planning process.	The Proponent has engaged with federal, state, local agencies, and stakeholder groups to identify and address any issues of potential concern. This engagement has informed the design of the Project and the activities presented in the SAP.
Lessees shall consolidate necessary infrastructure requirements whenever practicable.	The Proponent has made every effort to consolidate infrastructure requirements. The maximum horizontal radius of the mooring chain contacting the seafloor will not be more than 74.4 m and will be within the assessed 300 m x 300 m (984 ft by 984 ft) buoy deployment area. Any impact from installation vessels will be very limited, as the installation will be performed without anchoring.

Table 9.8-1 BOEM's SAP Best Management Practices (Continued)

Best Management Practices: BOEM 2019 SAP Guidance	SAP Activities
Preconstruction Planning	
Lessees shall develop a monitoring program to ensure that environmental conditions are monitored during construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, and shall be established at the project level to ensure that potential adverse impacts are mitigated.	A monitoring program should be commensurate with potential impacts from a proposed activity. The Proponent's monitoring program for each metocean buoy includes appropriate marine notifications of buoy locations, including issuance of Offshore Wind Marine Updates and coordination with USCG to issue Notices to Mariners for buoy deployment, maintenance, and recovery activities; on- going locational monitoring of the buoy system by GPS and alerts if the buoy moves outside the designated buoy watch circle; efforts to minimize and remove marine debris associated with SAP activities; submission of compliance reports to BOEM as required, including recommendations for adaptive management measures; and removal of each metocean buoy system as described in Section 7.0.
Seafloor Habitats	
Lessees shall conduct seafloor surveys in the early phases of a project to ensure that the alternative energy project is sited appropriately to avoid or minimize potential impacts associated with seafloor instability or other hazards.	The Project is located within the Massachusetts Wind Energy Area (MA WEA), which BOEM has identified as appropriate for development of wind energy. In addition, the Proponent has conducted geophysical and geotechnical surveys under a BOEM-approved Survey Plan, to confirm that site conditions are suitable for the installation of the metocean buoys.
Lessees shall conduct appropriate pre-siting surveys to identify and characterize potentially sensitive seafloor habitats and topographic features.	Pre-siting surveys have been conducted to identify and characterize potentially sensitive seafloor habitats and topographic features. See Sections 8.0 and 9.0 and related appendices for detailed findings. No sensitive seafloor habitats have been identified within the metocean buoy deployment study areas.
Lessees shall avoid locating facilities near known sensitive seafloor habitats, such as coral reefs, hard-bottom areas, and chemosynthetic communities.	No sensitive seafloor habitats have been identified within the metocean buoy deployment study areas.
Lessees shall avoid anchoring on sensitive seafloor habitats.	Installation of the metocean buoy(s) will be performed without vessel anchoring. The mooring weight for each buoy will not be placed on sensitive seafloor habitats, as none have been identified in the study areas.
Lessees shall reduce scouring action by ocean currents around foundations and to seafloor topography by taking all reasonable measures and employing periodic routine inspections to ensure structural integrity.	There will be no foundations. Little to no scour development around the chain is expected due to minimal currents and relatively cohesive seabed conditions. The Proponent will conduct periodic inspections of the metocean buoys.

Table 9.8-1 BOEM's SAP Best Management Practices (Continued)

Best Management Practices: BOEM 2019 SAP Guidance	SAP Activities
Marine Mammals and Sea Turtles	
Vessels related to project planning, construction, and operation shall travel at reduced speeds when assemblages of cetaceans are observed, and maintain a reasonable distance from whales, small cetaceans, and sea turtles as determined during site-specific consultations.	The Proponent will adhere to legally mandated speed, approach, and other vessel requirements included in Addendum C of the Lease for OCS-A 0522, unless BOEM approves a waiver. The National Oceanic and Atmospheric Administration's vessel strike guidance will also be implemented. Additional measures to protect marine mammals and sea turtles are described in Section 9.8.1.
Lessees shall minimize potential vessel impacts to marine mammals and turtles by requiring project-related vessels to follow the National Marine Fisheries Service (NMFS) Regional Viewing Guidelines while in transit. Operators shall be required to undergo training on applicable vessel guidelines.	Project vessels will comply with the NMFS Regional Viewing Guidelines while in transit (see Section 9.8.1). In addition, vessel operators will undergo training on applicable guidelines.
Lessees shall use the best available mooring systems using buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchors that prevent any potential entanglement or entrainment of marine mammals and sea turtles, while ensuring the safety and integrity of the structure or device.	Each metocean buoy will utilize entanglement or entrainment avoidance measures agreed upon with BOEM and NMFS. These are expected to include using a single steel chain to link the bottom mooring weight with the floating buoy (see Section 4.1). All attachment lines will utilize one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables, or similar equipment types that prevent lines from looping or wrapping around animals or entrapping protected species. No entanglement or entrainment of marine mammals and sea turtles is expected.
Lessees shall locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches.	The metocean buoy(s) will not require any cable landfalls or onshore facilities.
Fish Resources and Essential Fish Habitat	
Lessees shall conduct pre-siting surveys (may use existing data) to identify important, sensitive, and unique marine habitats in the vicinity of the projects and design the project to avoid, minimize, or otherwise mitigate adverse impacts to these habitats.	Pre-siting surveys have been conducted to identify and characterize potentially sensitive marine habitats. See Section 9.0 for detailed findings. No sensitive marine habitats have been identified within the metocean buoy deployment study areas.
Lessees shall minimize seafloor disturbance during construction and installation of the facility and associated infrastructure.	Seafloor disturbance will be minimized to the extent practicable. The maximum expected horizontal radius of the mooring chain contacting the seafloor will not be more than 74.4 m and will be within the 300 m x 300 m (984 ft by 984 ft) buoy deployment area. Any impact from installation vessels will be very limited, as the installation will be performed without anchoring.

Table 9.8-1 BOEM's SAP Best Management Practices (Continued)

Best Management Practices: BOEM 2019 SAP Guidance	SAP Activities
Avian Resources	
The lessee shall evaluate avian use in the project area and design the project to minimize or mitigate the potential for bird strikes and habitat loss. The amount and extent of ecological baseline data required will be determined on a project-to-project basis.	Avian use and impacts to avian resources due to the installation of metocean buoys were thoroughly analyzed for the entire MA WEA in BOEM's (2014) Revised Environmental Assessment (EA). The Revised EA found that impacts to birds are expected to be negligible. The low profile of the metocean buoy will minimize the avian use of the buoy as a perch or nesting site.
Lessees shall take measures to reduce perching opportunities.	The Revised EA found that meteorological buoys provide few perching opportunities for birds and that those opportunities would pose no threat to birds.
Lessees shall comply with Federal Aviation Administration (FAA) and USCG requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts to avian species.	Flashing marine navigation lighting on the metocean buoy(s) will comply with USCG requirements and are expected to have characteristics that minimize impacts to avian species.
Fisheries	
Lessees shall work cooperatively with commercial/recreational fishing entities and interests to ensure that the construction and operation of a project will minimize potential conflicts with commercial and recreational fishing interests.	As described in BOEM's Revised EA, "activities related to the installation/operation of the meteorological towers and buoys would not measurably impact commercial or recreational fishing activities."
Lessees shall review planned activities with potentially affected fishing organizations and port authorities to prevent unreasonable fishing gear conflicts. Lessees shall minimize conflict with commercial fishing activity and gear by notifying registered fishermen of the location and time frame of the project construction activities well in advance of mobilization with updates throughout the construction period.	The SAP study areas for the metocean buoy(s) were selected to avoid heavily trawled areas. The Proponent will issue Offshore Wind Marine Updates and coordinate with USCG to issue Notices to Mariners for buoy deployment, maintenance, and recovery activities. Coordinates for the buoys will be provided to fishermen and mariners.
Lessees shall use practices and operating procedures that reduce the likelihood of vessel accidents and fuel spills.	The Proponent is firmly committed to full compliance with applicable safety and environmental protection regulations and codes. The oil spill response measures are described in Section 4.4.
Lessees shall avoid or minimize impacts to the commercial fishing industry by marking applicable structures (e.g., wind turbines, wave generation structures) with USCG-approved measures (such as lighting) to ensure safe vessel operation.	The metocean buoy(s) will be equipped with the proper safety lighting, markings, and signal equipment per USCG Private Aids to Navigation (PATON) requirements, including USCG Navigation and Vessel Inspection Circular 01-19. Coordination with the USCG will occur prior to deployment (see Table 3.3-1).

Table 9.8-1 BOEM's SAP Best Management Practices (Continued)

Best Management Practices: BOEM 2019 SAP Guidance	SAP Activities
Coastal Habitats	
Lessees shall avoid hard-bottom habitats, including seagrass communities and kelp beds, where practicable, and restore any damage to these communities.	No sensitive seafloor habitats have been identified within the metocean buoy deployment study areas.
Lessees shall implement turbidity reduction measures to minimize effects to hard-bottom habitats, including seagrass communities and kelp beds, from construction activities.	No hard-bottom habitats have been identified within the metocean buoy deployment study areas.
Lessees shall minimize effects to seagrass and kelp beds by restricting vessel traffic to established traffic routes.	No sensitive seafloor habitats have been identified within the metocean buoy deployment study areas. If sensitive resources are known along transit routes, vessels will be advised to avoid the area to the greatest extent practicable.
Transportation and Vessel Traffic	
Lessees shall site alternative energy facilities to avoid unreasonable interference with major ports and United States Coast Guard (USCG)-designated Traffic Separation Schemes.	The metocean buoy(s) will be sited within the MA WEA, which, after public comment, was developed to avoid shipping lanes and USCG-designated Traffic Separation Schemes.
Lessees shall meet Federal Aviation Administration (FAA) guidelines for sighting and lighting of facilities.	The metocean buoy(s) will be located beyond FAA jurisdiction, will not exceed 61 m (200 ft) in height and therefore do not require any aviation obstruction lighting per BOEM's (2021) *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development*.
Lessees shall place proper lighting and signage on applicable alternative energy structures to aid navigation per USCG circular navigation and vessel inspection circular 07-02 (USCG 2007) and comply with any other applicable USCG requirements.	The metocean buoy(s) will be equipped with the proper safety lighting, markings, and signal equipment per USCG Private Aids to Navigation (PATON) requirements, including USCG Navigation and Vessel Inspection Circular NVIC 01-19. Coordination with the USCG will occur prior to deployment (see Table 3.3-1).
Operations	
Lessees shall prepare waste management plans, hazardous material plans, and oil spill prevention plans, as appropriate, for the facility.	The Proponent is firmly committed to full compliance with applicable environmental protection regulations and codes. The Project's Oil Spill Response measures are described in Section 4.4.

10.0 REFERENCES

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Appendix A

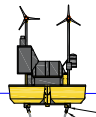
Buoy Specifications

A-1 Mooring Design
A-2 **CONFIDENTIAL** Buoy (EOLOS FLS200) Technical Specifications

A-1 Mooring Design

OCS-A-522 LLC
SITE: SAP-2
40° 40' 21.11909" N
70° 13' 07.76668" W

SEA SURFACE



(2)
(3)
(4) 4 x 3 m 1" BRIDLE CHAIN
(5)
(6)
(7)
(8) 10 m 1" CHAIN
(9)
(10)
(11)
(12) 25.5 m 1-1/4" CHAIN

DRAWING NOT TO SCALE

(13)
(14)
(15) 27.5 m 1-1/2" CHAIN

5000 kg ANCHOR
1.5m x 1.2 m x 0.6 m

(24)
(23)
(22) 27.5 m 1-1/2" CHAIN
(19)
(20)
(21)
(18) 27.5 m 1-1/2" CHAIN
(16)
(17)

SEA FLOOR - 46.6 m

Project No.	—	**Ocean Tech Services, LLC.** Marine Monitoring Systems and Surveys	
Project	OCS-A-522 FLS	Drawing Title	OCS-A-522 SAP-2 Mooring Design 46.6 m depth
Customer	OCS-A-522 LLC		
Drawn: JAW	Date: Apr-01-2021		
Designed: BTR	Date: Apr-01-2021		
Rev 1: JAW	Date: Dec-28-2021	Size	Print # / Sheet of / Rev & Date: 1, Dec-28-2021
Approved: —	Date: —	File Path and Name	

Vineyard Northeast LLC - FLS200 BUOY

Conceptual Mooring Component List

REVISION:	01	**LATITUDE:**	40˚ 41' 21.11909" N
DATE:	28-Dec-21	**LONGITUDE:**	70˚ 13' 07.76668" W
CREATED BY:	BTR	**WATER DEPTH:**	46.6 m
		MOORING LENGTH:	121 m
		CHAIN ON SEABED:	74.4 m
		SCOPE:	2.6 : 1

ITEM #	DESCRIPTION	SIZE	WLL	LENGTH	NOTES	HAVE
1	FLS200	FLS200				
2	(4) Isolation Shackle and Pin	1-1/4" (32mm)			Custom Made	
3	(4) Shackle (bow)	1-1/4" (32mm)	12T		Green Pin G-4163	
4	(4) Bridle chain	1" (26mm)		3m	OLC	
5	(4) Shackle (bow)	1-1/4" (32mm)	12T		Green Pin G-4163	
6	Master Link Assembly	1-1/2" (38mm)	30.5T		Crosby A-345	
7	Shackle (bow)	1-3/8" (35mm)	13.5T		Green Pin G-4163	
8	Chain	1" (26mm)		10m	OLC	
9	Shackle (bow)	1-3/8" (35mm)	13.5T		Green Pin G-4163	
10	Swivel	1-1/2" (38mm)			Crosby G-402	
11	Shackle (bow)	1-3/8" (35mm)	13.5T		Green Pin G-4163	
12	Chain	1-1/4" (32mm)		25.5m	OLC	
13	Shackle (bow)	1-3/8" (35mm)	13.5T		Green Pin G-4163	
14	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
15	Chain	1-1/2" (38mm)		27.5m	OLC	
16	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
17	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
18	Chain	1-1/2" (38mm)		27.5m	OLC	
19	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
20	Swivel	1-1/2" (38mm)			Crosby G-402	
21	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
22	Chain	1-1/2" (38mm)		27.5m	OLC	
23	Shackle (bow)	1-1/2" (38mm)	17T		Green Pin G-4163	
24	Shackle (bow)	1-3/4" (44mm)	25T		Green Pin G-4163	
25	5,000 Kg Sinker	5,000 Kg			5T Cast Iron Sinker	
RECOVERY LINE						
1	Shackle (bow)	7/8" (23mm)	6.5T		Not welded, Used in val.	
2	Chain	3/4" (19mm)		10m	Used in validation	
3	Shackle (bow)	7/8" (23mm)	6.5T		Not welded, Used in val.	

This Appendix has been redacted in its entirety.

Appendix B

Forms for BOEM Reporting Requirements

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

Lease Number OCS-A 0522

CONTACT INFORMATION FOR REPORTING REQUIREMENTS

The following contact information must be used for the reporting and coordination requirements specified in ADDENDUM "C", Stipulation 3:

United States Fleet Forces (USFF) N46
1562 Mitscher Ave, Suite 250
Norfolk, VA 23551
(757) 836-6206

The following contact information must be used for the reporting requirements in ADDENDUM C, Stipulation 4.4:

Reporting Injured or Dead Protected Species

National Oceanic and Atmospheric Administration
Fisheries Northeast Region's Stranding Hotline
800-900-3622

All other reporting requirements in Stipulation 4.4

Bureau of Ocean Energy Management
Environment Branch for Renewable Energy
Phone: 703-787-1340
Email: renewable_reporting@boem.gov

National Marine Fisheries Service
Northeast Regional Office, Protected Resources Division
Section 7 Coordinator
Phone: 978-281-9328
Email: incidental.take@noaa.gov

Vessel operators may send a blank email to ne.rw.sightings@noaa.gov for an automatic response listing all current dynamic management areas.

ENCLOSURE

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

APPENDIX A TO ADDENDUM "C"

Lease Number OCS-A 0522

Incident Report: Protected Species Injury or Mortality

Photographs/Video should be taken of all injured or dead animals.

Observer's full name: _____

Reporter's full name: _____

Species Identification: _____

Name and type of platform: _____

Date animal observed: _____ Time animal observed: _____

Date animal collected: _____ Time animal collected: _____

Environmental conditions at time of observation (i.e. tidal stage, Beaufort Sea State, weather):

_____

_____

Water temperature (°C) and depth (m/ft) at site: _____

Describe location of animal and events 24 hours leading up to, including and after, the incident (incl. vessel speeds, vessel activity and status of all sound source use):

_____

_____

_____

_____

_____

Photograph/Video taken: YES / NO If Yes, was the data provided to NMFS? YES / NO
(Please label *species, date, geographic site* and *vessel name* when transmitting photo and/or video)

Date and Time reported to NMFS Stranding Hotline: _____

Sturgeon Information: *(please designate cm/m or inches and kg or lbs)*

Species:_____

Fork length (or total length):_____ Weight:_____

Condition of specimen/description of animal: _____

_____

_____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY

Fish tagged: YES / NO If Yes, *please record all tag numbers.*

Tag #(s):_____

Genetic samples collected: YES / NO

Genetics samples transmitted to:_____ on____/_____/20__

Sea Turtle Species Information: *(please designate cm/m or inches)*

Species:_____ Weight (kg or lbs):_____

Sex: Male Female Unknown

How was sex determined?:_____

Straight carapace length:_____ Straight carapace width:_____

Curved carapace length:_____ Curved carapace width:_____

Plastron length:_____ Plastron width:_____

Tail length:_____ Head width:_____

Condition of specimen/description of animal:_____

_____

_____

Existing Flipper Tag Information

Left:_____ Right:_____

PIT Tag#:_____

Miscellaneous:

Genetic biopsy collected: YES NO Photographs taken: YES NO

Turtle Release Information:

Date:_____ Time:_____

Latitude:_____ Longitude:_____

State:_____ County:_____

Remarks: (note if turtle was involved with tar or oil, gear or debris entanglement, wounds, or mutilations, propeller damage, papillomas, old tag locations, etc.)_____

_____

_____

_____

Marine Mammal information: *(please designate cm/m or ft/inches)*

Length of marine mammal (note direct or estimated): _____

Weight (*if possible, kg or lbs*):_____

Sex of marine mammal (if possible):_____

How was sex determined?:_____

Confidence of Species Identification: SURE UNSURE BEST GUESS

Description of Identification characteristics of marine mammal:_____

_____

_____

_____

_____

Genetic samples collected: YES / NO

Genetic samples transmitted to:_____ on____/____/20__

Fate of marine mammal:_____

_____

_____

_____

Description of Injuries Observed:_____

_____

_____

_____

Other Remarks/Drawings:_____

_____

_____

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF OCEAN ENERGY MANAGEMENT

APPENDIX B TO ADDENDUM "C"

Lease Number OCS-A 0522

REQUIRED DATA ELEMENTS FOR PROTECTED SPECIES OBSERVER REPORTS

The Lessee must ensure that the PSO record all observations of protected species using standard marine mammal observer data collection protocols. The list of required data elements for these reports is provided below:

1. Vessel name;
2. PSOs' names and affiliations;
3. Date;
4. Time and latitude/longitude when daily visual survey began;
5. Time and latitude/longitude when daily visual survey ended; and
6. Average environmental conditions during visual surveys including:
    a. Wind speed and direction;
    b. Sea state (glassy, slight, choppy, rough, or Beaufort scale);
    c. Swell (low, medium, high, or swell height in meters); and
    d. Overall visibility (poor, moderate, good).
7. Species (or identification to lowest possible taxonomic level);
8. Certainty of identification (sure, most likely, best guess);
9. Total number of animals;
10. Number of juveniles;
11. Description (as many distinguishing features as possible of each individual seen, including length, shape, color and pattern, scars or marks, shape and size of dorsal fin, shape of head, and blow characteristics);
12. Direction of animal's travel relative to the vessel (preferably accompanied by a drawing);
13. Behavior (as explicit and detailed as possible, noting any observed changes in behavior);
14. Activity of vessel when sighting occurred.

Appendix C

CONFIDENTIAL

Geophysical, Geologic & Biological Survey Reports for Site Assessment Plan:

C-1 Site Assessment Plan Survey Summary Report
C-2 Geophysical Survey Operations Report
C-3 Geotechnical & Environmental Operations Report

This Appendix has been redacted in its entirety.

Appendix D

CONFIDENTIAL
Archaeological Report for Site Assessment Plan

This Appendix has been redacted in its entirety.

Appendix E

Biological Survey Report for Site Assessment Plan

ALPINE VINEYARD WIND

Lease Area OCS-A 0522 Site Assessment Plan Sites Benthic Report

Prepared by:

RPS Ocean Science

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1 INTRODUCTION

RPS was contracted by Alpine Ocean to collect, process, analyze, and compile benthic data from a towed video sled and grab sampler for two lease areas offshore of Martha's Vineyard, Massachusetts (OSC-A 0501 and OSC-A 0522) intended for the construction of offshore wind turbines. The grab samples and video imagery data conclusions presented here will support interpretation of geophysical data to characterize surficial sediment conditions and classify the benthic habitat in lease area OSC-A 0522 according to the Coastal and Marine Ecological Classifications Standards (CMECS; FGDC 2012) and recent guidance (draft National Marine Fisheries Service [NMFS] guidance 2020) for inclusion in the Site Assessment Plan (SAP) for Bureau of Ocean Energy Management (BOEM). Remaining samples from OSC-A 0501 South and OSC-A 0522 (522) will be summarized in a following report. This report provides:

- A description of the benthic grab sampling methods, results, and analyses;
- The analysis of benthic grab sampling results using key statistical analyses such as taxa richness, density per cubic meter, community composition, etc.;
- A description and analysis of the video data collected; and
- CMECS classifications of each sample site based on the video, grain size, and benthic community lab results.

2 METHODS

2.1 Field Survey

2.1.1 Towed Camera Sled

Underwater video transects were taken in conjunction with grab samples for visual classification of the seafloor from mid-October to late-December 2019. The camera sled was equipped with an altimeter to record distance above sea floor, temperature probe, parallel-mounted lasers 7.5 centimeters (cm) apart, and a cable that transmitted real-time viewing of images to the vessel. The video sled was deployed from a side-oriented A-frame by the Alpine Ocean crew and lowered until positioned 0.5-1.5 meters (m) above the seafloor. Distance of camera to the seafloor varied along each transect due to differences in sediment type, vessel speed, swells, and low visibility/high turbidity.

Transects were recorded in accordance with procedures approved by Alpine and Vineyard Wind and following BOEM's Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 (BOEM, 2019). Vessel speed was usually kept to 1 knot or lower and never exceeded 3 knots. Direction was given from the video operator to the winch operator to raise and lower the camera sled as needed to maintain proximity to the seafloor; however, a combination of difficult weather and vessel design created changes in deck height

relative to the seafloor which frequently pulled the video sled out of visible range of the seafloor. While recording, field notes were taken containing sample information (date, time, global positioning satellite [GPS] coordinates, station ID, depth, and video file name) and observations of sediment/seafloor characteristics of note to aid in post-processing of video data. Special notes were made for the beginning and end of the transect as well as any changes in weather or visibility conditions, sediment, or species. During video recording, attention was given to noting if potentially sensitive benthic habitats (e.g., exposed hard bottom, seagrass/kelp/algal beds, coral species) were present, as per BOEM's guidelines (BOEM, 2019).

2.1.2 Grab Sampling

Benthic grab samples were acquired using a Harmon/Day Grab Sampler owned by Alpine Ocean. The standard sampler has been modified to improve penetration and reduce sample disturbance, contamination, and washout during retrieval by the addition of weights, the use of stainless-steel sample doors and bucket, and an extended bucket lip. An ultra short baseline (USBL) beacon was fixed to the grab sampler to obtain GPS coordinates in conjunction with a pole-mounted USBL system. An attached camera was intended for use when determining sensitivity of benthic habitat but high turbidity/low visibility and rapid changes in grab sampler altitude due to weather and side deployment made it difficult to assess bottom type without contact.

Upon retrieval, the grab sampler was examined for sample acceptability. A sample was initially deemed acceptable only if the bucket was more than 50% full, the sample was not over penetrated (i.e., not full to the top), and sample surface structures were undisturbed and even (i.e., not slumped). However, due to the frequency of soft-bottom habitat comprised of mud and silt, RPS was authorized by onboard client representatives to accept over penetrated samples with disturbed surfaces (though discretion was used in cases of severely compromised samples).

If a sample did not fulfil these requirements, the contents were deposited into a clean bucket and another sample attempt was made. All subsequent failed samples were collected in the same bucket, contents mixed thoroughly, and core and sediment samples collected from the mixture to acquire the sample. If more than three failed sample attempts occurred at one station, sampling moved on to the next station (no more than three fails occurred in any one sampling station). The results of each attempted grab were recorded in field notes.

Once an acceptable sample was obtained, the following steps were taken:

1. A photograph was taken of the sample next to an identification label containing sample identification number.

2. Field notes included descriptions of physical features (depth of penetration, sediment color, texture, surface features) and surface macrofauna, which were then returned to the water (none present).

3. The grab sample was then divided into an “A” and backup “B” sample based on the bucket design which was accessed via two hinged doors divided by a central support bar. The “A” designation was assigned to the least disturbed side or arbitrarily when samples were of equal quality.

4. A four-inch diameter lexan tube was inserted and sediment cores were removed from each side of the grab sampler bucket and placed in sieving buckets.

5. A 100-mL sample was taken from the sediment surrounding the cores on both sides and placed in plastic bags for grain size analysis.

After collection, the “A” sample was then photographed and described more thoroughly (grain size and characteristics at depth) and both samples were then loaded onto a processing table and material washed through a 500-µm sieve using seawater under gentle pressure.

Organisms, shell fragments, and other remaining material was placed into a plastic container using stainless steel forceps as needed. The container was filled no more than one-half to two-thirds full of sample and seawater. If the quantity of sample exceeded this volume, it was placed in a second container. The sample was fixed/preserved with 10% buffered formalin solution dyed with Rose Bengal by filling the remaining space within the bottle with solution. Containers were tightly sealed with tape and stored in a cooler at ambient temperature (not frozen or refrigerated). Prior to sieving the next sample, the sieve was cleaned by backwashing with pressurized water. The infaunal benthic community samples were sent to EcoAnalysts (Moscow, ID) for processing and the grain size samples were sent to TerraSense (Totowa, NJ).

2.2 Lab Analysis

2.2.1 Grain Size and TOC Analysis

Grain size samples were analyzed by TerraSense using ASTM D6913 and ASTM D7928 Standard Test Methods for Particle-size distribution of soils (ASTM, 2016a,b).

2.2.2 Benthic Infauna Analysis

The benthic infauna analysis was conducted by EcoAnalysts according to the following steps:

1. Benthic infaunal samples were catalogued and verified against the Chain of Custody to ensure samples received match those listed in the shipment.

2. Samples were rinsed with freshwater to remove the formalin and transferred to 70 percent ethanol alcohol for sorting and storage.

3. Organisms were identified to the lowest practical taxonomic level (LPTL) (at least to Family) and counted by taxonomists using the most appropriate taxonomic references for the region (Bousfield, 1973; Cutler, 1994; Winston and Hayward, 2012).

4. Species classification and abundance were recorded in project data sheets and summarized in both tabular and graphical formats.

5. Prior to performing the infaunal data analysis, the overall dataset was scanned for noninfaunal taxa (i.e., pelagic or planktonic organisms) that were excluded from all analyses; examples include chaetognaths, hyperiid amphipods, and decapod zoea/megalopae.

6. Calculations of abundance included all taxa occurring in each sample whether identified to species level or not.

7. Calculations based on species (diversity, evenness, and number of species) included only those taxa identified to species level.

2.3 Video Data Post-Processing

2.3.1 Objectives

Post-processing and analysis of video transect data was conducted by RPS to provide:

- General characterization of substrate including bottom type, texture, micro-topography, and presence and approximate thickness (absent, light, moderate, or heavy) of sedimentation ("drape") covering hard substrates;
- Evidence of benthic activity by organisms (burrows, trails, biogenic reefs);
- Identification of epibenthic macroinvertebrates (decapod crustaceans, mollusks [including squid mops], echinoderms) and benthic habitat;
- Presence/evidence and general characterization of submerged aquatic vegetation (macroalgae, sea grass);
- Identification of fish and fish habitat (where feasible) as classified by Auster (1998) to provide back compatibility with prior sampling work in the region;
- Identification of organisms to the lowest practical taxonomic level (generally to Order to Family) using standard taxonomic keys for the geographic area;
- Evidence of fishing activity, such as trawl scars, pots, and working nets; and
- Presence of derelict fishing gear, military expended materials, shipwrecks, cultural artifacts, or other marine debris.

All still images from videos will be classified according to CMECS (FGDC, 2012); Auster (1998) classification is also included as it is indicative of overall habitat features that can be important to fish, while CMECS focuses more closely on grain size and composition. The BOEM Benthic Habitat Survey guidelines (BOEM, 2019) also require that the developer characterize the benthic community composition which

includes documentation of abundance, diversity, percent cover, and community structure. The following were recorded when present and identifiable:

- Characterization and delineation of any submerged aquatic vegetation (seagrass or macro-algae) that occurs within the area of potential adverse effect;
- Characterization and delineation of any hard-bottom gradients of low to high relief such as coral (heads/reefs), rock or clay outcroppings, or other shelter-forming features; and
- Identification of communities of sessile and slow-moving marine invertebrates (clams, quahogs, mussels, polychaete worms, anemones, sponges, echinoderms) that may be within the area of potential adverse effect.

2.3.2 Methods

The video data post-processing methods were developed based on relevant information presented in various peer-reviewed publications and technical guidelines, such as:

- "Northeast Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC) and Joint Nature Conservation Committee (JNCC): Epibiota remote monitoring from digital imagery: interpretation guidelines (Turner et al., 2016);
- "NMBAQC and JNCC: Epibiota remote monitoring from digital imagery: operational guidelines" (Hitchin et al., 2015).
- "Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects" (Judd, 2011);
- "Mapping European Seabed Habitats (MESH) Seafloor video mapping: collection, analysis, and interpretation of seafloor video footage for the purpose of habitat classification and mapping" (White et al., 2007);
- "Video analysis, experimental design, and database management of submersible-based habitat studies" (Tissot, 2008); and
- "Photographic evaluation of the impacts of bottom fishing on benthic epifauna" (Collie et al., 2000).

Videos were reviewed and analyzed in two separate steps. First, each video was reviewed in its entirety multiple times and any notable seafloor features or epifaunal/benthic/demersal species were recorded. When a feature or species was identified, the reviewer recorded the time, rated video visibility, categorized the bottom based on Auster (1998), and recorded the lowest possible taxon and abundance of organisms greater than ~4 cm in size (equal to roughly half the distance between the laser points). CMECS classification was applied to each individual still image during a later processing step using percent cover information. Most portions of the videos were reviewed multiple times using slower playback speeds and replay functions. After review, the taxonomic details of each macrofaunal observation were investigated and data were recorded at the lowest possible taxonomic level identifiable through the video.

Second, each video was subsampled to produce still images at 5-second intervals. Metadata were recorded for each still image including latitude and longitude, transect, and ID number. The quality of each image was assessed with a categorical scale from 0 to 4. Still images with quality scores of "moderate" (2 or greater) were analyzed with seabed image processing software photoQuad (Trygonis and Sini, 2012). Each image was calibrated using the reference laser points and the area of the visible portion was recorded. Poorly lighted or blurry edges of "passing" images were excluded from analysis.

The abundance of macrofauna was recorded along with presence/absence benthic biotic activity, submerged aquatic vegetation (macroalgae, sea grass), fishing activity, derelict gear, military expended materials, shipwrecks, coral heads/reefs, rock outcroppings, other shelter features, and other marine debris. A score for visibility, Auster (1998) fish habitat characterization and rugosity (i.e., seafloor roughness or habitat complexity based on visual estimation) were assigned for each image as a whole (see definitions in Table 2).

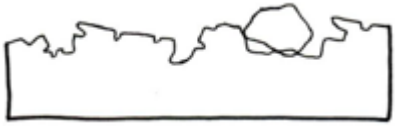
For CMECS classification, fifty points were distributed uniformly across the entire visible portion of each still image using photoQuad. Percent cover data were recorded as the number of points under which different substrate types or features were visible: boulder/cobble, pebble/granule, sand/mud, worm tubes, shell debris, mobile macrofauna, sessile macrofauna, algae, or encrusting organisms. These point counts were multiplied by two to approximate percent cover for the still image and used to assign the appropriate substrate classifications of the habitat to the furthest extent possible according to CMECS standards (FGSC, 2012). Biogenic modifiers were included based on the size and percent cover of the biogenic features (Table 1).

Table 1 CMECS biogenic modifier size and percent cover categories.

Biogenic Size	Definition	Biogenic Cover	Definition*
Reef	> 4,096 mm	Trace	< 1%
Rubble	64 – 4,096 mm	Sparse	1 – 30%
Hash	2 – 64 mm	Moderate	30 – 70%
Sand	< 2 mm	Dense	70 – 90%
		Complete	> 90%

* Adapted from FGDC, 2012.

Table 2 Still image data analysis categories for visibility, Auster sediment class, and rugosity.

Visibility Score	Visibility Definition	Auster Category	Auster Definition*	Rugosity Score	Rugosity Definition**
0 – none	obscured or turbid, lasers not visible on seafloor	1 – flat sand/mud	areas with no vertical structure	0 – none	
1 – low	some visibility but still blurry, lasers may or may not be visible	2 – sand waves	troughs and waves in sand	1 – low	
2 – moderate	some features distinguishable, both lasers in view	3 – biogenic structures	burrows, depressions, and other features created or used by mobile fauna for shelter	2 – moderate	
3 – high	most features distinguishable, both lasers in view	4 – shell aggregates	shells create complex interstitial spaces for shelter and high-contrast background	3 – high	
4 - excellent	all features clearly visible, both lasers in view	5 – pebble-cobble	small interstitial spaces, less ephemeral than shell	4 - extreme	
		6 – pebble-cobble with sponge cover	attached fauna increase spatial complexity		
		7 – partially buried or dispersed boulders	partially buried boulders provide high vertical relief while dispersed boulders over cobble provide simple crevices		
		8 – piled boulders	provide deep interstitial spaces of variable sizes		

*Adapted from Auster, 1998. ** Adapted from Turner et al., 2016.

2.4 Benthic Infaunal Data Post-Processing

The benthic infaunal community analysis was based on the laboratory results provided by Ecoanalysts for the three successful grab samples at SAP sites in the 522 lease area. Infaunal community statistics were calculated using species and abundance estimates in each sample, which were reported as count per 0.008 m^2 (area of subsample corer). Community composition parameters included: total abundance, number of phyla, number of taxa, Margalef's Richness Index, Shannon Diversity Index, and Pielou's Index of Evenness for each station and within each lease area.

2.4.1 Taxonomic Composition

Taxa composition was assessed to characterize the high-level trends in taxa data. Taxa composition includes the relative proportions of taxonomic groups by number of identifiable taxa and number of individuals, used to evaluate dominance of common phyla across all samples. Taxa composition was summarized for individual samples.

2.4.2 Richness, Diversity, and Evenness

Species richness, evenness, and diversity are common ecological parameters used to measure the overall biodiversity of a community or discrete unit. Species richness is the number of unique species or taxonomic groups represented in an area of interest. In this assessment, species richness was calculated using Margalef's Richness Index (Formula 1) for each station and lease area to acquire individual and average richness indices.

Formula 1. Margalef's Richness Index (RI).

$$RI = \frac{(S - 1)}{\ln(n)}$$

Where:

S= the number of species

n= the total number of individuals in the sample

Interpretation: The higher the index, the greater the species richness.

The diversity index for a community considers species richness and the proportion of each unique species. The Shannon Diversity Index (H'; Formula 2) was calculated using the number of each species, the proportion of each species relative to the total number of individuals, and the sum of the proportions. This index was used to assess diversity of each station and lease area. The diversity index (H') increases with increasing species richness and evenness.

Formula 2. H'- Shannon Diversity Index.

$$H' = -\sum_{i=1}^{R} p_i \ln(p_i)$$

Where:

p_i = the proportion of individuals belonging to the species in the dataset of interest

Interpretation: The greater the H', the greater the richness and evenness.

Evenness of a community refers to the similarity in abundances of different species comprising a population or sample. Pielou's Index of Evenness includes H' (Shannon-Weiner Diversity Index) in its calculation.

Formula 2. J'- Pielou's Index of Evenness.

$$J' = \frac{H'}{H_{Max}}$$

Where:

H' = the Shannon- Weiner Diversity Index

H_{Max} = the maximum possible value of H', where each species occurs in equal abundances.

$$H_{Max} = \ln(s)$$

Where: s = Number of species

Interpretation: J' is constrained between 0 and 1. The greater the value of J', the more evenness in the sample.

3 RESULTS

3.1 Video Analysis

The characteristics and locations of the two priority SAP underwater video transects within the 522 lease area are described in Table 3 and Figure 1. Note that transects collected near the beginning of the survey effort used a fiberglass tow sled frame that did not perform well under rough sea conditions; thus, the same camera was transferred to a heavier metal tow sled frame that provided more stability to the tow system for the remaining transects.

Table 3 Underwater video transect locations and characteristics.

Transect	Date	Recorded Duration (min:sec)	Start/End Latitude	Start/End Longitude	Equipment	Total # Stills	# Analyzed Stills
VT01	11/3/2019	12:21	40.673915 40.671418	-70.218842 -70.218723	TS-500; fiberglass tow sled frame	138	15
VT02	11/14/2019	10:42	40.690992 40.689175	-70.165337 -70.157590	TS-500; metal tow sled frame	118	34

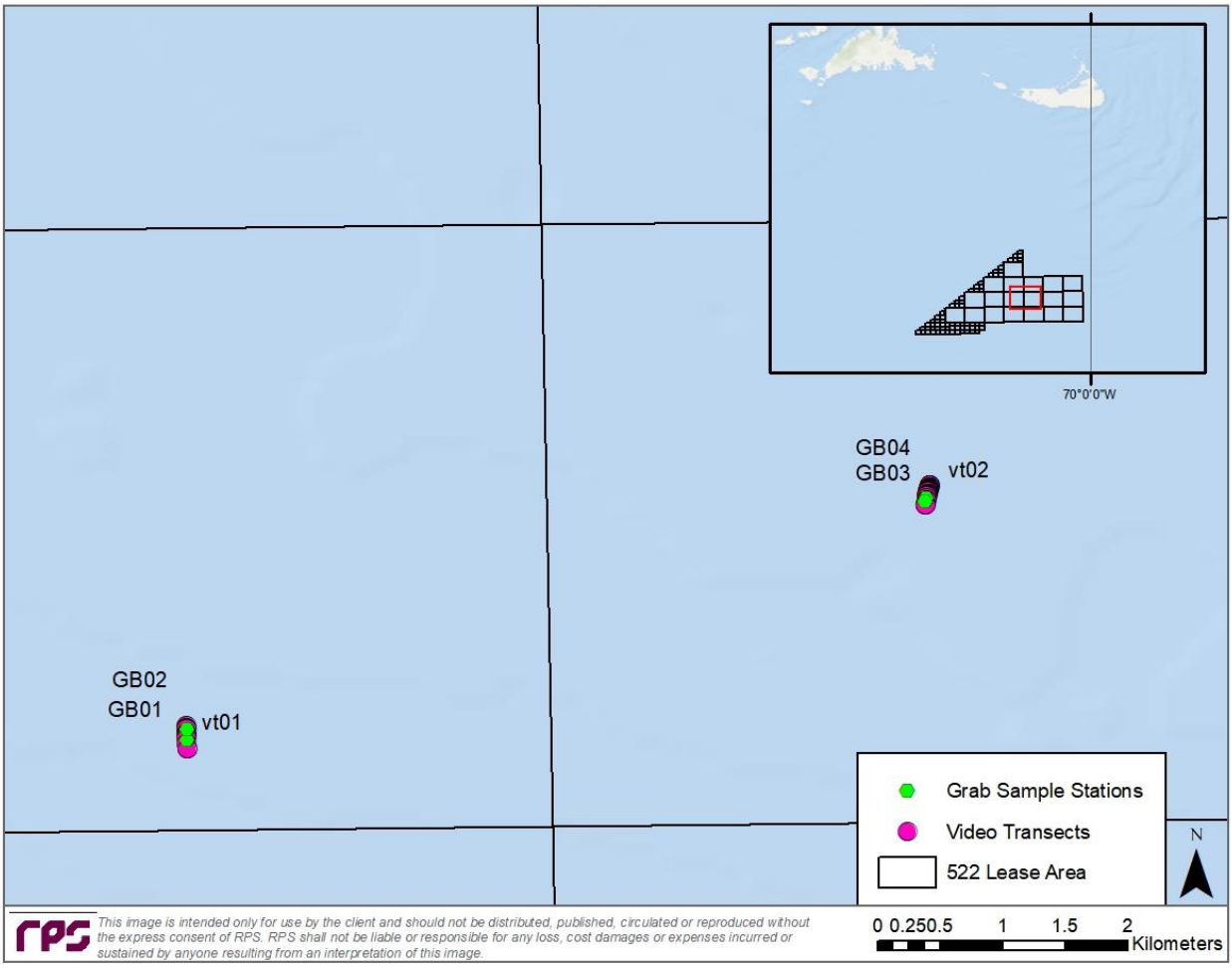


Figure 1 Map of 522 lease area SAP underwater video transects VT01 and VT02 (pink circles) and grab sample stations GB01, GB02, GB03, and GB04 (green octagons).

3.1.1 Macrofauna Counts

The presence and abundance of macrofauna > 4 cm were recorded during the video review process. Organisms were identified to the LPTL, usually Order or Family. Fifteen organisms were enumerated in the VT01 and VT02 video transects with over 66% of counts comprised of *Cancer spp.* crabs and Rajidae skates (Table 4 and Figure 2). See below for representative images from VT01 showing a skate (Figure 3) and VT02 showing a *Cancer spp.* crab (Figure 4).

Table 4 Macrofauna enumerated during review of the two video transects.

Lowest Taxonomic Grouping	Common Name	Counts per Transect	
		VT01	VT02
Cancer spp.	Cancer crab	1	6
Euspira spp.	Moon snail		1
Euspira spp. - egg case	Moon snail egg case	2	
Rajidae	Skate	2	1
Rajidae - egg case	Skate egg case	1	
Pagurus spp.	Hermit crab	1	
Totals		7	8

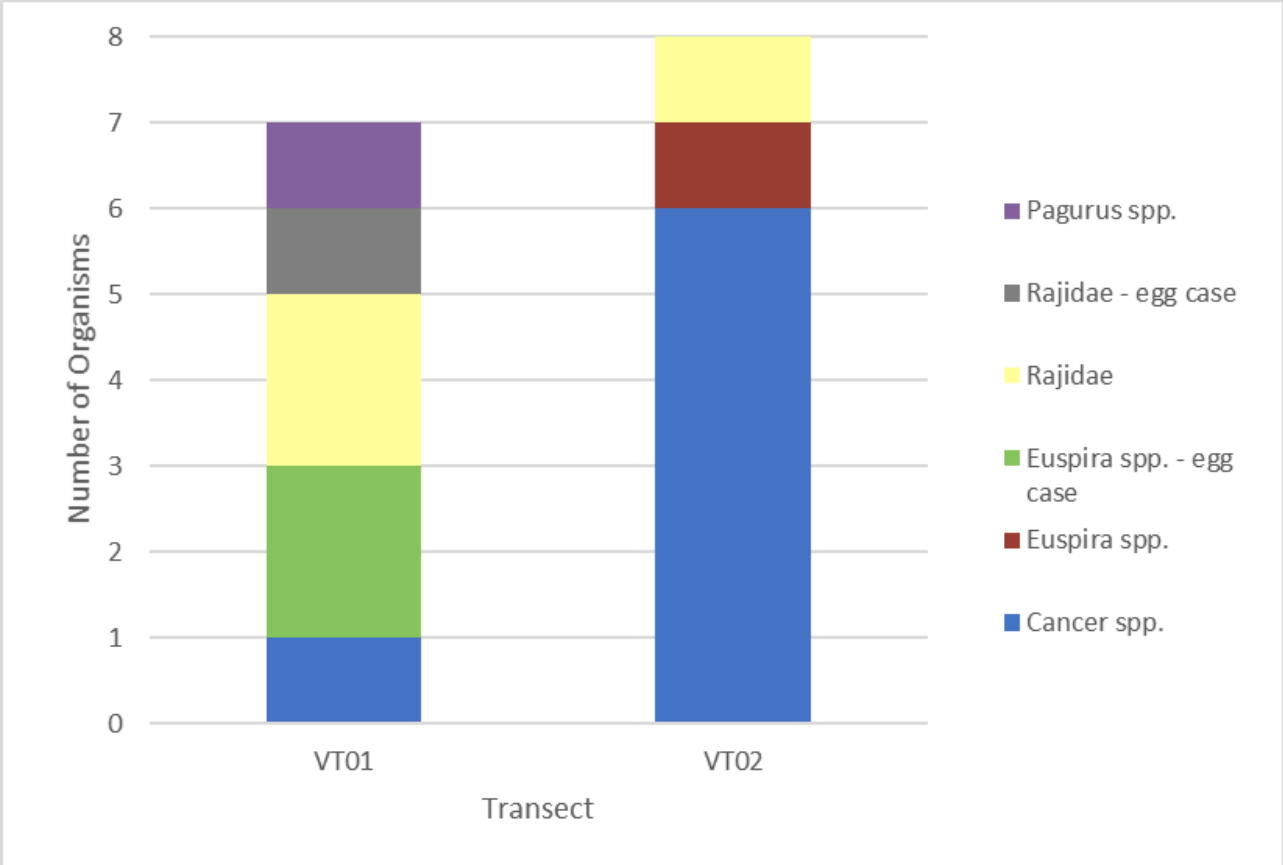


Figure 2 Counts of macrofauna enumerated during video review for each transect, identified to lowest practical level.

Figure 3 Representative screenshot from VT01 showing a skate swimming quickly across the top of the frame.

Figure 4 Representative screenshot from VT02 showing a *Cancer sp.* crab, below and to the right of lasers.

3.1.2 Percent Cover

The following sections summarize the percent cover data obtained from still images taken throughout the underwater video transects. CMECS substrate categories were combined to the level detectable via visual analysis; finer resolution classification into different subgroups requires grain size analysis of samples overlapping the video transect directly. For these percent cover estimates, our grain size categories were sand/mud, pebble/granule, and boulder/cobble. Biogenic categories of percent cover were worm substrate and shell substrate. We also included a percent cover category for evidence of crab or amphipod burrows, which would fall under the burrows/bioturbation geoform group within the biogenic origin category.

In total, 49 of 256 stills from VT01 and VT02 were analyzed (Table 5, Figure 5, Figure 6). Coverage was dominated by the combined CMECS substrate group component sand/mud. Aquatic vegetation, evidence of fishing activity, encrusting or colonial organisms, and anthropogenic debris were not observed in any of the still images.

Table 5 Total area, mean rugosity, and mean percent cover summarizing point count data for the two video transects.

Transect ID	Total Area Analyzed (m^2)	Mean Rugosity	boulder/ cobble (%)	pebble/granule (%)	sand/mud (%)	worm (%)	burrow (%)	shell (%)
VT01	2.3	0	0	0	97.2	2.6	0	0.2
VT02	13.4	0.26	0	0	78.4	0	0	21.6

Percent cover in VT01 primarily consisted of sand/mud with no evident macrofauna (Figure 5). A few stills captured small worm tubes (2.6% coverage) and one still was classified as shell rubble. Since the worm tubes were not cemented or conglomerated together, nor did they dominate any of the imagery, they were not considered a major biogenic substrate type used in classification.

VT02 consisted of sand/mud with varying amounts of shell rubble or hash and no evident macrofauna. A total of 8 still images from VT02 contained > 60% cover of moderate to dense shell pieces. These stills could be classified as biogenic shell rubble (> 64 mm in size) with geologic sand substrate as a co-occurring element (Figure 6 shows shell rubble from ocean quahog). However, when taken across the transect as a whole, VT02 had just 21.6% of the still image area analyzed over the entire transect composed of shell rubble and the dominant substrate group of the remainder of the transect was sand. Parallel-mounted lasers in representative images are 7.5 cm apart.

Figure 5 Representative still image of video transect data from VT01: sand/mud with no evident macrofauna.

Figure 6 Representative still image of video transect data from VT02: ocean quahog shell rubble.

Auster classifications were also made of each still image for back-compatibility with prior habitat work. All of VT01 was classified as flat sand/mud while VT02 contained a mix of flat sand/mud, sand waves, and shell habitat (Figure 7).

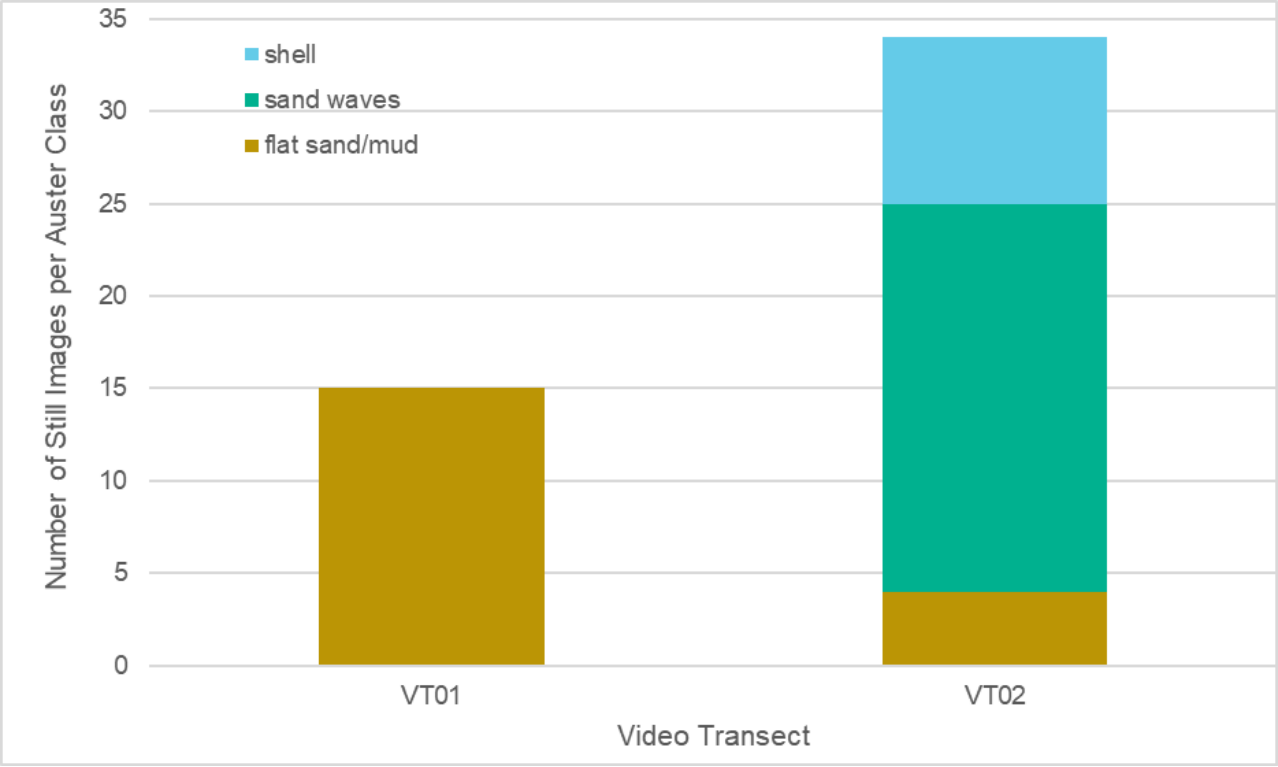


Figure 7 Number of still images assigned to different Auster classifications for each video transect.

3.2 Grab Samples

The characteristics and locations of the four priority SAP sample stations within the 522 lease area are described in Table 3 and shown in Figure 1. Three grab attempts were made at GB03, however, the sampler did not recover any sediment due to the presence of large clam rubble on the surface.

Table 6 Grab sample station locations and characteristics.

Station	Time (EST)	Latitude	Longitude	Water Depth (m)	Penetration Depth (cm)
GB01	7:29	40.672548	-70.218815	50	13
GB02	7:45	40.673305	-70.218841	49.9	14
GB03	9:11	40.689899	-70.165626	46.5	n/a
GB04	8:44	40.689727	-70.165659	45.8	5

3.2.1 Sediment Analysis

The following section presents grab sample grain size composition results from the TerraSense lab analysis. Samples from the three 522 lease area SAP grab sample stations were generally sandy comprising 82 – 94% fine sand (Table 7 and Figure 8). No gravel-sized grain components were reported in GB01 or GB02 with only 0.1% of smaller sized gravel (2 – 4.75 mm) found in GB04. GB01 contained both the greatest percentage of fines (silt and clay, 17.5%) as well as the highest moisture content (60%). There is no data for GB03 because that was the failed grab sample site.

Table 7 Grain size composition, percent finer than, and sample moisture content from grab samples.

Sample	% Gravel (> 4.75 mm)	% Coarse Sand* (2 – 4.75 mm)	% Medium Sand (0.41 – 2 mm)	% Fine Sand (0.075 – 0.41 mm)	Silt & Clay (< 0.075 mm)	% Moisture Content
GB01	0.0	0.0	0.3	82.2	17.5	59.8
GB02	0.0	0.0	1.3	85.5	13.2	42.8
GB04	0.0	0.1	0.4	93.5	6.0	35.3

* Note that this sieve size category falls under “gravel” according to CMECS guidelines.

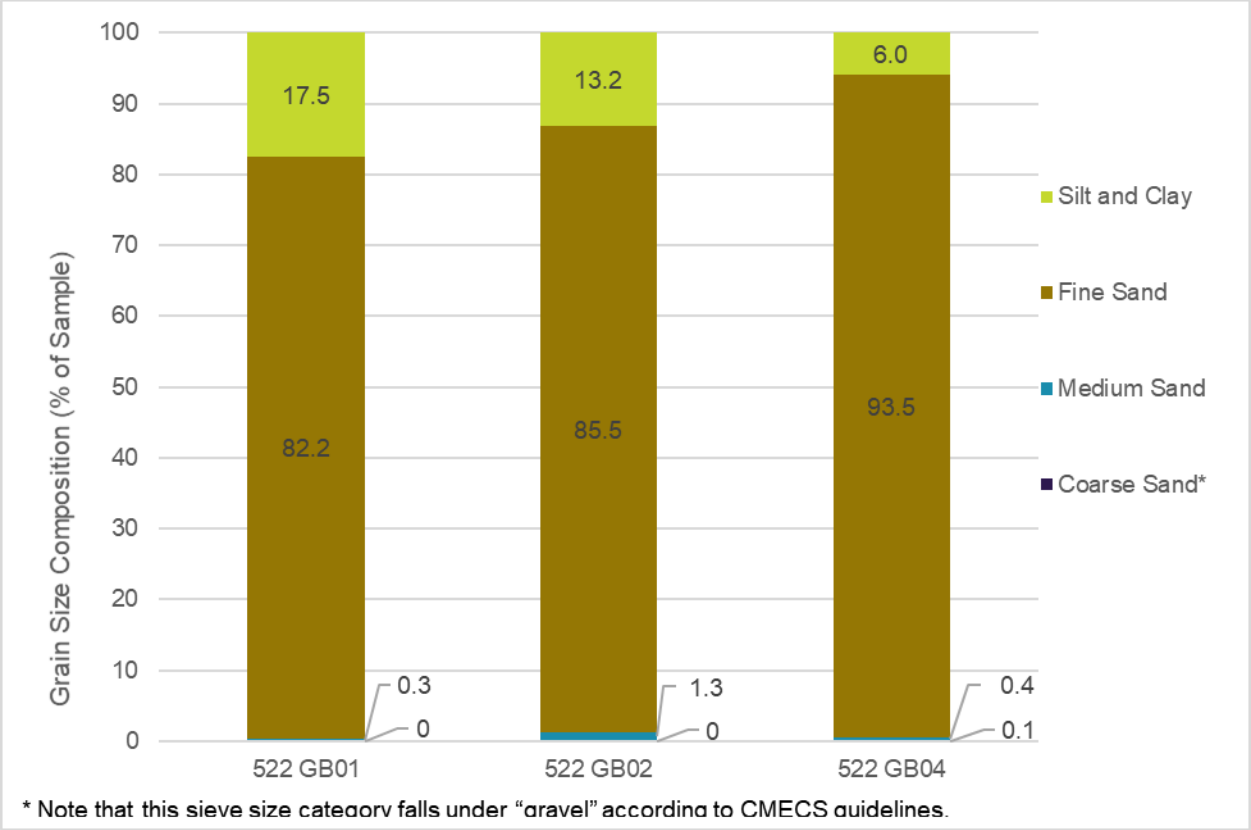


Figure 8 Grain size composition at each SAP grab station.

3.2.2 Benthic Community Analysis

3.2.2.1 Taxonomic Composition

Successful grab samples were collected from three of the four SAP grab sample sites, including GB01, GB02, and GB04. Three attempts were made at GB03; however, none contained any sediment due to the presence of large clam rubble. Due to the lack of sediment in these samples, no sediment or infaunal samples were sent to the labs. Three grab sample attempts were made at GB04, all of which failed due to partial closure of the sampler bucket. Although the third and final attempt at sampling was considered a failure, enough undisturbed sediment remained in one half of the sampler and therefore one infaunal sample was collected from the sample. The second infaunal sample was collected from a mixture of the three failed attempts.

The three benthic grab samples collected at the SAP sites yielded a total of 616 individual macrofaunal organisms from 5 unique phyla and 28 families (or LPTL; Table 8). The phyla Annelida, Arthropoda, and Mollusca dominated the samples in both abundance and unique number of taxa (i.e., taxa richness), representing 98% of all organisms and 93% of all unique taxa (Figure 9).

Table 8 Phyla present in the three benthic grab samples.

Phyla	Abundant Taxonomic Groups (common names)	Abundance (# per 0.008m^2)	Number of Taxa
Annelida	Polychaete worms (segmented and bamboo worms)	131	12
Arthropoda	Amphipods	335	9
Mollusca	Nut clams	144	5
Nematoda	Nematodes	5	1
Nemertea	Ribbon worms	1	1
Totals		**616**	**28**

Abundance across the three benthic grab sites ranged from 127 organisms in GB04, the northeasterly site, to 295 in GB02, the southwesterly site. Mean abundance was 205 organisms per station, averaged across the three samples (Table 9). The percent composition of each sample by phyla is shown in Figure 10.

Table 9 Abundance of each Phylum counted within each grab sample.

Station	Annelida	Arthropoda	Mollusca	Nematoda	Nemertea	Total Abundance
GB01	53	129	11	1	-	194
GB02	74	192	24	4	1	295
GB04	4	14	109	-	-	127
Totals	**131**	**335**	**144**	**5**	**1**	**616**

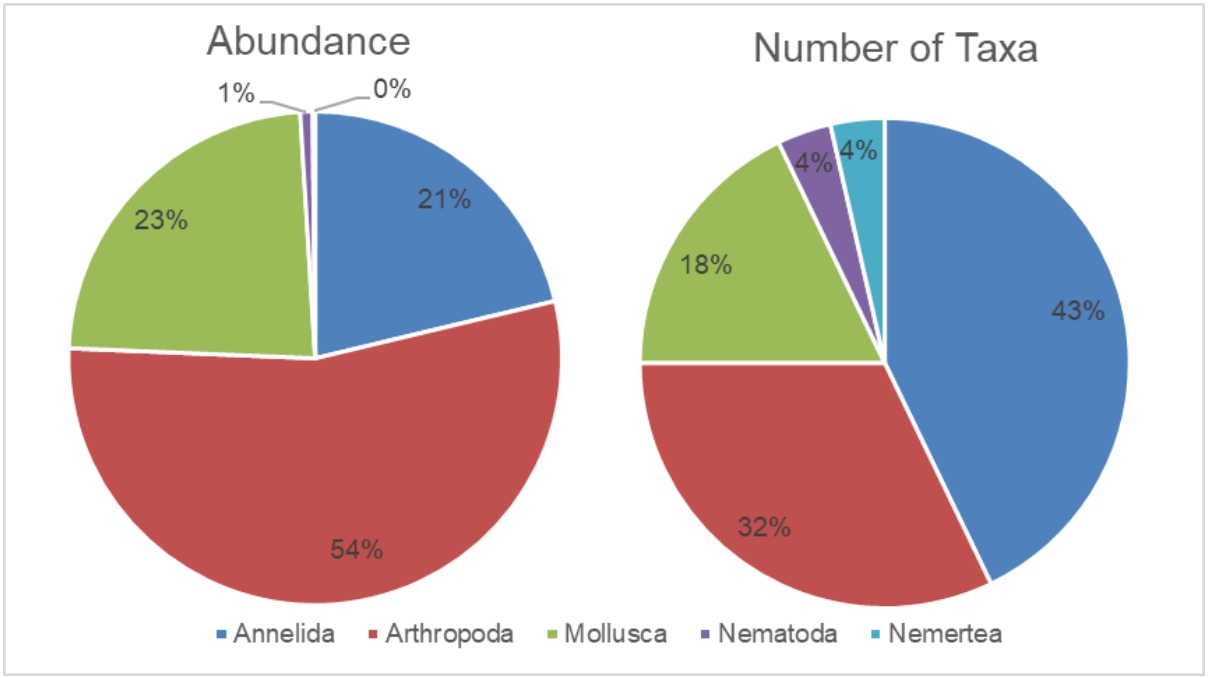


Figure 9 Abundance and number of unique taxa (Family or LPTL) for each phylum collected in all benthic grab samples. Results presented in percentage of total.

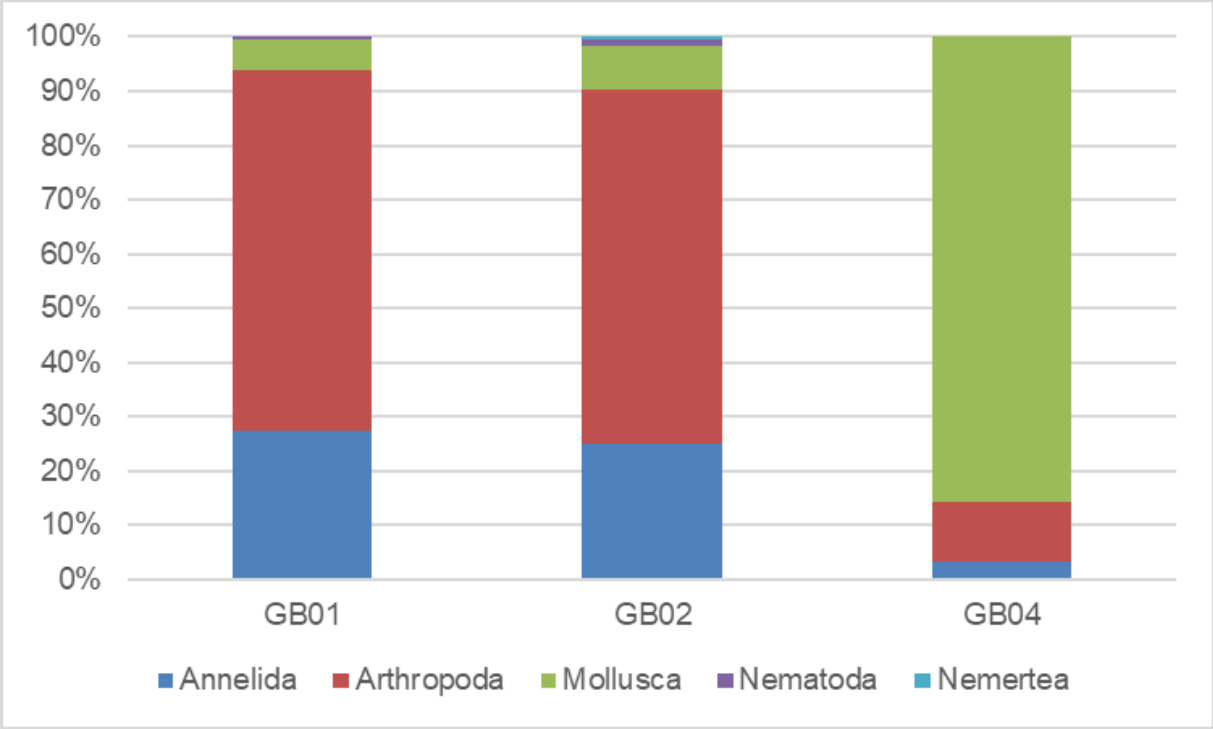


Figure 10 Percent composition of organisms in each represented phylum for the three benthic grab sample stations (GB01, GB02, and GB04).

3.2.2.2 GB01

Organisms collected in GB01 belonged to 4 phyla and 17 different Families or LPTL (Table 10) which primarily consisted of amphipods and polychaete worms. Amphipods from the Ampeliscidae family were most numerous, while organisms from the Annelida phylum were most diverse with 9 unique families or LPTL identified in the single sample. In the taxa tables presented here, taxa were listed on the same line if they each had the same abundance value to save space. For example, there were 2 individuals counted for each of Nephytidae and Syllidae families in the Annelida phyla (see line 4 in Table 10 below). Abundance was also summarized by phylum.

Table 10 Total abundance of each phyla and taxa (family or LPTL).

Phyla	Taxa	Abundance (# / 0.008 m^2)
Annelida	Paraonidae	24
	Maldanidae	14
	Lumbrineridae	7
	Nephtyidae, Syllidae	2
	Ampharetidae, Glyceridae, Oligochaeta (LPTI), Sabellidae	1
Total Annelida		53
Arthropoda	Ampeliscidae	118
	Leuconidae	7
	Phoxocephalidae, Unciolidae	2
Total Arthropoda		129
Mollusca	Mactridae	2
	Nuculidae	8
	Thyasiridae	1
Total Mollusca		11
Nematoda	Nematoda (LPTI)	1
Total Nematoda		1
Total Abundance at GB01		**194**

3.2.2.3 GB02

Organisms collected in GB02 belonged to 5 phyla and 20 different Families or LPTL (Table 11). Ampeliscidae amphipods (Arthropoda) dominated the sample at GB02 based on abundance.

Table 11 Total abundance of each phyla and taxa (family or LPTL).

Phyla	Taxa	Abundance (# / 0.008 m^2)
Annelida	Paraonidae	36
	Lumbrineridae	13
	Oligochaeta (LPTI)	10
	Maldanidae	8
	Nephtyidae, Syllidae	2
	Ampharetidae, Opheliidae, Polygordiidae	1
Total Annelida		74
Arthropoda	Ampeliscidae	165
	Phoxocephalidae	12
	Leuconidae	6
	Ischyroceridae	4
	Corophiidae	3
	Unciolidae	2
Total Arthropoda		165
Mollusca	Nuculidae	13
	Lucinidae	10
	Mactridae	1
Total Mollusca		24
Nematoda	Nematoda (LPTI)	4
		4
Nemertea	Emplectonematidae	1
Total Nemertea		1
Total Abundance at GB02		**295**

3.2.2.4 GB03

While GB03 grab attempts did not recover any sediment due to the veneer of concentrated shell material and thus did not have an infaunal sample analyzed, crabs were noted amongst the shell debris when the sample was collected.

3.2.2.5 GB04

Organisms collected in GB04 belonged to 3 phyla and 10 different Families or LPTL (Table 12). Taxa dominating the sample collected at GB04 included nut clams from the Nuculidae family (Mollusca).

Table 12 Total abundance of each phyla and taxa (family or LPTL).

Phyla	Family or LPTI	Abundance (# / 0.008 m^2)
Annelida	Sigalionidae	2
	Oligochaeta (LPTI), Polygordiidae	1
Total Annelida		4
Arthropoda	Ampeliscidae	7
	Ostracoda (LPTI)	4
	Diastylidae, Phoxocephalidae, Tryphosidae	1
Total Arthropoda		14
Mollusca	Nuculidae	108
	Nassariidae	1
Total Mollusca		109
Total Abundance at GB04		**127**

3.2.3 Richness, Diversity, and Evenness

Taxonomic richness across the three grab samples collected in the 522 lease area was 4.20, which was higher than the index score for each individual grab sample (Table 13). The richness of organisms collected in each of the benthic grab samples was 3.04 in GB01, 3.34 in GB02, and 1.86 in GB04. The sample collected at GB04 had the lowest richness, diversity, and evenness values as 86% of organisms in the sample came from a single family, Nuculidae (nut clams).

The ecological indices were relatively similar between nearby sample sites GB01 and GB02 as the distributions of organisms were similar, with the majority of organisms belonging to the Arthropoda (66% and 65% of organisms in GB01 and GB02, respectively) and Annelida (27% and 25% of organisms in GB01 and GB02, respectively) phyla. GB04, located eastward and farther away from GB01 and GB02, had ecological indices and infaunal community composition that differed noticeably from the other two sites.

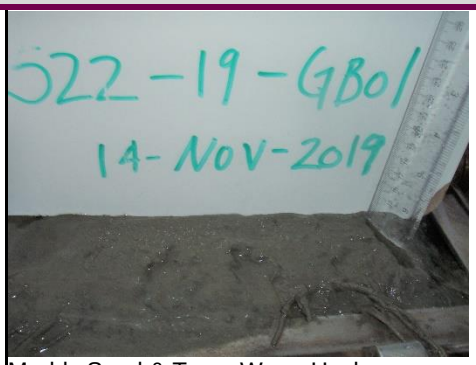
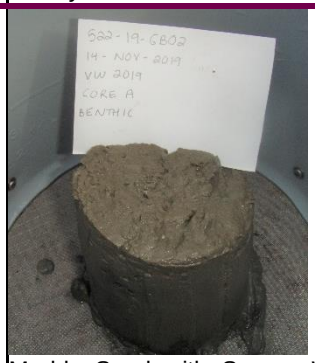
Table 13 Community composition parameters calculated for each grab sample station.

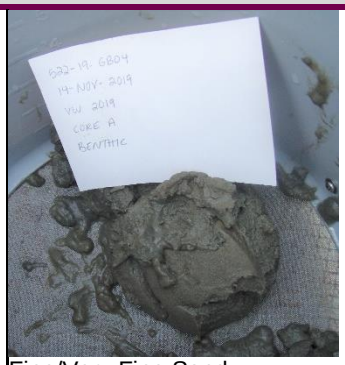
Station	Abundance (# of individuals per 0.008 m^2)	# of Taxa	Ecological Indices		
			Richness	Diversity	Evenness
GB01	194	17	3.04	1.52	0.54
GB02	295	20	3.34	1.75	0.59
GB04	127	10	1.86	0.70	0.30
Totals	616	28	4.20	1.85	0.55

4 CMECS CLASSIFICATIONS

We assigned CMECS classifications to each grab sample station based on visual inspection of the sample on board the ship, as well as laboratory analysis of grain size and infaunal communities. We also assigned a CMECS substrate classification to each still image from the underwater video transects that were analyzed for percent cover. Table 14 shows the images of each grab sample and core after retrieval along with the CMECS classifications.

Table 14 Images of grab and subsequent core samples prior to processing, along with CMECS classifications.

Station	Grab Sampler	Core Sample
GB01	 Muddy Sand & Trace Worm Hash	 Muddy Sand & Trace Worm Hash
GB02	 Muddy Sand with Sparse Worm Hash and Amphipod Bed	 Muddy Sand with Sparse Worm Hash and Amphipod Bed
GB03*	 (A) Clam Rubble Substrate	 (B) Clam Rubble Substrate

Station	Grab Sampler	Core Sample
GB04	 Fine/Very Fine Sand	 Fine/Very Fine Sand

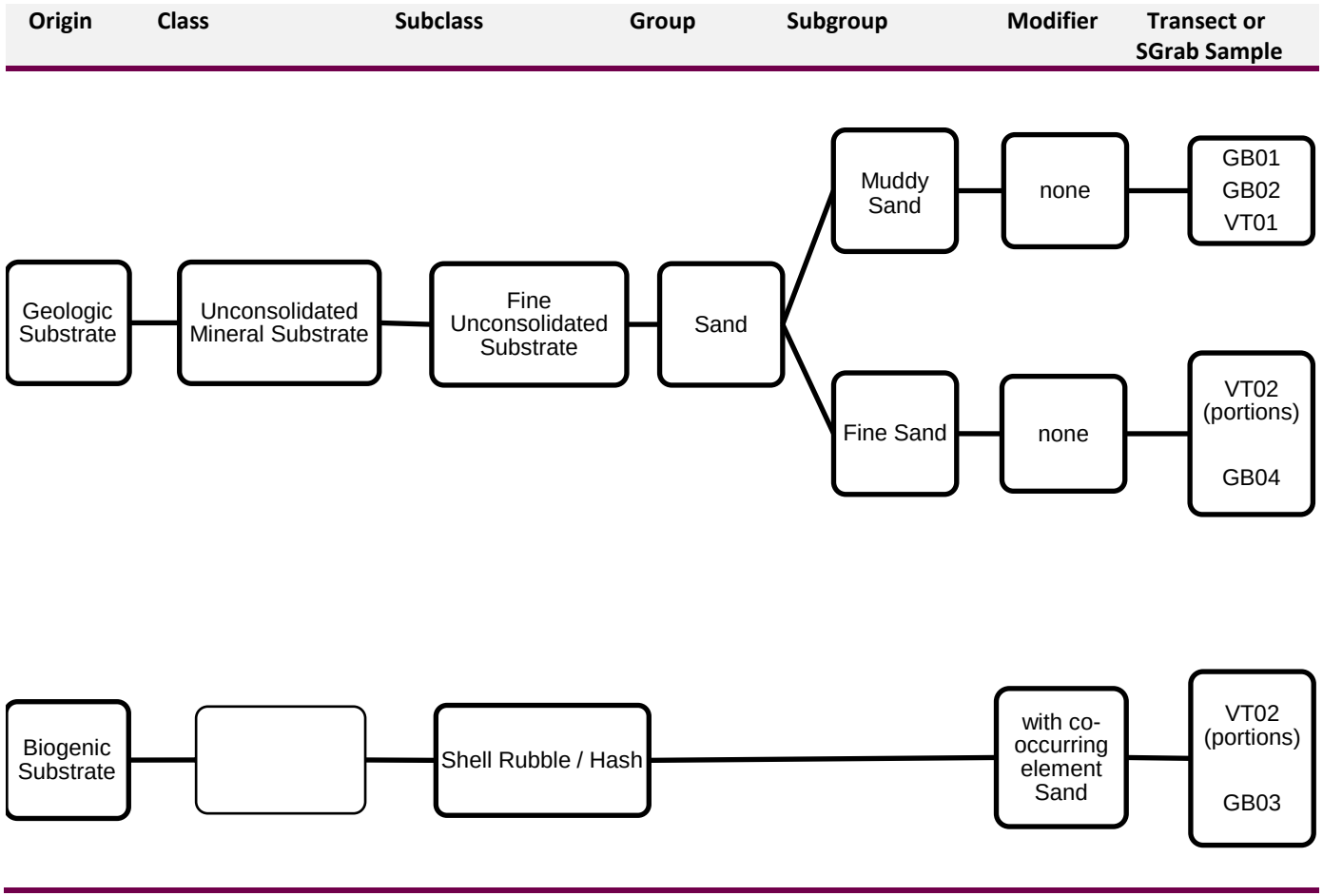
* Note: Images for GB03 represent the two of the three failed grab attempts.

Substrate classification results are presented as a hierarchy in Table 15 for both grab and video samples. Grab samples from the two sites nearest each other to the west (GB01 and GB02) were both classified as muddy sand (no gravel, ~ 85% fine sand, ~15% silt/clay). The video survey nearest these grab sites, VT01, was also classified as sand/mud from the imagery and can be assumed to have similar silt/clay components as the grab samples, classifying it in the muddy sand subgroup.

Grabs at GB03 did not recover sediment because of the large amount of shell rubble present; this was classified as biogenic shell rubble with co-occurring sand. This sample is in the same vicinity of VT02, portions of which were also classified as biogenic shell rubble during the video review. GB04, which is near both GB03 and VT02, was classified as fine sand which is indicative of the pattern observed in the field of sandy crests with shell rubble collected in troughs in between.

Maps displaying the location and CMECS classification of each individual still image analyzed for the video transects are provided below (Figure 11 and Figure 12).

Table 15 CMECS hierarchical classification of substrates collected at each grab sample or video transect.



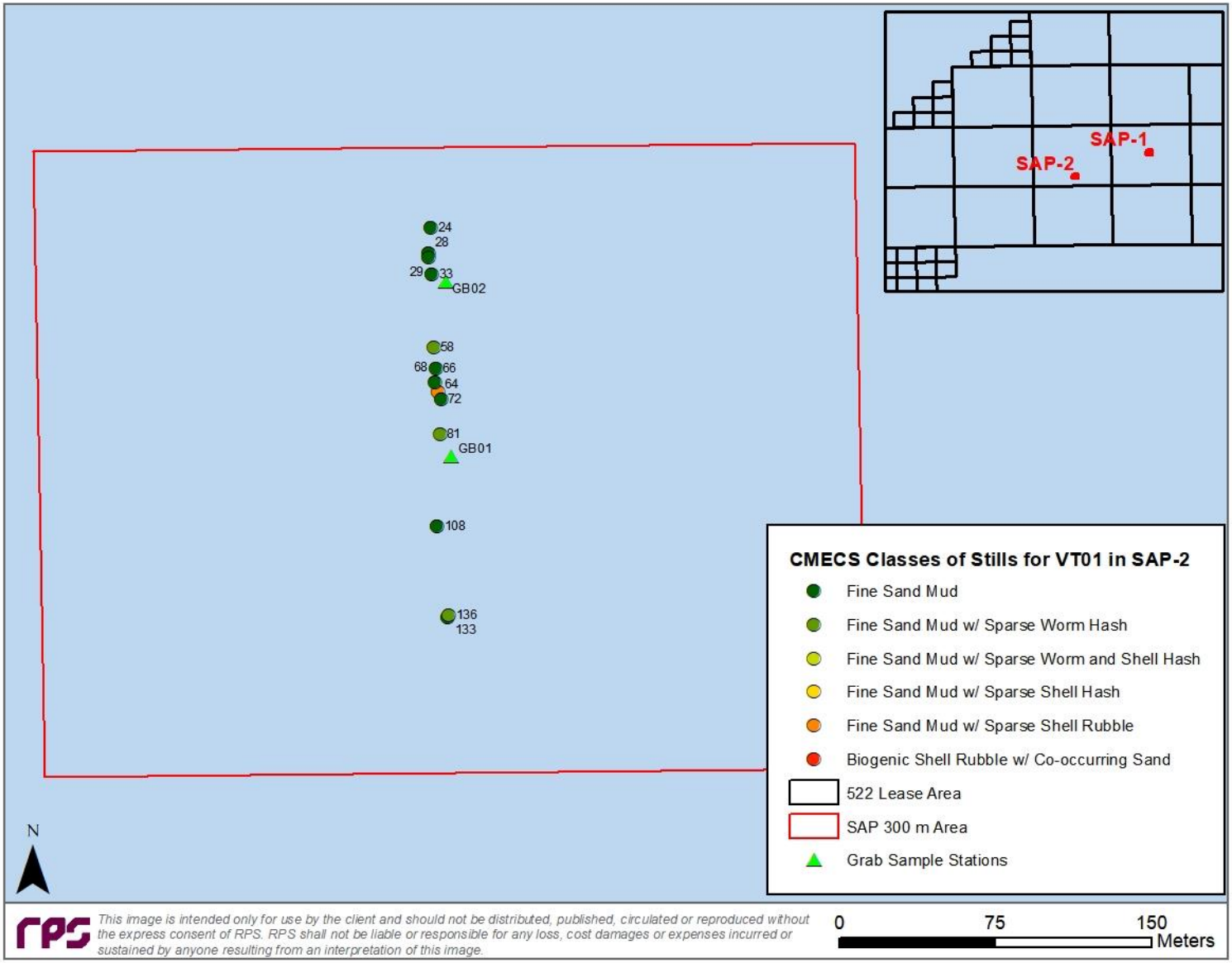


Figure 11 CMECS substrate classification for all viable still images in VT01 (numbers indicate still image ID).

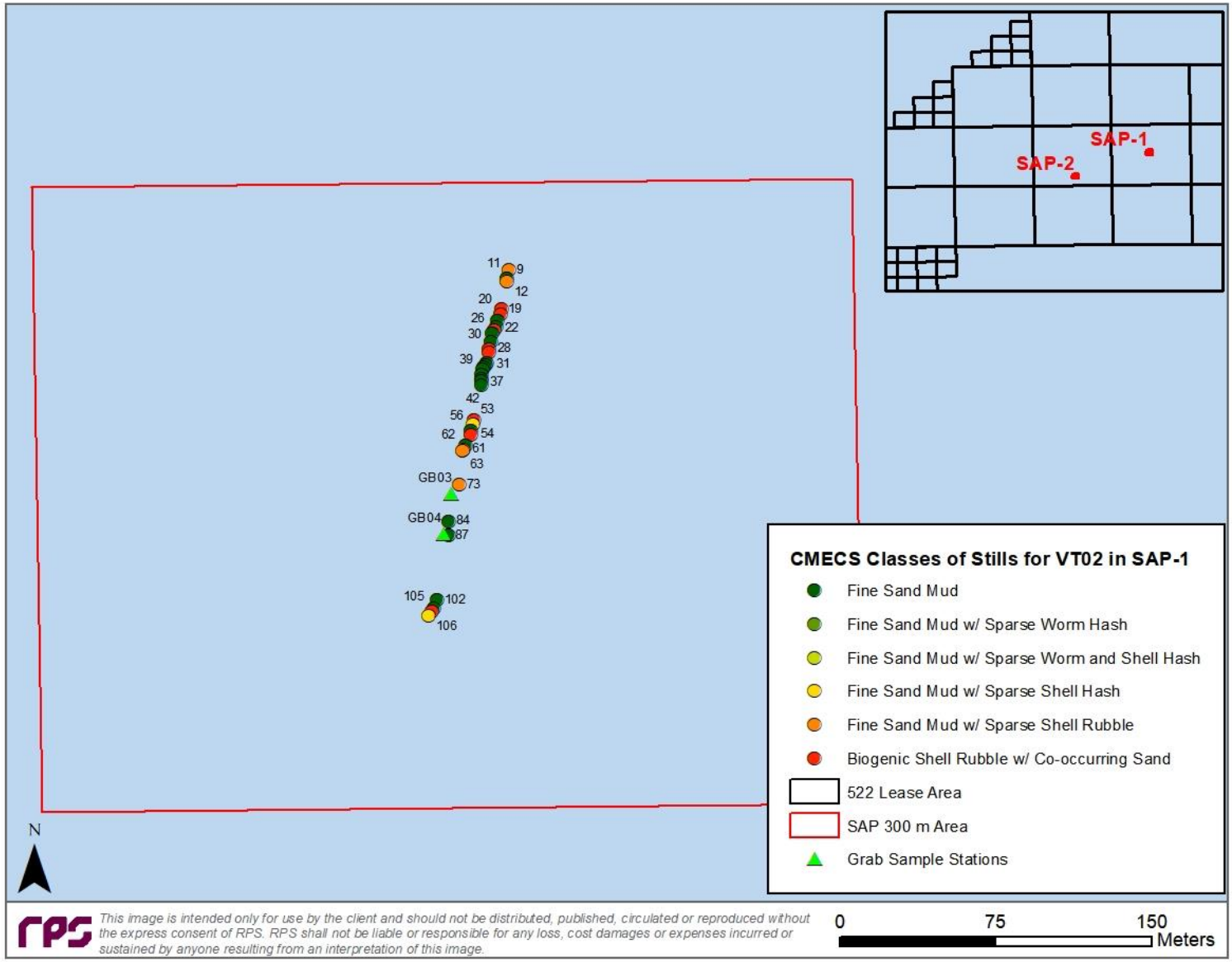


Figure 12 CMECS substrate classification for all viable still images in VT02 (numbers indicate still image ID).

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