



Final Supplemental Site-Specific Environmental Assessment for Pioneer Array Modifications and Relocation to the Mid-Atlantic Bight

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**OCEAN
OBSERVATORIES
INITIATIVE**

Final Supplemental Site-Specific Environmental Assessment for Pioneer Array Modifications and Relocations to the Mid-Atlantic Bight

Prepared for

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DEFINITIONS & ACRONYMS

~	approximately
ADCP	Acoustic Doppler Current Profiler
ARF	U.S. Academic Research Fleet
AUV	autonomous underwater vehicle
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CGSN	Coastal and Global Scale Nodes
CVOW	Coastal Virginia Offshore Wind
DCM	North Carolina Division of Coastal Management
EA	environmental assessment
EFH	Essential Fish Habitat
EM	electromechanical
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
HAPC	Habitat Areas of Particular Concern
IMO	International Maritime Organization
km	kilometer
km²	square kilometer
LNM	Local Notice to Mariners
m	meter
m²	square meter
MAB	Mid-Atlantic Bight
MMPA	Marine Mammal Protection Act
Mooring Site	2 km by 2 km area surrounding each mooring location of the Pioneer Array
NARW	North Atlantic right whale
NC Survey Final EA	North Carolina Survey Final Environmental Assessment
NEPA	National Environmental Policy Act
NES	New England Shelf
NLAA	not likely to be adversely affected
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOTMAR	Notice to Mariners
NSF	National Science Foundation
NWP	Nationwide Permit
O&M	operations and maintenance
OCS	Outer Continental Shelf
OOI	Ocean Observatories Initiative
OOIFB	Ocean Observatories Initiative Facility Board
PATON	Private Aids to Navigation

PEA	Programmatic Environmental Assessment
Project	Pioneer Array
Project Area	~13 nm to 45 nm offshore off the coast of Nags Head, North Carolina
Proposed Action	Relocating the Pioneer Array with modifications to the MAB
ROV	remotely operated vehicle
SAFMC	South Atlantic Fisheries Management Council
SER	Supplemental Environmental Report
SOP	Standard Operating Procedure or Special Operating Procedure
SSEA	Site-Specific Environmental Assessment
SSSEA	Supplemental Site-specific Environmental Assessment
Tetra Tech	Tetra Tech, Inc.
UNOLS	University-National Oceanographic Laboratory System
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USCG	U.S. Coast Guard

1 PURPOSE

This Supplemental Site-specific Environmental Assessment (SSSEA) has been prepared to assess the potential impacts on the human and natural environments associated with proposed changes to components of the U.S. National Science Foundation (NSF) Ocean Observatories Initiative (OOI) Coastal Pioneer Array, including: 1) proposed relocation from the northern Mid-Atlantic Bight (MAB) on the New England Shelf (Pioneer NES) to the southern MAB east of Nag's Head, North Carolina (henceforth "Pioneer MAB"; Figure 1); 2) modifications in the mooring design; and 3) inclusion of additional scientific instrumentation. The SSSEA tiers to OOI documentation previously prepared pursuant to the National Environmental Policy Act of 1969 (42 United States Code [U.S.C.] §4321 *et seq.*; NEPA),¹ including a Programmatic Environmental Assessment (PEA; NSF 2008); a Site-specific Environmental Assessment (SSEA; NSF 2011a); Findings of No Significant Impacts (FONSI; NSF 2009a, 2011b); and Supplemental Environmental Reports (SER; NSF 2009b, 2013, 2015). The SSSEA was prepared in compliance with NEPA, the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] 1500-1508), and NSF procedures for implementing NEPA and Council on Environmental Quality regulations (45 CFR 640). The NEPA process ensures that environmental impacts of proposed major federal actions are considered in the decision-making process.

The SSSEA focuses on activities and associated potential impacts that were not previously assessed in OOI NEPA documentation. The SSEA was prepared by the NSF to assess the potential impacts on the human and natural environments associated with proposed site-specific requirements in the design, installation, and operation of the OOI that were initially assessed in the PEA (NSF 2008,) and the 2009 SER (NSF 2009b). The SSEA analysis concluded that installation and operations and maintenance (O&M) of the proposed OOI infrastructure, as presented in the 2011 Final SSEA, would not have a significant impact on the environment and a FONSI was signed on January 31, 2011 (NSF 2011b). In addition, SERs were prepared in 2013 and 2015 to determine if proposed OOI design modifications since completion of the 2011 SSEA would result in significant impacts to the environment not previously assessed in the SSEA, including cumulative impacts. Based on the analysis in the 2013 and 2015 SERs, there were no additional impacts on any resource area with implementation of the proposed OOI design modifications, and the 2013 and 2015 SERs concluded that the FONSI for the 2011 SSEA was still warranted (NSF 2011b), and additional NEPA documentation was not necessary.

1.1 Background of the OOI Coastal, Regional, and Global Scale Nodes

The following is a brief summary and background of the OOI based upon the information provided in the 2011 SSEA. For a more detailed description of the purpose, goals, and design of the OOI, and the mission of the NSF, which remain unchanged, please refer to the 2008 PEA; 2011 SSEA; and 2009, 2013, and 2015 SERs.

To provide the U.S. ocean sciences research community with the basic sensors and infrastructure required to make sustained, long-term, and adaptive measurements in the oceans, the NSF Division of Ocean Sciences supported the creation of the OOI major facility. The final design and form of the OOI was the result of planning guided by input from the U.S. and international scientific community. OOI builds upon recent technological advances, experience with existing ocean

¹ Previous OOI NEPA documentation is available on the NSF website: <https://www.nsf.gov/geo/oce/envcomp/>.

observatories, and lessons learned from several successful pilot and test bed projects. The OOI is an interactive, globally distributed, and integrated network of cutting-edge technological capabilities for ocean observations. This network of sensors enables the next generation of complex ocean studies at the coastal, regional, and global scales.

The OOI infrastructure includes cables, buoys, deployment platforms, moorings, junction boxes, electric power generation (e.g., solar, wind, and undersea cabled power supplies), mobile assets (i.e., autonomous underwater vehicles [AUV] and gliders), and two-way communications systems. This large-scale infrastructure supports sensors located at the sea surface, in the water column, and at or beneath the seafloor.

As described in detail in the PEA, the OOI design is based upon three main physical infrastructure elements across global, regional, and coastal scales. At the global and coastal scales, mooring observatories provide locally generated and/or stored power to seafloor and platform-mounted instruments and sensors, and use satellite or other wireless technologies to link to shore stations and the Internet. Up to four Global Scale Nodes or mooring arrays for ocean sensing are installed in the Eastern Pacific and Atlantic Oceans. The Regional-scale Nodes off the coast of Oregon consist of seafloor and mooring observatories with various physical, chemical, biological, and geological sensors linked with submarine cables to shore that provide power and Internet connectivity. The Coastal Scale Nodes are represented by the Endurance Array off the coast of Washington and Oregon and the Pioneer Array (Project) off the east coast of the U.S. The Pioneer Array was designed and planned to be relocatable approximately every 5 years with new locations proposed by the scientific community.

1.2 Scope of this SSSEA

The scope of the environmental impact analysis of this SSSEA is tiered from the previously prepared PEA, associated FONSI, and SERs. It focuses only on those activities and the associated potential impacts, including cumulative impacts, not previously assessed in the tiered NEPA documents:

- Relocation of the Pioneer Array from the original Pioneer NES to the proposed Pioneer MAB location;
- Modifications to the mooring components and mobile assets as applied to the proposed Pioneer MAB relocation; and
- Inclusion of additional scientific instrumentation.

All other components, installation, and O&M activities of the OOI would remain unchanged from the description and analysis presented in the PEA, SSEA, and SERs. Section 2.0 describes in detail the proposed changes to the Pioneer Array addressed in this SSSEA. Although O&M would remain the same, Standard Operating Procedures (SOP, also referred to as Special Operating Procedures in previous documentation) were reviewed and were included in this SSSEA for context. For the Pioneer MAB Array, the surrounding area of potential effect would consist of seven sites that would have 10 total moorings deployed, with three sites accommodating two moorings side-by-side. Each mooring site would include an area of 2-kilometer (km) x 2 km (1 nautical miles [nm] x 1 nm) surrounding the site center. In addition, there would be mobile assets, such as AUVs and gliders that would operate around the moorings (see Figure 1).

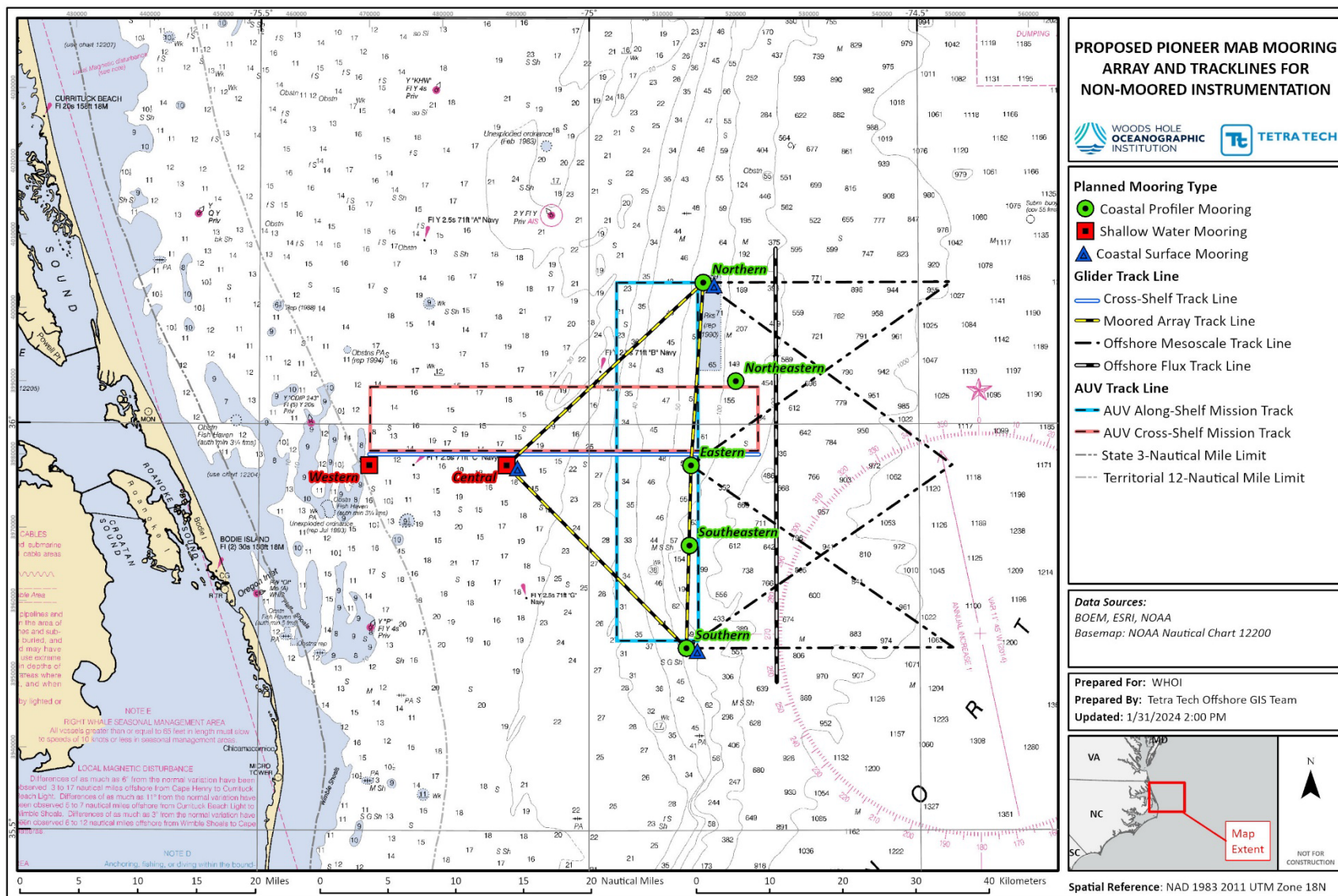


Figure 1. Proposed Pioneer MAB Array of Moorings and Surface Expressions of Underwater Track Lines for Mobile Assets

2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

In this SSSEA, two alternatives were evaluated: 1) Proposed Action: Relocating the Pioneer Array with modifications to the MAB; and 2) No Action.

2.1 Proposed Action: Relocating the Pioneer Array with Modifications to the MAB

2.1.1 Pioneer MAB Array

The MAB of eastern North America is characterized by a relatively broad shelf, a persistent equator-ward current originating from the north, a well-defined shelf break front separating shelf and slope waters, distributed buoyancy inputs from rivers, variable wind forcing, and intermittent offshore forcing by Gulf Stream rings and meanders. The Pioneer MAB Array would be designed to resolve transport processes and ecosystem dynamics within the shelf-slope front, which is a region of complex oceanographic dynamics, intense mesoscale variability, and enhanced biological productivity. It collects high-resolution, multidisciplinary, synoptic measurements spanning the shelf and shelf-break on horizontal scales from a few kilometers to several hundred kilometers.

The proposed Pioneer MAB Array would be a T-shaped array located off the coast of Nags Head, North Carolina, starting approximately (~) 24 km (13 nm) offshore, extending ~59 km (32 nm) east/west and 49 km (26 nm) north/south across the continental shelf, centered at the shelf-break front (Figure 1 and Table 1), referred to as the Project Area.

Similar to the original Pioneer NES array, the Pioneer MAB Array would employ Shallow Water Moorings, Coastal Surface Moorings, Coastal Profiler Moorings, Gliders, and AUVs to sample on multiple horizontal scales from the air-sea interface to the seafloor. The Shallow Water Moorings (Figure 1) would be equipped with a small surface expression for navigational aids and data telemetry equipment, a profiling vehicle to sample the water column, and would be moored to the seabed with an inductive wire and electromechanical (EM) stretch hoses, allowing incorporation of a benthic node for seabed instrumentation. The Coastal Profiler Moorings (Figure 3) would be similar to the Shallow Water Moorings but would not have a benthic node. The Coastal Surface Moorings (Figure 4) would be equipped with a surface expression carrying navigational aids, data telemetry systems, instrumentation to measure surface meteorology and air-sea fluxes, fitted with power generation capability, and moored with EM stretch hoses to the seafloor, allowing incorporation of a benthic node for science user instrumentation.

2.1.2 Pioneer MAB Array Components

The Pioneer MAB Array would consist of two lines of moorings running east/west and north/south in a T-shape across the continental shelf (Figure 1). The east/west line would consist of two Shallow Water Moorings (Figure 2), a Coastal Profiler Mooring (Figure 3), and a Coastal Surface Mooring (Figure 4). The north/south line would consist of Coastal Surface Moorings and Coastal Profiler Moorings. In total, 10 moorings would be deployed in 7 locations, as the Coastal Surface Moorings are paired with other moorings at the same location (Figure 1).

Table 1. Planned Mooring Types and Locations

Mooring Name	Mooring Type	Water Depth (meters)	Latitude (°N)	Longitude (°E)
Western	Shallow Water	30	35.9500	-75.3333
Central	Shallow Water and Coastal Surface	30	35.9500	-75.1250
Eastern	Coastal Profiler	100	35.9500	-74.8457
Northern	Coastal Profiler and Coastal Surface	100	36.1750	-74.8267
Southern	Coastal Profiler and Coastal Surface	100	35.7250	-74.8530
Northeastern	Coastal Profiler	300	36.0536	-74.7776
Southeastern	Coastal Profiler	300	35.8514	-74.8482

The Shallow Water Moorings (Figure 2) would be deployed in 30-meter (m) water depths, and the Coastal Profiler Moorings (Figure 3) would be deployed in 100-m and 300-m water depths. The Northeastern and Southeastern Coastal Profiler Moorings were initially proposed to be deployed in 600-m water depth. Taking into consideration comments received during the NEPA public comment period (see Appendix G), these moorings would be deployed in 300-m water depths to mitigate potential impacts on longline fisheries. Additional information regarding this change can be found in Section 3.1.2.6.1 Fisheries. The Coastal Surface Moorings (Figure 4) would be deployed in 30-m and 100-m water depths (see Table 1).

Gliders and AUVs would run missions in the vicinity of the moored array. The approximate surface expressions of the underwater track lines indicating the glider and AUV paths are shown in Figure 1. Both gliders and AUVs move slowly forward (0.25 m per second or 0.5 miles per hour for gliders, 3 m per second or 6 miles per hour for AUVs), while also moving up and down in the water column. The planned tracks are approximate and would be adjusted as needed to account for bathymetry and currents, and therefore may curve as needed to cover the area of concern. Four (4) gliders would be used to provide monitoring capability along and across the continental shelf and within the slope sea offshore. Gliders would be deployed on a 60- to 90-day rotation schedule and would run continuously along their pre-determined paths (Figure 1). The gliders are piloted from shore using satellite communications during short intervals when the vehicles are on the surface, and procedures are in place to maintain the gliders at depth through charted marine traffic areas. Two (2) AUVs would be used to provide monitoring capabilities along and across the continental shelf near the moored array. AUVs would be deployed for limited periods of ~4 days every 2 months. AUVs are piloted from a research ship which would remain in the deployment area and monitor vessel traffic.

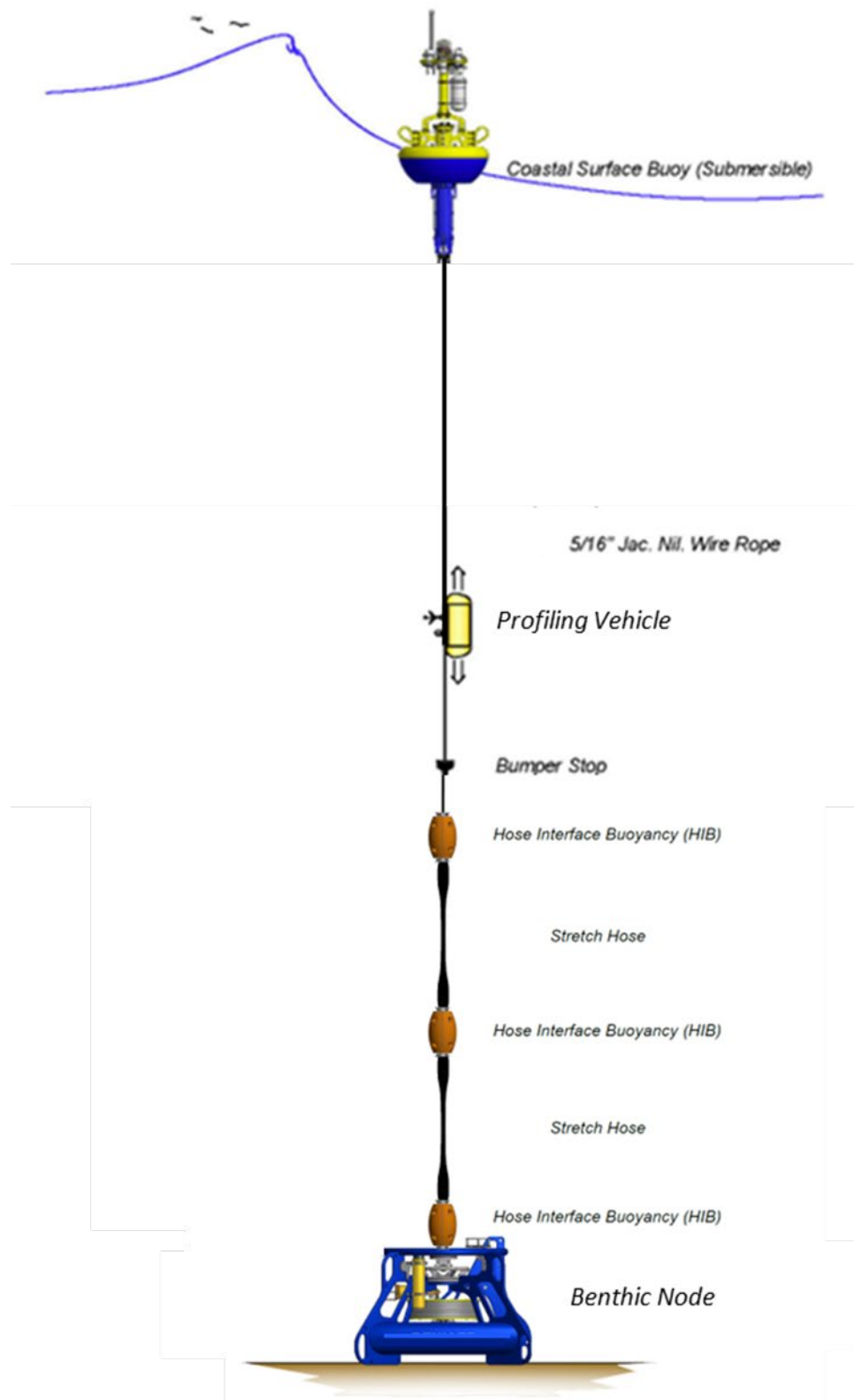


Figure 2. Proposed Shallow Water Mooring Design

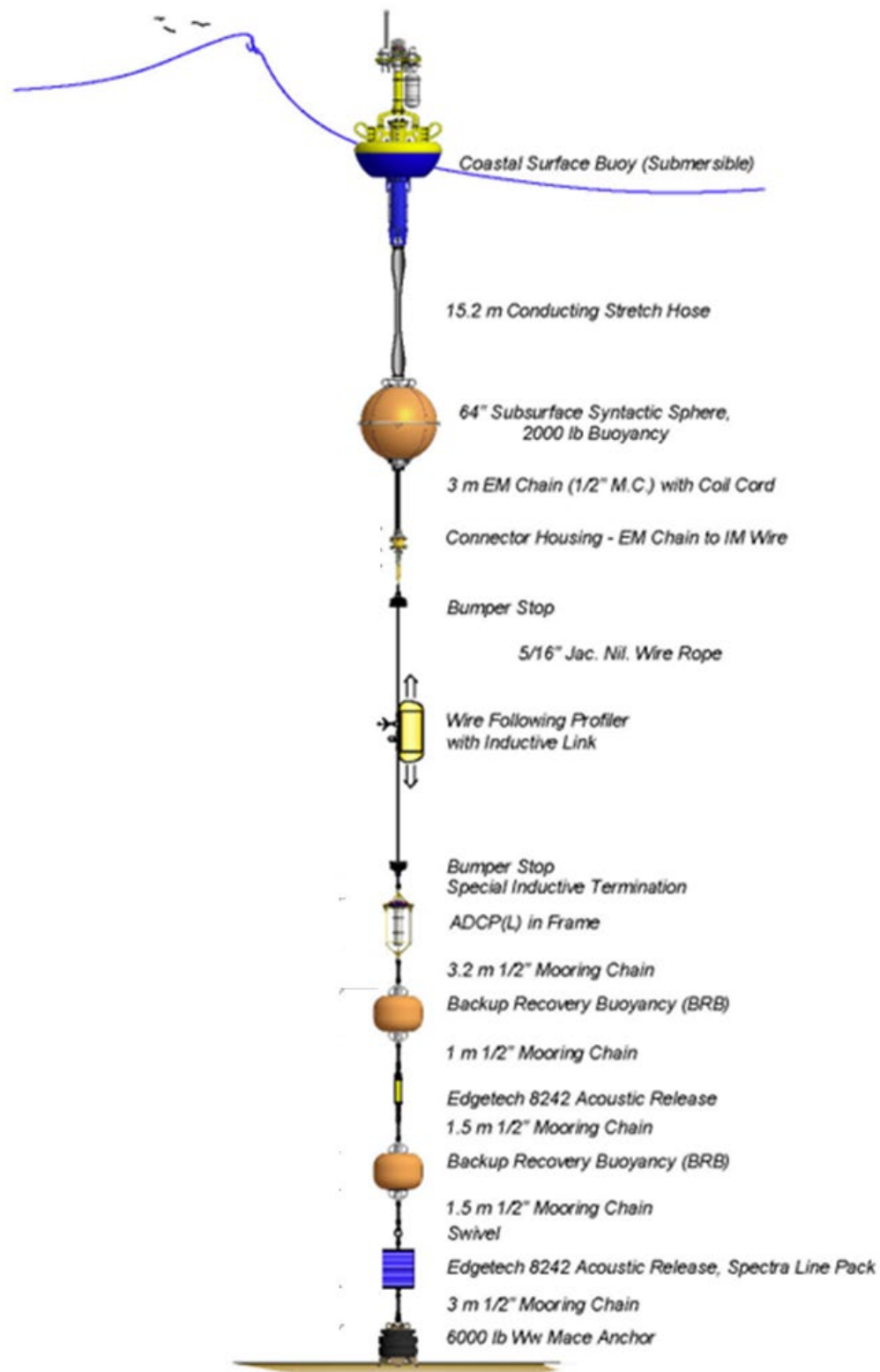


Figure 3. Proposed Coastal Profiler Mooring Design

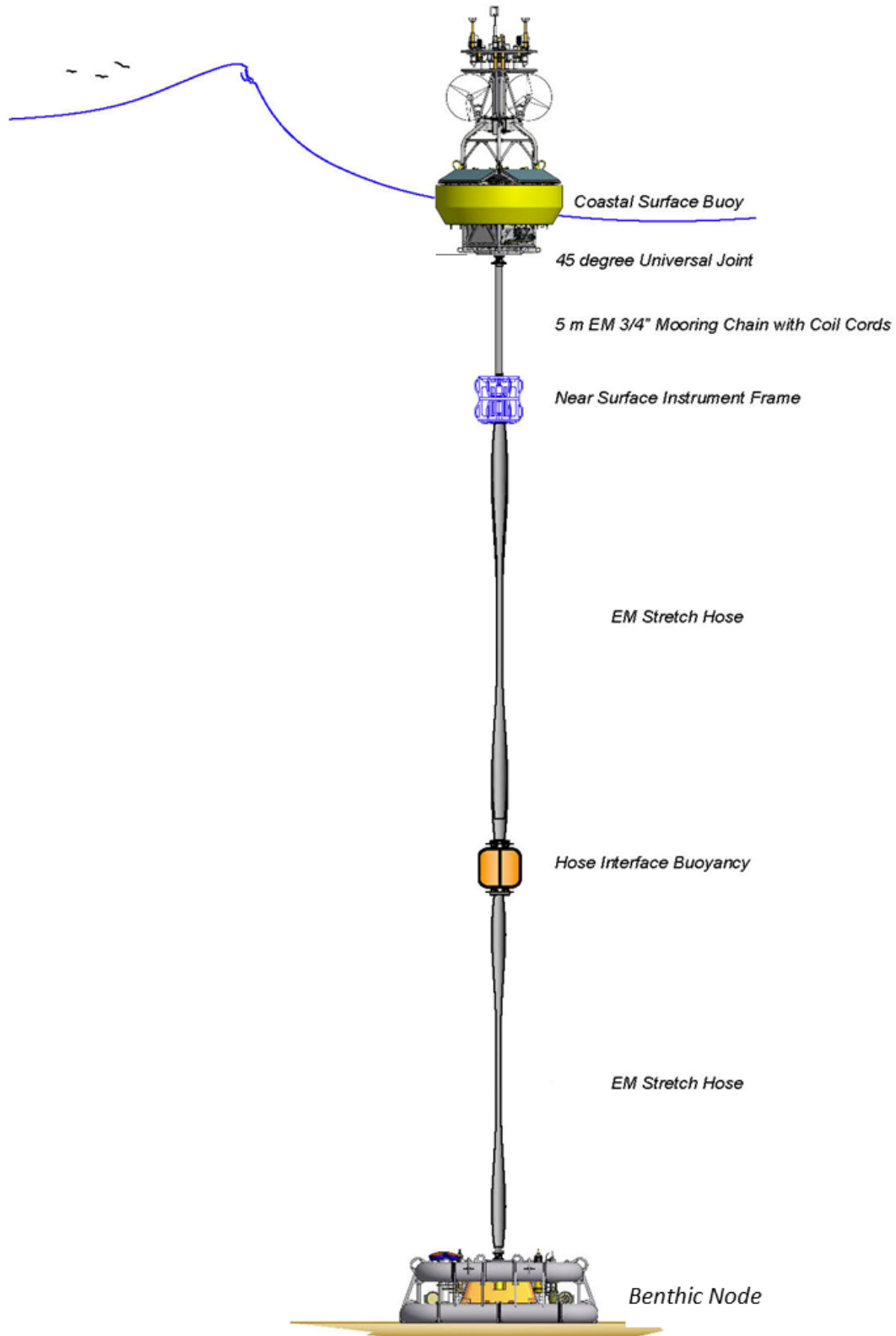


Figure 4. Proposed Coastal Surface Mooring Design

2.1.3 Proposed Pioneer Array Location and Design Modifications

As assessed in this SSSEA, the proposed changes in the Pioneer Array location and configuration would include:

- Relocation to the MAB;
- Modifications to the moored array; and
- Inclusion of additional scientific instrumentation.

2.1.4 Relocation of Pioneer to the MAB

As part of the original design of OOI, the Pioneer Array was expected to be relocated approximately every 5 years. In 2020, the NSF and the OOI Facilities Board (OOIFB) announced the process for the potential relocation of the Pioneer Array. The NSF, along with the OOIFB, organized a series of workshops to select the location, develop the science themes, layout the infrastructure, and recommend instrumentation. The site selection and design process steps undertaken are described in more detail in Appendix A.

The six baseline science themes found in the OOI Science Plan (<https://ooifb.org/ooi-science-plan/>) were initially developed by the scientific community for OOI and were retained as guidance for the Pioneer Array relocation:

1. Ocean-atmosphere exchange and coastal storm response;
2. Climate variability and ecosystems;
3. Coastal dynamics and biogeochemical cycling;
4. Seafloor processes;
5. Physical oceanography of the shelf and slope; and
6. Interactions of physical and biological processes.

The scientific community also highlighted three topics specific to the Pioneer MAB Array within the baseline themes:

1. Dynamical processes at the shelf break, including wind forcing, frontal instability, and Gulf Stream influences;
2. Physical/biogeochemical coupling, including carbon, nutrients, and particulates, and considering ecosystem response to cycling and transport; and
3. Episodic events and impacts, such as freshwater outflows and hurricanes.

Also, based on the third NSF-sponsored workshop, the science community confirmed the utilization of the existing mooring components, with minor modifications, from the Pioneer NES Array reviewed in the previous SSEA and SERs.

To support the environmental assessment of the proposed new location, regulatory (Appendix B), desktop (Appendix C), and marine archeology studies (Appendix D) were undertaken by OOI and its contractor, Tetra Tech, Inc. (Tetra Tech). Further details of the efforts to identify locations for the moorings in the Project Area were included in the Coastal and Global Scale Nodes (CGSN) Site Characterization (Appendix E). A remotely operated vehicle (ROV) was used to inspect and verify that anchoring the scientific moorings within each proposed 2-km by 2-km (1-nm by 1-nm) square, or Mooring Site, would have minimal to no impacts to environmental resources (Appendix F).

2.1.5 Modifications to the Moored Array

A list of components previously assessed in the PEA, SSEA, and SERs for Pioneer NES Array versus the proposed components for Pioneer MAB Array in this SSSEA is provided in Table 2.

Table 2. Pioneer NES/MAB Component Comparison

Component	Pioneer NES	Pioneer MAB
Moorings	3 Coastal Surface Moorings with Benthic Node (8 m ² footprint each)	3 Coastal Surface Moorings with Benthic Node (8 m ² footprint each)
	7 Coastal Profiler Moorings with anchor (1 m ² footprint each)	5 Coastal Profiler Moorings with anchor (1 m ² footprint each)
	–	2 Shallow Water Moorings with Benthic Node (4 m ² footprint each)
AUVs	2 AUVs, Mission Box = 8,537 km ²	2 AUVs, Mission Box = 4,318 km ²
Gliders	6 Gliders, Mission Box = 24,507 km ²	4 Gliders, Mission Box = 17,143 km ²

AUV—autonomous underwater vehicle; km²—square kilometer; m²—square meter; MAB—Mid-Atlantic Bight; NES—New England Shelf

The Coastal Surface and Coastal Profiler Moorings proposed for the Pioneer MAB Array location are identical in design to the Pioneer NES Array moorings. The new deployment depths would alter the length of the riser components but would not alter the design or material types. The original SSEA and both the 2013 and 2015 SERs noted that the Coastal Surface Moorings could be powered by a methanol fuel cell. The fuel cells were never deployed and have been removed, eliminating the risk of a potential spill of alcohol-based fuel.

Two Shallow Water Moorings are proposed at the new MAB location. These moorings would operate similarly to the existing Coastal Profiler Mooring, utilizing an instrumented vehicle that moves up and down along a taut wire, but are designed for shallow water. The Shallow Water Mooring would consist of the following (Figure 2):

- A small surface expression mounted with aids to navigation, data telemetry equipment, and battery housing for the mooring operation;
- A profiler vehicle containing scientific instrumentation for sampling the water column;
- A mooring riser consisting of inductive wire and EM stretch hoses; and
- A benthic node containing seafloor instrumentation.

All components of the Shallow Water Mooring are based on existing designs, incorporating elements of both the Coastal Surface Moorings and Coastal Profiler Moorings from Pioneer NES Array. As with all the Pioneer Array moorings, the benthic node and anchor of the Shallow Water Moorings are designed to be fully recoverable, minimizing impacts to the seabed. The capability to fully recover all mooring anchors was proven in November 2022 when Pioneer NES was recovered, and all infrastructure was removed from the seabed successfully. The Pioneer MAB Array designs would be deployed, recovered, and maintained using the same procedures as the original Pioneer NES Array moorings.

2.1.6 Inclusion of Additional Scientific Instrumentation

During the Pioneer Array relocation planning process, additional measurements were requested by the scientific community:

- **Phytoplankton Imaging:** submersible flow cytometry (i.e., a measure of light scattering and fluorescence from a single cell or particle) and high-resolution imagery of suspended particulates.
- **Turbidity:** a measure of clarity based on light scattered by suspended particulates.
- **Near-surface Velocity:** a measure of water velocity in the upper 20 m of the water column.
- **Suspended Particulates:** a measure of the size of suspended particulates.

The Pioneer Array moorings were designed to allow the addition of new instrumentation. The few instruments requested could be incorporated into the Pioneer infrastructure with only minor modifications in bracketry. New instrumentation includes phytoplankton imaging via imaging flow cytometry on coastal surface moorings, turbidity using optical measurement on coastal surface moorings, near-surface velocity using acoustic measurement on coastal profiler mooring and shallow water moorings, and suspended particulates using optical measurement on coastal surface moorings.

2.1.7 Installation and O&M of Pioneer Array

The Pioneer MAB Array is proposed to be deployed in April 2024. Following deployment, the moored array would be serviced using a University-National Oceanographic Laboratory System (UNOLS) Global or Ocean Class vessel in April/May and August/September of each year (i.e., every 6 months). These periods offer the most suitable weather and sea conditions to perform the mooring recoveries and re-deployments. Vessel scheduling issues and other unforeseen events (e.g., weather) might require that some maintenance cruises occur outside of the planned time window in a given year. Other activities during the maintenance cruises include Glider recoveries/deployments as necessary, and AUV surveys. Since Gliders have an endurance of 75-90 days, they require recoveries and deployments between maintenance cruises using small research or charter vessels. AUV surveys are planned for every 2 months, and would also require small vessel cruises except for the two times per year that surveys are conducted during the mooring maintenance cruises. A proposed schedule for installation, operations, and maintenance is included below in Table 3.

Table 3. Proposed Schedule for Installation and Operation and Maintenance

Operation	Description	Date	Duration	Vessel
Deployment at MAB	First deployment of moorings, gliders, and AUVs at planned MAB site	April 2024	~24 days	UNOLS Research Vessel
Spring Maintenance Cruise	Spring recovery and replacement of moorings, deployment of gliders & AUVs	April/May	~24 days	UNOLS Research Vessel
Fall Maintenance Cruise	Fall recovery and replacement of moorings, deployment of gliders & AUVs	August/September	~24 days	UNOLS Research Vessel
Glider Operations	Deployment and recovery of gliders based on vehicle endurance	Every 75-90 days	~2-3 days	Small research or charter vessel
AUV Operations	AUV surveys of Pioneer MAB, vehicles deployed for ~2 days, then recovered	Every 2 months	~5-7 days	Small research or charter vessel

The methods for the installation of the Pioneer MAB Array infrastructure, and for conducting routine O&M activities, would be the same as those described in the 2011 SSEA (refer to Section 2.2.6 of the PEA [NSF 2008]). Installation and O&M activities follow standard methods and procedures currently used by the ocean observing community, such as the National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center; regional ocean observing programs funded by the NOAA Integrated Ocean Observing System (<https://www.ioos.noaa.gov>); and other federal agencies (e.g., U.S. Department of Energy, see: <https://www.pnnl.gov/projects/wind-forecast-improvement-project-3>). The moorings deployed at Pioneer NES included anchors and benthic nodes that were designed to be fully recoverable minimizing impacts to the seabed. Following the last recovery of the Pioneer NES Array in November 2022, all seabed infrastructure was recovered successfully proving the effectiveness of the design. There would be no changes to the installation of the Pioneer MAB Array components, as addressed in Sections 2.1.1.3 and 2.1.1.4 and Tables 2 and 3 of the 2013 and 2015 SERs.

2.1.8 Special Operating Procedures for Installation and Operation and Maintenance of the Proposed Modifications to the Pioneer Array

The proposed modifications to the Pioneer Array do not require any changes or additions to the SOPs that were presented in the 2011 SSEA (NSF 2011a, Section 2.2.10, Table 2-13).

The SOPs presented in Table 4 would continue to be followed to avoid and minimize any potential impact to ocean uses/users, (e.g., marine traffic and commercial fishing activities).

Table 4. Standard Operating Procedures

Standard Operating Procedures
<p>1. All Pioneer Array moorings would be permitted as Private Aids to Navigation (PATONs) through the U.S. Coast Guard (USCG). Surface buoys would be marked per USCG requirements, with all required lights and markings, with locations appearing in the Notice to Mariners (NOTMAR) and Local Notice to Mariners (LNM). Surface buoys would be marked with contact information, which would be included in the NOTMAR and LNM with suggested buffer zones* around moorings. Should any vessel accidentally snag Ocean Observatories Initiative (OOI) moorings or equipment, they would be instructed to contact that number and/or the USCG. As Pioneer Array moorings would be considered PATONs, they are protected by USCG rules and regulations pertaining to Aids to Navigation (33 Code of Federal Regulations [CFR] 66 and 33 CFR 70). Penalties for interference, collision, and vandalism can be levied by the USCG in accordance with 33 CFR 70. So long as surface buoys are marked per regional USCG requirements, all lights and markings are operating correctly, and the infrastructure is on the marked location (i.e., as described in NOTMAR and LNM), the OOI project is not liable for snagging of or damage to any gear or vessel.</p>
<p>2. Locations for all moorings and associated components of the Pioneer Array would be published on NOAA charts once moorings are listed in the USCG NOTMAR and LNM. In addition, accurate locational information would be made available to fishers to assist their avoidance of the instruments.</p>
<p>3. The coordinates for Pioneer Array autonomous underwater vehicles (AUV) and glider mission boxes would be published through a NOTMAR. Gliders and AUVs would be marked with the name of the owning organization and a contact telephone number that fishers can call to report potential entanglements.</p>

2.2 Alternatives Considered

An alternative to conducting the Proposed Action is the “No Action” alternative, which is to not relocate the Pioneer Array with modifications to the MAB. Under the “No Action” alternative, the NSF would not provide funding to relocate the Pioneer Array with modifications to the MAB. If the Pioneer Array with modifications was not relocated to the MAB, the “No Action” alternative would result in no disturbance to the marine environment. Although the “No Action” alternative is not considered a reasonable alternative because it does not meet the purpose and need for the Proposed Action, it is included and carried forward for analysis in Section 3.0.

Although the Pioneer Array could be relocated to several sites to collect critical oceanographic data, extensive effort was undertaken by the NSF, OOI, the scientific community, and interested parties to evaluate potential sites for relocating the array, narrowing the selection based on scientific justification to the proposed MAB site, as described in Section 2.1.4. For this reason, relocating the Pioneer Array to other locations as an alternative was eliminated from further consideration. Given that the Pioneer Array is designed to be relocated approximately every 5 years, other locations would be considered and evaluated for future opportunities.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

As this SSSEA tiers off previous documents evaluating the Pioneer NES Array, the affected environment and environmental consequences are the same as those previously discussed and assessed in the 2011 SSEA and 2013 and 2015 SERs; only the changes in the geographic location and the minor array infrastructure modifications proposed for the Pioneer MAB Array are assessed. No additional impacts from operating the Pioneer NES Array were observed by or reported to OOI. Additional resources that are generally evaluated in preparation of an environmental assessment (EA) were not evaluated in this SSSEA because it was determined that implementation of the Proposed Action would be unlikely to have any effect on those resources. Overall, O&M is anticipated to remain at similar levels to prior operations of the Pioneer NES Array. Therefore, these proposed changes (i.e., relocation and array modifications) are the main scope of the analysis in this SSSEA.

3.1 Proposed Action

3.1.1 Array Modifications

The new array instrumentation (e.g., sensors) would be mounted on or incorporated into the existing mooring designs. The type of measurement, method, impact, and mooring to be installed on-site are listed in Table 5.

Table 5. Impact of New Scientific Measurements

Measurement	Method	Impact	Installation
Phytoplankton Imaging	Imaging flow cytometry. Utilizes a combination of natural fluorescence and microscopy.	No adverse impact	Coastal Surface Mooring
Turbidity	Optical measurement. Detection of light scattered by suspended particles.	No adverse impact	Coastal Surface Mooring
Near-surface Velocity	Acoustic Doppler Current Profiler utilizes acoustics (>180 kHz) to measure currents. Existing instrument class in OOI.	Acoustic source considered <i>de minimis</i> ; acoustic frequencies used (>180 kHz) not audible by fish/marine mammals and of low power. No adverse impact	Coastal Profiler Mooring, Shallow Water Mooring
Suspended Particulates	Optical measurement. Particle size estimation through the analysis of laser diffraction.	Illuminated area <1 cm ³ No adverse impact	Coastal Surface Mooring

cm³—cubic centimeter; kHz—kilohertz

Acoustic Doppler Current Profiler (ADCP) instruments would be used to perform the near-surface velocity measurements. ADCPs are an existing OOI instrument class and were reviewed as part of the original SSEA and PEA. The ADCPs would operate at frequencies higher than those frequencies considered audible by fish and marine mammals (i.e., greater than 180 kilohertz).

The potential impacts from the moorings would be the same as those already assessed in the PEA, 2011 SSEA, and 2013 and 2015 SERs, which concluded that no significant effects on the

environment were expected. For these reasons, none of the new instrumentation or measurements would be anticipated to result in significant or adverse impact to the marine environment, including marine biological resources.

3.1.2 Relocation, Installation, and O&M Activities

This section builds from the PEA, 2011 SSEA, and 2013 and 2015 SERs and focuses only on those resources potentially subject to impacts from the Relocation, Installation, and O&M activities.

3.1.2.1 Geological Resources

Regional sediment classification maps (Appendix E) summarize bottom characteristics along the southern portion of the Mid-Atlantic Bight and suggest that, in the OOI mooring region, the seabed is mainly sandy, with some gravelly sediment on the inshore shelf and possible sandy clay or silt on the slope. The seabed surveys performed by OOI in February/March 2023 and October/November 2023 (Appendix F) confirmed the seabed types at each mooring location.

The planned Pioneer MAB Array has the equivalent number of moored components as the original Pioneer NES Array. Although it would have a slightly larger footprint (~37 square meters [m²] versus 31 m² of seabed impacted; see Table 2) the difference was determined to be negligible. As reviewed in the previous SSEA, 2008 PEA, and 2013 and 2015 SERs, the temporary placement of benthic nodes and mooring anchors would result in short-term, insignificant impacts to surface sediments in the immediate vicinity of the proposed Pioneer Array assets, and there would be no significant impacts to marine geological resources. Over time, the natural movement of sediments by ocean currents and burrowing organisms would reestablish natural bottom topography.

Upon conclusion of approximately 5 years of operations, the entire system, including anchors, would be removed and relocated in alignment with the 2011 PEA and other OOI environmental documentation. In November 2022, OOI successfully recovered all Pioneer NES Array infrastructure components, including anchors, leaving nothing on the seabed or in the water column. For these reasons, direct and indirect impacts from the proposed activities on geological resources are not anticipated to be significant.

3.1.2.2 Air Quality

Overall, there would be no change in the level of planned operations and management of the Pioneer Array with the relocation. Proposed activities would result in minor temporary emissions from surface vessels during installation and maintenance activities of the Pioneer MAB Array (Appendix C: page 3-36). These emissions would not be anticipated to represent a substantial increase or decrease above existing NES operating conditions, as only a small number of vessels would be used. Upon conclusion of approximately 5 years of operations, the entire system, including anchors, would be removed and relocated in alignment with the 2011 PEA and other OOI environmental documentation.

The Pioneer MAB array would be located outside the jurisdiction of any state. O&M activities would likely be undertaken by vessels within the U.S. Academic Research Fleet (ARF), or similar types of vessels, which follow high maintenance standards, including International Maritime Organization (IMO) standards. Although there are no emissions standards for vessels or activities operating beyond 22 km (12 nm) of shore and no mitigation would be required, to reduce impacts

on air quality, ARF vessels typically use ultra-low sulfur fuel (less than 15 parts per million of sulfur) and employ Ship Energy Efficiency Management Plans to reduce and minimize fuel consumption (e.g., speed optimization), generally resulting in lower emissions.

For these reasons, direct and indirect impacts from the proposed activities on air quality would be negligible and are not anticipated to be significant.

3.1.2.3 Water Quality

Although the Project would require a federal Nationwide Permit (NWP), given the location of the Project several kilometers outside of state waters, the Project is not anticipated to affect state water quality. As Section 401 Water Quality Certifications are automatically associated with NWPs, a separate authorization application and approval would not be required (Appendix C: page 3-34). Proposed installation, operation, and maintenance activities at the proposed Pioneer MAB Array would not introduce any materials or substances into the marine environment that would adversely affect marine water quality. The Project would not alter currents or circulation regimes. A minor and localized area for which the benthic nodes and anchors would be placed would likely have some re-suspension of sediment, but these effects would be very brief and temporary. Therefore, no direct or indirect impacts to water quality with implementation, operation, or eventual removal of the Pioneer MAB Array are anticipated.

3.1.2.4 Cultural Resources

Potential impacts to cultural resources from the proposed Pioneer MAB Array would only be associated with the placement of 10 benthic nodes and mooring anchors on the seafloor greater than 24 km (13 nm) offshore. The NOAA Marine Cadastre wreck database was referenced (Figure 5; Appendix A: page 14); a desktop review of NOAA, Bureau of Ocean Energy Management (BOEM), and Esri data was performed (Appendix C); and a marine archeology study was undertaken by OOI and Tetra Tech during the planning phase to avoid known cultural resources and wreck locations (Appendix D). In February and March 2023, a site survey was conducted of each proposed mooring site and surrounding 2 km by 2 km (1 nm by 1 nm) square to determine if any known or unknown cultural resources (e.g., shipwrecks) would be present (Appendix F). No cultural resources or hazards were located within the survey areas and all documented wrecks or submerged cultural resources would be avoided by greater than the recommended distance of 50 m. Any overlaps of symbology in Figure 5 are due to the scale of the symbols being larger than the Mooring Sites to be visible in the figure. Therefore, the placement of the proposed Pioneer MAB Array should avoid and not result in impacts to cultural resources.

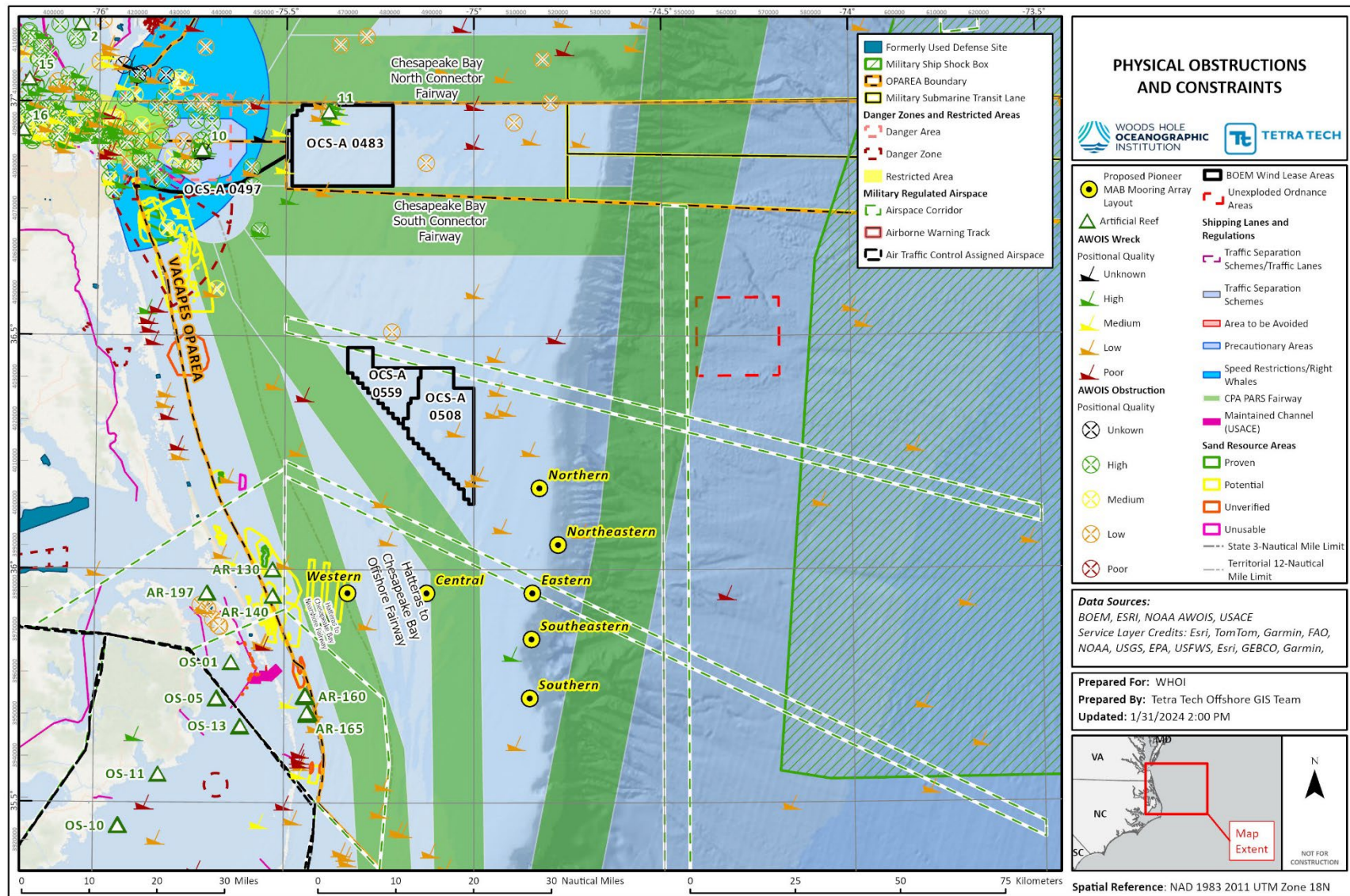


Figure 5. Physical Obstructions and Constraints

3.1.2.5 Marine Biological Resources

There are 36 species of marine mammals (7 large whales, 18 dolphins [including larger oceanic dolphin species], 1 porpoise, 5 beaked whales, 4 seals, and 1 manatee) that occur in the Southeast Atlantic Outer Continental Shelf (OCS) region, and all are protected by the Marine Mammal Protection Act (MMPA). Six of these species are federally listed under the Endangered Species Act (ESA) as threatened or endangered and are known to be present, at least seasonally, in the Mid-Atlantic, five of which have the likely potential of occurring in the Project Area:

- Blue whale (*Balaenoptera musculus*)
- North Atlantic right whale (*Eubalaena glacialis*);
- Fin whale (*Balaenoptera physalus*);
- Sei whale (*Balaenoptera borealis*); and
- Sperm whale (*Physeter macrocephalus*).

Appendix C provides more detailed information on the known marine mammal distributions within coastal North Carolina and the Project Area and summary of key information for each species. Appendix C also indicates species that were not further analyzed as they are unlikely to occur in the Project Area.

The five species of sea turtles that have historically been reported to occur in Mid-Atlantic waters off the coast of North Carolina include the following:

- Atlantic hawksbill (*Eretmochelys imbricata*);
- Green (*Chelonia mydas*);
- Kemp's ridley (*Lepidochelys kempii*);
- Leatherback (*Dermochelys coriacea*); and
- Loggerhead (*Caretta caretta*).

Appendix C provides the known sea turtle distributions within coastal North Carolina and the proposed array area and summary of key information for each species, all of which are listed as threatened or endangered under the ESA.

The vessels and activity associated with installation of 10 moorings and associated scientific sensors on the seafloor may cause marine species to temporarily avoid the immediate vicinity of the proposed Pioneer MAB Array, but this impact would not be significant due to the small scale and temporary nature of the proposed activities (estimated time to deploy a mooring with one vessel is 12 to 24 hours). The vessel used for mooring deployment would move very slowly (0.5 to 2 knots) during the activity and therefore would not pose a vessel strike or collision threat to marine mammals or sea turtles. Furthermore, vessels of the ARF would follow National Marine Fisheries Service (NMFS) standard oceanographic marine mammal vessel strike avoidance guidance and special measures, such as those triggered by temporary Dynamic Management Areas, for the North Atlantic right whale (NARW). Entanglement of marine species is not anticipated because of the rigidity and tautness of the mooring cables and the ability of marine species to detect and avoid the mooring lines. Once installed on the seabed, the proposed mooring anchors and scientific sensors would be equivalent to other hard structures on the seabed, again posing no risk of adverse effect on marine organisms. No known vessel strikes or entanglements were associated with the Pioneer NES Array. Therefore, no significant impacts would be anticipated from the Proposed Action on marine mammal and sea turtle species in the

proposed Project Area. While ESA-listed species may be affected, based on and consistent with past OOI NEPA documents, they would not likely be adversely affected (NLAA). However, based on Pioneer NES Array experience, potential impacts, and other experience with similar research technology, any impacts to marine mammals or sea turtles from the Proposed Action would be anticipated to be very minor and temporary, and thus a determination of no effects may be more appropriate. However, for consistency with past documentation and to ensure compliance with ESA, a NLAA determination for marine mammals and sea turtles was made.

Impacts from the placement of proposed mooring anchors or nodes on the seafloor would include temporary mechanical disturbance of soft sediments and long-term coverage of relatively small areas of substrate by the anchors and scientific sensors. Due to the large water depth in the Project Area, and attenuation of light to such depths, the presence of ESA-listed plant species is not expected. In addition, the video survey of the Project site (Appendix F) indicates that the existence of ESA-listed vegetation is unlikely. This video survey also indicates that the presence of ESA-listed invertebrates is unlikely. Given the footprint of moorings and scientific equipment ($\sim 37 \text{ m}^2$), no significant impact would be anticipated from the Proposed Action on ESA-listed plants or invertebrates, therefore, the Proposed Action is likely to have no adverse effects on these species.

Based on the expected size and number of anchors and scientific sensors on the seafloor, $\sim 37 \text{ m}^2$ of Effective Fish Habitat (EFH) may potentially be impacted during installation activities. (See Appendix C, Table 3-1 for a comprehensive list of EFH which overlaps with the Project Area.) Over time, the natural movement of sediments by ocean currents and burrowing organisms would reestablish natural bottom topography. Upon conclusion of approximately 5 years of operations, the entire system, including anchors, would be removed and relocated in alignment with the 2011 PEA and other OOI environmental documentation. The short-term and minor increases in turbidity and sedimentation resulting from system installation and removal would not affect the ability of EFH to support healthy fish populations, and affected areas are expected to recover quickly.

The use of up to four gliders (survey area of $\sim 17,143$ square kilometers [km^2]) and two AUVs (survey area of $\sim 4,318 \text{ km}^2$) around the Pioneer MAB Array is not expected to affect marine species, as the proposed gliders and AUVs would move within the water column similar to a dolphin or whale. The proposed operational area for AUVs would be smaller than for Pioneer NES, resulting in an overall smaller footprint. Gliders are sealed, contain no motors, fuels, or hazardous materials; and move at very slow speeds (~ 0.5 knot), thereby eliminating the potential for collisions with marine mammals. AUVs also move at low speeds (~ 3.5 knots) with little potential for collisions with marine species. AUV batteries are sealed with little potential for leakage. Therefore, the use of gliders and AUVs associated with the proposed Pioneer MAB Array would not be anticipated to have a significant impact on marine species, including no adverse effects on ESA-listed species or their critical habitat, in the Project Area.

The Pioneer MAB Array also does not incorporate any new acoustic instrument classes and, therefore, is not expected to result in any significant acoustic impacts to marine species, fish, and marine mammals.

Specific sensitive areas were considered during early planning and placement of the Pioneer MAB Array:

- **Artificial Reefs:** Artificial reefs AR-130, -140, -145, -160, -165 are located west of the Project Area (Figure 5) with the closest mooring greater than 3.5 km (1.9 nm) away. Pioneer MAB Array would therefore be anticipated to have no impact on artificial reefs.
- **Fishery Nursery Areas:** The southern moorings would be located within a Primary/Secondary Nursery Habitat. There is a moratorium against excavation or filling activities in April through September. Since these activities are not associated with the Pioneer MAB Array operations, there would be no anticipated impact on fishery nursery areas.
- **Critical Habitat:** Four of the Pioneer MAB Array moorings would be located within the loggerhead sea turtle Constricted Migratory Corridor (Figure 6); however, they would not be anticipated to impede sea turtle migration. Therefore, the proposed activities are not likely to adversely affect ESA-listed loggerhead sea turtle critical habitat. The Pioneer MAB Array would not overlap with loggerhead sea turtle Coastal Critical Habitat Designation (sargassum habitat).
- **North Atlantic Right Whale Migratory Corridor and Seasonal Management Areas:** All of the Pioneer MAB Array moorings are located within the NARW migratory corridor (Figure 6); however, the migratory corridor does not require special management considerations or additional protective measures. The proposed activities are small scale and temporary, therefore installation and maintenance are not likely to pose risks of entanglement or collision. The Pioneer MAB Array avoids the two designated NARW critical habitats and does not overlap with the Mid-Atlantic Seasonal Management Areas.
- **EFH:** EFH may be defined as the waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. § 1801(10)), where the term “necessary” indicates habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem. Managed fish with designated EFH in the Project Area were identified using the online EFH Mapper (see Appendix C). The Pioneer MAB Array is located within an area that contains EFH for species managed by the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, and South Atlantic Fisheries Management Council (SAFMC). While Figure 6 does not explicitly show EFH within the Project Area, EFH exists for certain life stages of 36 fish species managed by the Councils, as previously stated, particularly for sharks, tuna and other Highly Migratory Species. The 36 managed species that may occur seasonally or year-round in the Project Area are listed in Table 3-1 of Appendix C. The small scale and temporary nature of the array would have little to no impact on EFH, and no adverse effects on EFH are expected.
- **Habitat Areas of Particular Concern (HAPC):** The Pioneer MAB Array’s southernmost mooring (Figure 6) is located within a joint Snapper-grouper/Coral Reefs and Hardbottom/Dolphin and Wahoo HAPC designated by the SAFMC. The small scale and temporary nature of the array would have little to no impact on HAPC. The Pioneer MAB Array survey also did not find any indication of corals (Appendix F).

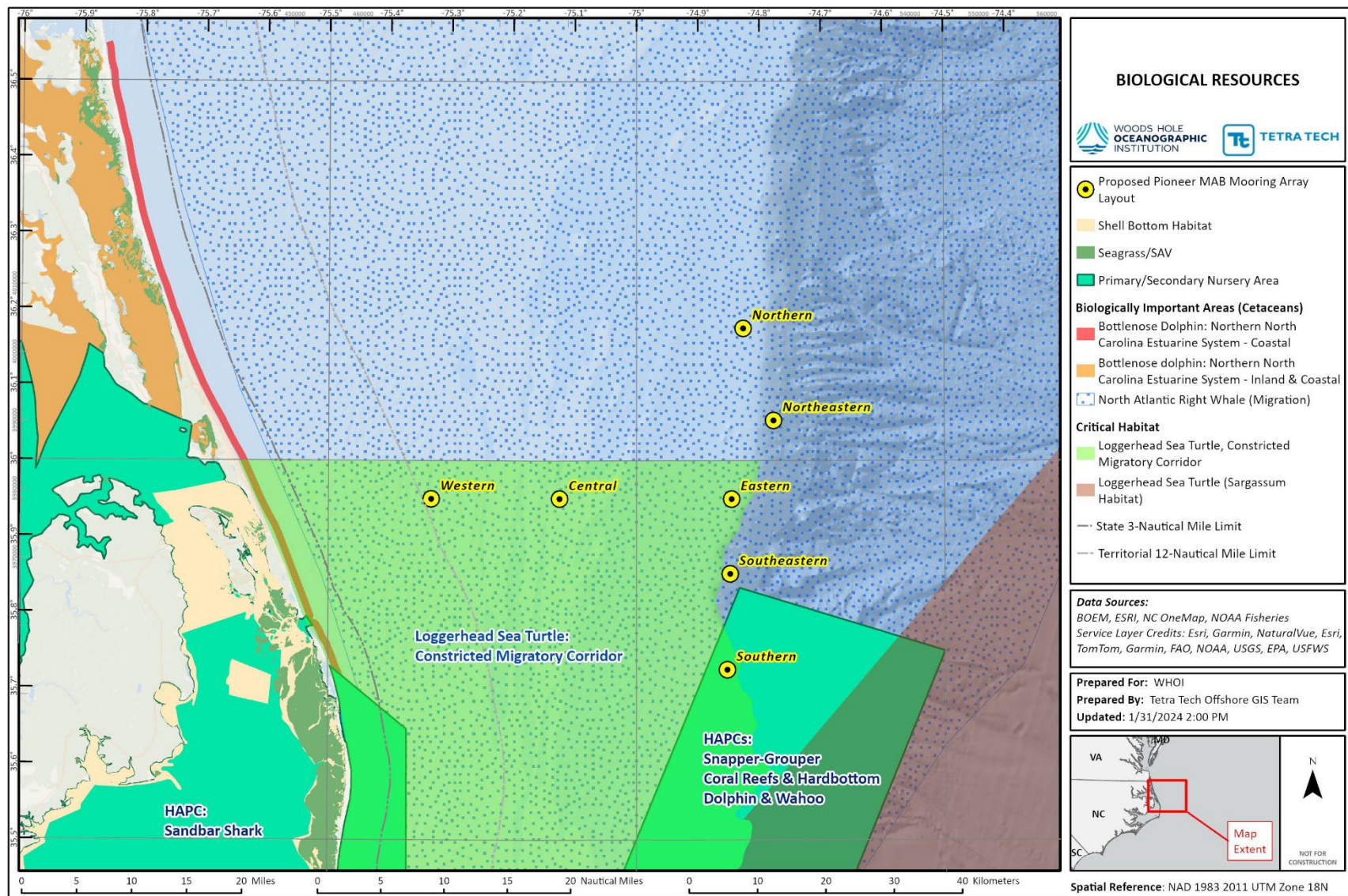


Figure 6. Biological Resources

In summary, the proposed activities, including Pioneer MAB Array location, installation, and O&M, are not anticipated to have significant effects on marine species, and no adverse effects are anticipated on ESA-listed species or designated loggerhead sea turtle critical habitat. Although the proposed activities may affect EFH and HAPC, no adverse effects on EFH or HAPC are expected. The NSF consulted with NMFS, pursuant to ESA Section 7 and the Magnuson-Stevens Act Fishery Conservation and Management Act, for EFH; NMFS concurred with NSF's determinations (see Section 4).

3.1.2.6 Socioeconomics

Review of resources within and around the Project Area indicated that recreational boating and fishing, charter fishing, shellfishing, sailboat races, sightseeing, bird and wildlife viewing (including whale watching), surfing, swimming, watersports, visiting beaches, and other activities are common to this part of coastal North Carolina. Due to the distance from shore, most of these activities would not occur near or within the proposed Pioneer MAB Array site; the activities that may be impacted or overlap with the Pioneer MAB Array site are discussed further below.

3.1.2.6.1 Fisheries

Detailed information regarding fisheries resources, including information on commercial and recreational fisheries, are included in Sections 3.1.1 and 3.3.6 of Appendix C. Additionally, the NSF recently prepared a Final EA titled, *Final Environmental Assessment/Analysis of Marine Geophysical Surveys by R/V Marcus G. Langseth off North Carolina, Northwest Atlantic Ocean* (NC Survey Final EA; NSF 2023) for a project that occurred slightly south of the proposed Pioneer MAB Array Project Area; the NC Survey Final EA included information on fisheries (Sections 3.7 and 4.1.6.5) and is incorporated by reference herein as if fully set forth.

In North Carolina waters, commercial fishery catches are predominantly various shellfish and finfish. Typical commercial fishing vessels in the North Carolina area include trawlers, gill netters, lobster/crab boats, dredgers, longliners, and purse seiners. In 2021, marine recreational fishers in the waters of North Carolina caught ~22 million fish for harvest or bait, and over 60 million fish in catch and release programs (NSF 2023). These catches were taken by over more than 17.9 million trips. Most of the trips (97 percent) occurred within 5.6 km (3.0 nm) from shore (NSF 2023).

As part of community outreach for the Pioneer Array relocation, OOI made presentations to the scientific community and to the general public, describing the Pioneer MAB Array plans and discussing potential space-use conflicts. It was noted that fishing activities would not be precluded in the Pioneer MAB Array area, although a safe distance from each Mooring Site (nominally outside of the 2 km by 2 km (1 nm by 1 nm) region at each mooring) would need to be maintained. Representatives of the fishing community attended some of these meetings, and follow-on conversations were conducted with representatives of the commercial longline fishing industry. It was noted during these discussions that the furthest offshore moorings (Northeastern and Southeastern, see Figure 6) may limit the ability of fishers to deploy free-drifting gear due to the possibility of entanglement. Based on 9 years of experience with the Pioneer NES Array, in the presence of similar types of fisheries, it is anticipated that entanglement would be rare and incidental (e.g., a portion of a longline set fouled in a mooring riser) and that fishers would continue to be able to operate in the area. Additionally, to further reduce the potential for space-use conflict, as noted previously and in Table 4, all mooring locations would be declared to the U.S. Coast Guard (USCG) and U.S. Army Corps of Engineers (USACE), locations would be published on NOAA charts, Notices to Mariners (NOTMAR), and Local Notices to Mariners (LNM), which would

be created and regularly updated throughout the lifetime of the project. Beyond these measures, OOI would continue to conduct outreach and coordinate with commercial fishery organizations to minimize potential impacts to fishing activities.

Although there may be overlap with some fisheries industries, given past experience, the relatively small footprint of the Pioneer MAB Array, and the fact that fisheries would not be precluded from the area, any impacts would not be anticipated to be significant. Feedback on the Draft SSSEA during the NEPA public comment period was received from an individual longline fisher (see Appendix G). Comments included concern for the original 600-m water depth location of the Northeastern Coastal Profiler Mooring. The primary issue was the potential for the mooring to impede longline fishing activities. The offshore moorings are needed to maintain a cohesive array and to accomplish the described science mission. Placement between the 300-m and 600-m contour is required to ensure ocean processes are measured beyond the shelf break. In response to the concerns raised, the originally planned 600-m locations (Northeastern and Southeastern moorings) would be moved westward to the 300-m contour. This new mooring position would reduce the likelihood of impacts to longline fishing activity .

3.1.2.6.2 Tourism, Recreation, Vessel Traffic, Other

Based on boat size and tour duration, there are several dolphin or other wildlife watching tour vessels that operate in the general region but would not be expected to venture far offshore. The NC Survey Final EA (NSF 2023) included information on whale watching (Section 4.1.6.6) and is incorporated by reference herein as if fully set forth. Once installed, the Pioneer MAB array would not be anticipated to have any impacts on wildlife watching industry; even during installation and maintenance, the impacts would be negligible involving at most, very brief, temporary displacement from the site and minor visual impacts (e.g., observation of the installation vessel).

Wreck SCUBA diving is a popular recreational activity in the waters off North Carolina and typically occurs at depths less than 100 m (NSF 2023); due to avoidance of wrecks, impacts from the Proposed Action would not be anticipated on SCUBA activities.

Vessel traffic, as noted in the NC Survey Final EA, occurs throughout the region. The additional vessel traffic associated with the installation and O&M of the Pioneer MAB Array would not be anticipated to conflict with other vessel traffic or significantly increase activity above current levels.

While other human activities could occur in the area, in addition to those noted above, it would not be anticipated that the Pioneer MAB Array would impact these activities, as they would not be prohibited from occurring within the proposed array area. Although a small buffer would be incorporated around array moorings, these would be noted on navigation charts and the array could be easily avoided. Further, the Pioneer MAB Array would be short term and temporary. For these reasons, while there may be minimal overlap with tourism, recreation, and vessel traffic, no significant impacts are anticipated.

3.1.2.6.3 Marine Infrastructure

There are no existing or publicly planned cables that would run near the planned mooring locations. Therefore, no impacts are anticipated on marine infrastructure.

3.1.2.6.4 Sand Resource Areas and Dredged Material Disposal Sites

The BOEM Marine Minerals Program identifies Atlantic OCS sediment aliquots with sand resource areas based on reconnaissance- and/or design-level OCS studies, categorizing them

as Proven, Potential, Unverified, or Unusable. Access to and identification of potential OCS sand resources is crucial for the long-term management of coastal restoration, beach nourishment, and habitat reconstruction to mitigate future coastal erosion, land loss, flooding, and storm damage along the U.S. Atlantic Ocean. Therefore, seabed disturbance within these resource areas should be avoided. These areas are typically within territorial sea (12 nm from land), nearshore of the proposed mooring locations. The Western mooring, being just seaward of the 12-nm territorial boundary, is close, but does not overlap with the nearest sand resource area.

Dredged material disposal sites are selected and permitted sites for dredged material to be placed after excavation. Just as sand resource areas are necessary for coastal restoration, disposal areas are vital to maintain safe navigable waterways. Seabed disturbance within these permitted sites should be avoided, but there are no disposal sites near the proposed mooring locations.

For the reasons noted above, no impacts are anticipated on Sand Resource Areas and Dredged Material Disposal Sites from the Proposed Action.

3.2 Cumulative Impacts and Other Projects within the Project Area

Cumulative effects refer to the impacts that result from a combination of past, existing, and reasonably foreseeable projects and human activities. Cumulative effects can result from multiple causes, multiple effects, effects of activities in more than one locale, and recurring events.

A desktop study was undertaken by Tetra Tech in support of Pioneer MAB planning to review other activities that could occur in the Project Area (Appendix C). Additionally, the NC Survey Final EA Section 4.1.6 included information on cumulative effects of past, present, and reasonably foreseeable projects that is also relevant for the Pioneer MAB Array Project and is, therefore, incorporated by reference as if fully set forth herein. The NC Survey Final EA and the desktop study undertaken by Tetra Tech found the following activities could occur in the Project Area (see also Figure 5 and Figure 6):

- Research;
- Offshore energy development;
- Sand borrow activities;
- Vessel traffic;
- Military activities;
- Fisheries; and
- Tourism/whale watching.

Additionally, to better understand stakeholder interests and activities undertaken in the Project Area, OOI conducted several outreach activities to academic institutions, federal agencies and regulators, and ocean users in the region which are also noted below and in Appendix G.

As noted in the NC Survey Final EA and the desktop study (Appendix C), research has occurred and is anticipated to continue to occur off the coast of North Carolina, however no specific details are known at this time. Other research activities in the Pioneer MAB Array Area can be accommodated and appropriate coordination would avoid space-use conflict.

Offshore wind lease areas off the southern coast of Virginia and the northern coast of North Carolina, near the proposed mooring locations, can be seen in Figure 5. Lease Area OCS-A 0497 is the Dominion-leased Coastal Virginia Offshore Wind (CVOW) Pilot Project, Lease Area OCS-

A 0483 is the Dominion-leased CVOW Commercial Project, Lease Area OCS-A 0559 is the Avangrid-leased Kitty Hawk North Project, and Lease Area OCS-A 0508 is the Avangrid-leased Kitty Hawk South Project. The CVOW Pilot and Commercial Project have existing and planned cable routes north of the Project Area. The Kitty Hawk North Project is currently planning to route its export cable from the lease area to the southern Virginia coast. The Kitty Hawk South Project has a potential export cable route option running south through the Pioneer MAB Project Area. However, there is only a moderate chance that the export cable would be routed south through the Project Area, and, if it is routed south, it would not be constructed within the next 10 years. In the event the Pioneer MAB Array is still in place by the time a potential export cable would run through the Project Area, it would be easy to avoid the Pioneer MAB Array mooring locations due to the distance between moorings along the continental shelf. There were additional draft wind energy areas alongside the Kitty Hawk North and South lease areas and another east of the OCS, but as of July 2023, those areas were not progressed to the final wind energy area stage (BOEM 2023). BOEM identified the deep-water wind energy areas, off the OCS, may be possible lease areas after more studies. However, construction on any of these deepwater wind energy areas would occur beyond the ~5-year Pioneer MAB Array Project operation period. BOEM and the U.S. Department of Energy have contacted the NSF and OOI to collaborate and coordinate activities in the Pioneer MAB Array Project Area. OOI confirmed the array location and that mobile asset operations do not impact or overlap with planned wind energy construction sites.

Vessel traffic in the Project Area is low and the locations of the moorings would be recorded on navigational charts. The Western mooring is just east of the St. Lucie to Chesapeake Bay Nearshore Fairway and the Central mooring would be just west of the St. Lucie to Chesapeake Bay Offshore Fairway (Figure 5).

Military operations in the vicinity of the Project Area include Virginia Capes and Cherry Point OPAREAS (Figure 5). The U.S. Navy was contacted regarding the location of moored infrastructure to ensure the array would not conflict with activities within the Virginia Capes Complex. The USCG would be contacted prior to the deployment of moorings as part of the Private Aids to Navigation (PATON) approval process and the array would be included on nautical charts and easily visible and avoidable. As all moorings locations and associated components of the Pioneer Array would be published in NOAA charts, NOTMARs, and LNM, it is anticipated that the USCG and U.S. Department of Defense would provide further detail regarding ongoing and upcoming military use in the Project Area should there be an unanticipated shift in level or location of activities.

Several institutions, state and federal agencies, tribal communities, and other ocean users from across the U.S. were invited to the Pioneer relocation workshops sponsored by the NSF and organized by the OOIFB (Appendix G). These potential stakeholders included NOAA, BOEM, National Aeronautics and Space Administration, USACE, USCG, U.S. Navy, offshore energy developers, and academic institutions.

Although these and the other noted human activities (e.g., whale watching, vessel traffic, etc.) could occur within the Project Area, it is anticipated that the Pioneer MAB Array would not interfere with these other activities due to the small footprint, localized/temporary nature (approximately 5 years) of the project, and avoidance measures put in place. This anticipation of no interference is guided by past experience with the Pioneer NES Array. More details are included in Appendix C. Overall, the combination of the proposed activities with other activities occurring in the region

would be expected to produce only a negligible increase in overall disturbance effects on the marine environment; therefore, no significant impacts are anticipated.

3.3 No Action Alternative

An alternative to conducting the proposed activity is the “No Action” alternative, that is, do not deploy the Pioneer Array to MAB and modify the array. If the Pioneer Array was not modified and deployed to MAB, the “No Action” alternative would result in no disturbance to the marine environment attributable to the proposed activity; however, valuable data about the marine environment, including climate variability, would be lost. Oceanographic data of significant scientific value that would provide knowledge for our oceans in general and the southern MAB in particular would not be collected. This would limit the ability of the greater scientific community to gain new insights on how oceanic processes operate and change under different conditions in both the short and long term. The “No Action” alternative would not meet the purpose and need for the proposed activity.

4 OTHER CONSIDERATIONS REQUIRED BY NEPA

The public outreach process for Pioneer MAB Array started in 2020 with presentations at several locations to obtain input (Appendix G). Participants from the Phase I Innovations Lab were invited to apply and many who had been interested in seeing the Pioneer Array move from the NES to the MAB, remained engaged. Additionally, applications from scientists, educators, engineers, and from government agencies, philanthropic, fishing community and other stakeholders were encouraged. Furthermore, as also noted in Section 4.1, as part of planning efforts, OOI coordinated with potential stakeholders to avoid potential space-use conflicts, including the U.S. Navy, and several outreach activities were undertaken (Appendix G).

On September 29, 2023, the Draft SSSEA was posted on the NSF website (<http://www.nsf.gov/geo/oce/envcomp/index.jsp>) for a 30-day public comment period, and notices were sent to tribes, government agencies, and potential interested parties (Appendix G). Six comments were received (see Appendix G). Of these, only one comment was actionable, which resulted in the movement of the original 600-m contour Northeastern and Southeastern Coastal Profiler Moorings to the 300-m contour area; see Section 3.1.2.6.1 Fisheries for further information.

As noted in the PEA, if the proposed site-specific activities associated with the proposed installation and operation of the OOI (i.e., the Proposed Action described in this SSSEA) were to potentially impact additional or larger areas or include activities not previously proposed in the PEA and SER, then consultations with federal regulatory agencies, as applicable and appropriate, would occur. Therefore, the NSF took into consideration compliance with other relevant statutes and processes, including those described below.

4.1 Marine Mammal Protection Act of 1972 (16 U.S.C. 1631 et seq.)

The NSF considered the potential impacts of the Proposed Action on marine mammals pursuant to the MMPA. Given the Proposed Action, the NSF determined that impacts on marine mammals would not be anticipated. Further, based on discussions and correspondence with NOAA in March 2022 during the generation of the regulatory study (Appendix B), it was determined that the Proposed Action, including anchoring of the Pioneer MAB Array, would not require an Incidental Harassment Authorization or Letter of Authorization and no further action was required pursuant to the MMPA.

4.2 Endangered Species Act of 1973 (16 U.S.C. Ch. 35 §1531 et seq.)

The NSF considered the potential impacts of the Proposed Action on ESA-listed species and their designated critical habitat as pursuant to the ESA. Based on and consistent with past OOI NEPA documents, a NLAA determination for ESA-listed marine mammals, sea turtles, and critical habitat, was determined. However, based on Pioneer NES Array experience, potential impacts, and other experience with similar research technology, any impacts to marine mammals or sea turtles from the Proposed Action would be anticipated to be very minor and temporary, and thus a determination of no effects may be more appropriate. However, for consistency with past documentation and to ensure compliance with ESA, an NLAA determination for marine mammals and sea turtles was made. Given the proposed activities, the NSF determined the Proposed Action may affect but is not likely to adversely affect ESA-listed plant species in the Project Area. Therefore, on November 17, 2023, NSF initiated informal consultation with NMFS pursuant to Section 7 the ESA. NMFS reviewed the consultation request submitted by NSF and recommended including blue whale (*Balaenoptera musculus*) as a species likely to occur in the Project Area. On December 7, 2023, NMFS concurred with NSF's determination that the proposed action is not likely to adversely affect the ESA-listed species and designated critical habitat under NMFS jurisdiction (see Appendix G).

4.3 Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.)

In June 2022, after reviewing information about the Proposed Action provided by OOI, the North Carolina Division of Coastal Management (DCM), Department of Environmental Quality confirmed completion of a Federal Consistency Determination (DCM2022041). Further, DCM concurred that the proposed Pioneer MAB Array activity was consistent with North Carolina's federally approved coastal management program. Although the state confirmed consistency, as part of their review, the DCM noted concerns about the two moorings furthest offshore potentially impacting the Highly Migratory Pelagic long lining fishery. OOI took this information into consideration, and as discussed in Section 3.1.2.6.

4.4 Magnuson-Stevens Fishery Conservation and Management Act—Essential Fish Habitat (Public Law 94-265; 16 U.S.C. Ch. 38 §1801 et seq.)

Although the proposed activities may affect EFH, no adverse effects on EFH are expected. The Pioneer MAB Array's southernmost mooring is located within a joint Snapper-grouper/Coral Reefs and Hardbottom/Dolphin and Wahoo HAPC designated by the SAFMC. Given the small scale and temporary nature of the array the associated proposed activities are not likely to adversely affect areas designated as EFH or HAPC. On November 17, 2023, the NSF initiated consultation with NMFS for EFH. On January 3, 2024, NMFS concurred with NSF's determination, offering no EFH conservation recommendations (Appendix G).

4.5 National Historic Preservation Act

Desktop and marine archeology studies were used to locate the mooring sites and avoid all documented shipwrecks and cultural resources. The site survey performed by OOI (Appendix F) supported the planning documentation and no evidence of shipwrecks or cultural resources were located. As part of the NEPA public comment period, the North Carolina State Historic Preservation Office reviewed the project and provided written confirmation that they are aware of no historic resources that would be affected by the project pursuant to Section 106 of the National Historic Preservation Act (Appendix G).

4.6 Tribal Engagement

Planning studies did not identify tribal concerns; the proposed activities would not impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights. No tribal cultural or historic resources were identified at the proposed array mooring locations in the Pioneer MAB Array marine archaeology study (Appendix D).

4.7 Permitting and Licensing Activities

OOI, as operator of the array, is responsible for obtaining all licenses and permits for the proposed Project:

- In March 2022, as part of permitting / licensing processes, the USACE confirmed the relocation of the Pioneer Array would require the use of NWP#5 (Scientific Measurement Devices), without the need for application or submittal of a Preconstruction Notification due to the low likelihood of impacts to resources (Appendix B).
- In August 2022, although not part of an official permitting / licensing process, OOI notified the U.S. Navy of the proposed relocation of the Pioneer Array to the MAB, providing infrastructure locations and an overview of O&M activities. In February 2023, OOI received confirmation from the U.S. Navy that the planned array location did not conflict with any U.S. Navy infrastructure.
- In June 2023, OOI completed the self-certification memorandum in support of NWP#5 activities, confirming adherence to USACE guidelines. Pursuant to NWP#5, proposed activities can have no significant impacts on the environment, including takes of ESA-listed species, EFH, designated critical resource waters, tribal rights, cultural resources, and navigation. The USACE District Engineer considered the activities and determined they would avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable in the Project Area. Mitigation in all forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) is required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.
- Prior to deployment of the new array, OOI would request PATONs from the USCG for each mooring location, have the array marked on navigational charts, perform Local Notices to Mariners, and update notifications to the U.S. Navy.

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