Construction & Operations Plan

South Fork Wind Farm

Volume I
Executive Summary, Introduction, Project Siting, Project Description, Site Characterization and Assessment of Potential Impacts, References

May 7, 2021

Submitted to
BOEM
Bureau of Ocean Energy Management

Submitted by
South Fork Wind
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Construction and Operations Plan

30 CFR Part 585

South Fork Wind Farm

Submitted to:
Bureau of Ocean Energy Management
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Sterling, VA 20166

Submitted by:
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EXECUTIVE SUMMARY

This *South Fork Wind Farm and South Fork Export Cable Construction and Operations Plan* (COP) is being submitted by South Fork Wind, LLC (SFW or the Applicant)[1] to support the siting and development of the South Fork Wind Farm (SFWF) and the South Fork Export Cable (SFEC), collectively the Project.

The SFWF includes up to 15 wind turbine generators (WTGs or turbines) with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located within federal waters on the outer continental shelf (OCS), specifically in the Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0517 (Lease Area),[2] approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. The SFWF also includes an Operations and Maintenance (O&M) facility that will be located onshore at either Montauk in East Hampton, New York, or Quonset Point in North Kingstown, Rhode Island.

The SFEC is an alternating current (AC) electric cable that will connect the SFWF to the existing mainland electric grid in East Hampton, New York. The SFEC includes both offshore and onshore segments. Offshore, the SFEC is located in federal waters (SFEC – OCS) and New York State territorial waters (SFEC – NYS) and will be buried to a target depth of 4 to 6 feet in the seabed. Onshore, the terrestrial underground segment of the export cable (SFEC – Onshore) will be located in East Hampton, New York. The SFEC – NYS will be connected to the SFEC – Onshore via the sea-to-shore transition where the offshore and onshore cables will be spliced together. The SFEC also includes a new Interconnection Facility where the SFEC will interconnect with the Long Island Power Authority (LIPA) electric transmission and distribution system in the town of East Hampton, New York.

The approximate location of the entire Project is shown on Figure ES-1. The landing site options and route variants of the SFEC – Onshore are shown on Figure ES-2.

The Project is scheduled to be installed starting in 2022 , and to be commissioned and operational by the end of 2023.

The Project components and locations presented in this COP have been selected based on environmental and engineering site characterization studies completed to date and will be refined in the Facility Design Report (FDR) and Fabrication and Installation Report (FIR), which will be reviewed by BOEM pursuant to Title 30 of the *Code of Federal Regulations* (CFR) Parts 585.700-702 before the commencement of installation. In addition, a Certified Verification Agent (CVA), approved by BOEM, will conduct an independent assessment and verify that the Project components are fabricated and installed in accordance with both this COP and the FIR.

The purpose of the Project is to generate electricity from an offshore wind farm located in the Lease Area and to transmit it to the East Hampton Substation. The Project addresses the need identified by the LIPA for new sources of power generation that can cost-effectively and reliably supply the South Fork of Suffolk County, Long Island, as an alternative to constructing new transmission facilities. The Project will also help LIPA achieve its renewable energy goals. The Project will enable SFW to fulfill its contractual commitments to LIPA pursuant

[1] On September 4, 2020 a *Certificate of Amendment of Certificate of Formation of Deepwater Wind South Fork, LLC* was executed which changed the name of Deepwater Wind South Fork, LLC to South Fork Wind, LLC.

[2] The leaseholder of Renewable Energy Lease Area OCS-A 0517 is South Fork Wind, LLC. On March 23, 2020 BOEM approved the assignment of a portion of lease OCS-A 0486 to Deepwater Wind South Fork, LLC which had the effect of segregating this portion into a new lease, which was given lease number OCS-A 0517. Subsequent to BOEM's approval of this lease assignment, Deepwater Wind South Fork, LLC changed its name to South Fork Wind, LLC.

to a Power Purchase Agreement executed in 2017 resulting from LIPA's technology-neutral competitive bidding process.

This COP includes the following information:

- An overview of the Project, including details on the regulatory framework in which the Project will be reviewed, a description of the agency and stakeholder outreach, a tentative schedule and other key project information requested by BOEM (Section 1);
- A summary of the siting and route selection process for both the SFWF and SFEC, including a siting history, details on steps taken to identify and evaluate potential SFEC routes, and description of technologies and installation methods considered (Section 2);
- A description of all planned facilities, including onshore and support facilities; and all proposed activities, including construction activities, commercial O&M, and conceptual decommissioning plans (Section 3);
- A characterization and assessment of potential impacts during construction, O&M, and decommissioning activities, which will support relevant project reviews and consultations (Section 4);
- A list of supporting references and citations, organized by COP section (Section 5); and
- Additional supporting information provided in appendices (Appendix A to Appendix BB3), some of which include references to Deepwater Wind South Fork, as the previous name of the Applicant.

This COP was prepared in accordance with 30 CFR § 585. BOEM is expected to be the lead federal agency under the National Environmental Policy Act (NEPA). For activities related to the SFEC – NYS and SFEC – Onshore in New York State, the New York Public Service Commission will lead the review of the Project activities under Article VII of the New York Public Service Law.

In addition to the federal and state level permits, the Project must also comply with applicable provisions of the Endangered Species Act, the Marine Mammals Protection Act, the Migratory Bird Treaty Act, the Magnuson-Stevens Fishery Conservation and Management Act, the National Historic Preservation Act, the Coastal Zone Management Act, the Clean Air Act, the Rivers & Harbors Act, and the Clean Water Act.

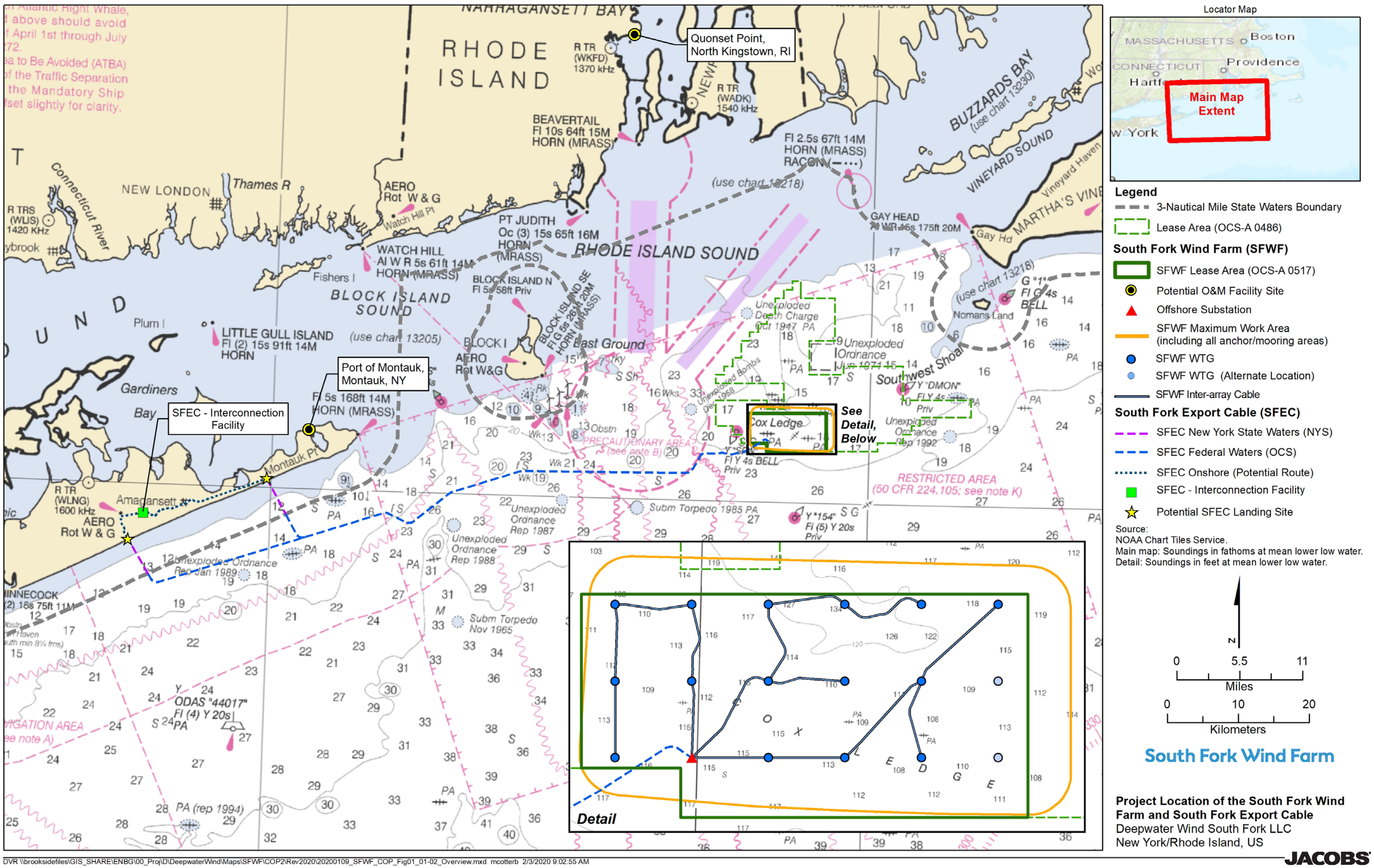

Figure ES-1. Project Location of the SFWF and SFEC

Depiction of the SFWF and SFEC, shown on a nautical chart.

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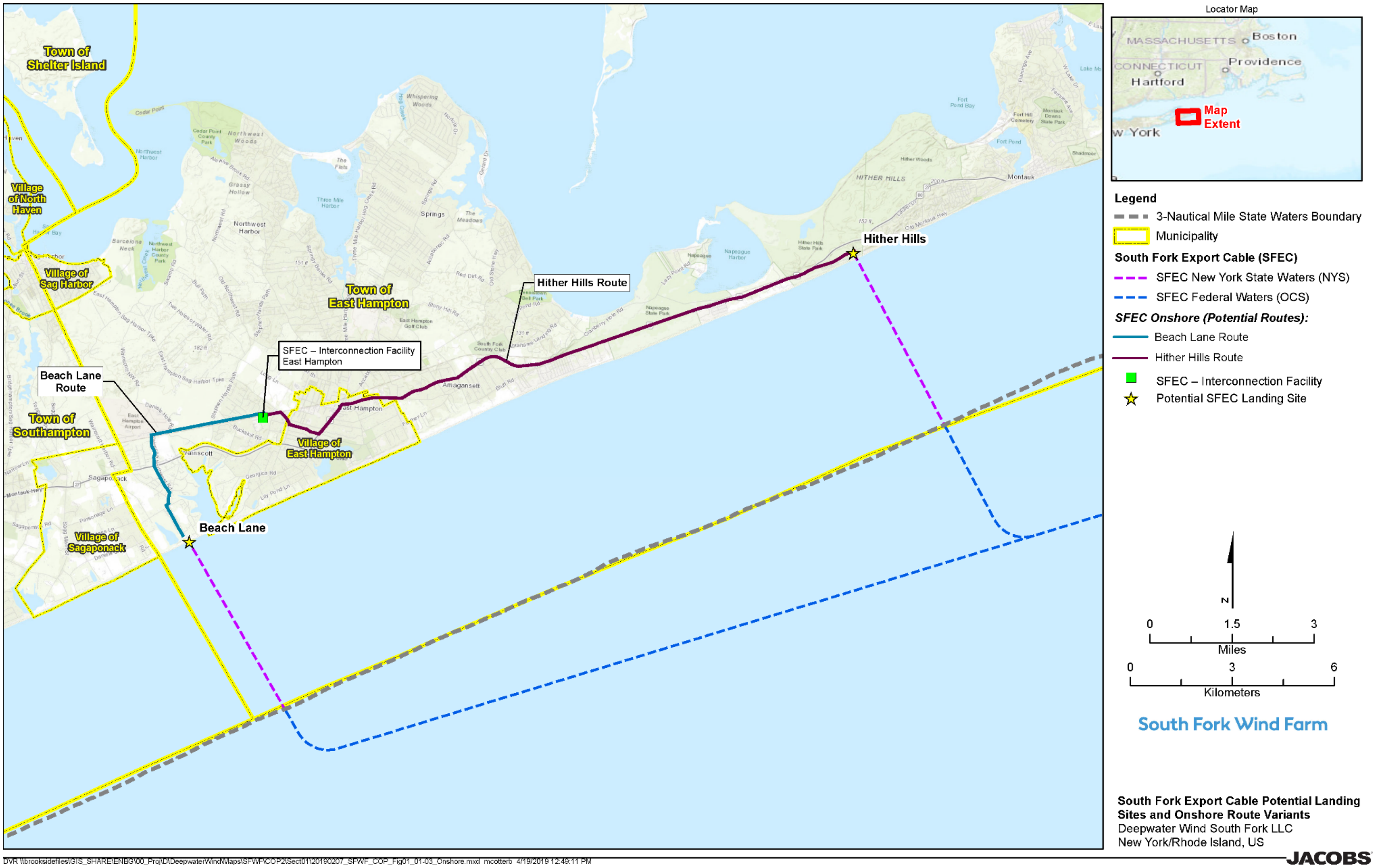

Figure ES-2. Location of the SFEC – Onshore and Interconnection Point

Depiction of the SFEC – NYS and SFEC – Onshore, including landing site options, route variants, and interconnection point.

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Since 2010, SFW has conducted a variety of activities that have informed the design and characteristics of the Project. For example, SFW has:

- Engaged in outreach relating to the Project with federal and state agencies, federally-recognized Native American tribes, municipal organizations in East Hampton, New York, stakeholders representing a broad range of perspectives, and the public.
- Evaluated several offshore and onshore cable routes and substation locations to fulfill the Project's objective to deliver power into eastern Long Island, New York.
- Completed geophysical and geotechnical surveys in 2017 and 2018 to inform a site characterization of the Project. These surveys were conducted for both the SFWF and along multiple routes considered for the SFEC. Where possible, the Project was sited to avoid areas with boulders, and to avoid or minimize impacts to commercial fishing areas, archaeological resources, and shallow hazards.
- Completed extensive studies and assessments in 2017 and 2018 to characterize the offshore resources that may be impacted by construction and installation, O&M, and decommissioning activities.
- Completed conceptual engineering and planning discussions with municipal and state agencies to identify potential landing sites and conducted field surveys for multiple onshore route options from the landing sites to the SFEC – Interconnection Facility.

Consistent with BOEM's *Draft Guidance Regarding the Use of a Project Design Envelope in a Construction and Operations Plan* (January 2018), SFW considered several potential technologies and installation methods for the SFWF and SFEC. This envelope approach results in a range of characteristics and locations for components that will be considered in the environmental review for the Project. The key characteristics for the Project, which may include relevant variations in the Project Envelope, are:

- SFWF foundation type (monopile, with pile diameter up to 11 m diameter).
- SFWF WTG size (6 to 12 megawatts [MW]). SFW has committed to an indicative layout scenario with WTG sited in a grid with approximately 1.15 mile (1.8 km, 1 nm) by 1.15 mile (1.8 km, 1 nm) spacing that aligns with other proposed adjacent offshore wind projects in the Rhode Island/Massachusetts Wind Energy Area.
- SFEC landing site (Beach Lane or Hither Hills).
- SFEC installation method for offshore cable (installed via mechanical cutter, mechanical plow, and/or jet-plow to achieve the target burial depth of 4 to 6 feet (1.22 to 1.83 meters [m]).
- SFEC installation method for sea-to-shore transition (a conduit installed by horizontal directional drilling [HDD] under the beach and intertidal water; may also include a temporary cofferdam located offshore beyond the intertidal zone).

This COP includes site characterization and assessment of potential impacts for the Project and recognizes that impacts may be different for the SFWF and SFEC during the phases of construction, operations and maintenance and decommissioning. The assessment is based upon the requirements set forth in 30 CFR § 585.627 and is also informed by input from federal and state agencies and other public and private stakeholders in the region. The approach to characterization and assessment included several steps:

- Impact-producing Factors (IPFs): Project activities that could impact resources were identified as IPFs, which include seafloor and land disturbance; sediment suspension and deposition; noise; electric and magnetic fields; discharges and releases; trash and debris; traffic; air emissions; visible structures; and lighting.

- Affected Environment: Physical, biological, cultural, visual, and socioeconomic resources were characterized based upon extensive desktop studies, targeted field studies, predictive modeling, and data analysis. These assessments provided a detailed background on the condition of these resources in the affected environment. Desktop studies included literature reviews; examination of publicly-available datasets; direct communication with academic and government science researchers; and consultation with state and federal government entities.

  The Rhode Island Ocean Special Area Management Plan, the New York Ocean Plan, and the Massachusetts Ocean Plan provided important insight on environmental conditions and existing human activities in and near the SFWF and SFEC. The resource characterizations also relied on the material published in recent BOEM NEPA documents, such as the *Final Programmatic Environmental Impact Statement (PEIS) for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (BOEM, 2007).

- Impact Assessment: The type and degree of potential impacts from proposed Project activities varies based on the characteristics of the resource (e.g., presence/absence, conservation status, abundance) and the IPF that may affect each resource. Potential impacts are discussed separately for the SFWF and SFEC. Where relevant and distinct, potential impacts for different segments of the SFEC are discussed separately. Where applicable, potential impacts were identified as direct or indirect; short term or long term; and negligible, minor, moderate, or major. If measures are proposed to avoid and minimize potential impacts, the impact evaluation included consideration of these environmental protection measures.

The SFWF and SFEC were sited, planned, and designed to avoid and minimize impacts. Most potential impacts to affected physical, biological, cultural, visual, and socioeconomic resources will be mitigated. Resources that may be impacted by the SFWF and SFEC are expected to recover given that impacts will be limited temporally and/or spatially.

Table ES-1 summarizes the potential impacts expected from the implementation of the activities described in this COP and the environmental protection measures that SFW will adopt to minimize these potential impacts.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Air Quality	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: Negligible – Minor • Visible Structures: No Impact • Lighting: No Impact	• Vessels providing construction or maintenance services for the SFWF will use low sulfur fuel where possible. • Vessel engines will meet the appropriate EPA air emission standards for nitrogen oxide emissions when operating within Emission Controls Areas. • Equipment and fuel suppliers will provide equipment and fuels that comply with the applicable U.S. Environmental Protection Agency or equivalent emission standards. • Marine engines with a model year of 2007 or later and non-road engines complying with the Tier 3 standards (in 40 CFR 89 or 1039) will be used to satisfy BACT. • The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.
Water Quality	• Seafloor and Land Disturbance: Negligible - Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize turbidity and total suspended solids. • Vessels will comply with regulatory requirements related to the prevention and control of discharges and accidental spills. • Accidental spill or release of oils or other hazardous materials will be managed through the Oil Spill Response Plan (OSRP) (Appendix D). • At the onshore HDD work area for the SFEC, drilling fluids will be managed within a contained system to be collected for reuse as necessary • An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out. • A Stormwater Pollution Prevention Plan, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.
Geological Resources	• Seafloor and Land Disturbance: Negligible – Minor	• The SFWF and SFEC - Offshore will avoid, to the extent practicable, identified shallow hazards. • Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Sediment Suspension and Deposition: Negligible – Minor • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging this method will minimize impacts to surficial geology. • Use of monopiles with associated scour protection will minimize impacts to surficial geology, compared to other foundation types. • Use of dynamic positioning (DP) vessel for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to surficial geology, as compared to use of a vessel relying on multiple-anchors. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the maximum work area (MWA) to protect sensitive areas or other areas to be avoided. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. SFEC - Onshore is sited within previously disturbed existing rights-of-way (ROWs).
Oceanographic and Meteorological Conditions	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: No Impact	• SFW has designed the Project to account for site-specific oceanographic and meteorological conditions within the Project Area; therefore, no additional measures are necessary.
Coastal and Terrestrial Habitat	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: No Impact • Air Emissions: No Impact • Visible Structure: No Impact	• SFEC - Onshore is sited within previously disturbed existing ROWs. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • A Stormwater Pollution Prevention Plan, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Lighting: No Impact	impacts to water quality during construction of the SFEC - Onshore.
Benthic and Shellfish Resources	• Seafloor and Land Disturbance: Negligible - Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: Negligible – Minor • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: Negligible	• The SFWF and SFEC - Offshore will minimize impacts to harder and rockier bottom habitats to the extent practicable. • Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize long-term impacts to the benthic habitat. • Use of monopiles with associated scour protection will minimize impacts to benthic habitat, compared to other foundation types. • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • Use of DP vessel for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to benthic and shellfish resources, as compared to use of a vessel relying on multiple-anchors. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including benthic and shellfish resources. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.
Finfish and Essential Fish Habitat	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: Negligible – Moderate • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Negligible - Moderate • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: Negligible	• The SFWF and SFEC - Offshore will minimize impacts to important habitats for finfish species. • Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize sediment disturbance and alteration of demersal finfish habitat. • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • Siting of the SFWF and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys. • Use of DP vessel for cable installation for the SFWF Inter-Array Cable and SFEC - Offshore will minimize impacts to finfish and essential

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		fish habitat (EFH) resources, as compared to use of a vessel relying on multiple-anchors. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including finfish and EFH resources. • SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Marine Mammals	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Major • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Moderate • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: Negligible	• Exclusion and monitoring zones for marine mammals will be established for pile driving and high-resolution geophysical (HRG) survey activities. • Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and National Oceanic and Atmospheric Administration (NOAA)-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate. • Impact pile driving activities will not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right whale, which will also have a protective effect for other marine mammal species. • Vessels will follow NOAA guidelines for marine mammal strike avoidance measures, including vessel speed restrictions. • All personnel working offshore will receive training on marine mammal awareness and marine debris awareness. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
Sea Turtles	• Seafloor and Land Disturbance: Negligible - Minor • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Moderate • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Moderate • Air Emission: No Impact • Visible Structure: Negligible • Lighting: Negligible	• Exclusion and monitoring zones will be established for sea turtles during pile driving activities and HRG survey activities • Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate. Impact pile driving activities will not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		whale, which will also have a protective effect for sea turtles. • Vessels will follow NOAA guidelines for sea turtle strike avoidance measures, including vessel speed restrictions. • All personnel working offshore will receive training on sea turtle awareness and marine debris awareness. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
Avian Species	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Minor • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Minor • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• The SFWF WTGs will be widely spaced apart allowing avian species to avoid individual WTGs and minimize risk of potential collision. • The location of the SFWF, more than 18 miles (30 km, 16 nm) offshore, avoids the coastal areas, which are known to attract birds, particularly shorebirds and seaducks. • Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction or disorientation. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. • An avian management plan for listed species will be prepared for the SFEC - Onshore. • The SFEC - Onshore cable will be buried; therefore, avoiding the risk to birds associated with overhead lines.
Bat Species	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: No Impact	• Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction (or attraction of insect prey) and possibly collision of bats at night.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROW, therefore, minimizing potential impacts from clearing.
Above-Ground Historic Properties	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible - Major • Lighting: Negligible – Minor	• The location of SFWF WTGs, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive above-ground historic properties. • SFWF WTGs will have uniform design, speed, height, and rotor diameter. • The color of the SFWF WTGs (less than 5 percent grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips. • The SFEC - Onshore cable will be buried; therefore, minimizing potential visual impacts to above ground historic properties. • The SFEC - Interconnection Facility will be located adjacent to an existing substation on parcel zoned for commercial and industrial/utility use. • The SFEC - Interconnection Facility land parcel is currently screened by mature trees. After construction, additional screening will be considered to further reduce potential visibility and visual impact.
Marine Archaeological Resources	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• The SFWF and SFEC - Offshore will avoid or minimize impacts to potential submerged cultural sites, to the extent practicable. • Native American tribes were involved, and will continue to be involved, in marine survey protocol design, execution of the surveys, and interpretation of the results. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		• As appropriate, SFW will conduct additional archaeological analysis and/or investigation to further assess potential sensitive areas. • Geophysical and geotechnical (G&G) survey coverage is sufficient to support design changes, if minor refinement of SFWF facility locations is necessary to avoid paleolandforms.
Terrestrial Archaeological Resources	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• The route for the SFEC - Onshore will minimize impacts to, or avoid, potential terrestrial archeological resources, to the extent practicable. • Native American tribes were involved, and will continue to be involved, in terrestrial survey protocol design, execution of the surveys, and interpretation of the results. • Analysis shows that the majority of the SFEC - Onshore route has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits is minimized. • An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation. • SFW will conduct additional archaeological investigation to further assess potential sensitive areas.
Visual Resources	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Minor • Air Emissions: No Impact • Visible Structures: Minor • Lighting: Minor	• The location of SFWF, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive public resources and population centers. • SFWF WTGs will have uniform design, speed, height, and rotor diameter. • The color of the SFWF WTGs (less than 5 percent grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips. • Use of an Aircraft Detection Lighting System will mitigate nighttime visual impacts. • The SFEC - Interconnection Facility will be located adjacent to an existing substation on a parcel zoned for commercial and industrial use.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		• At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise.
Population, Economy, & Employment	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible - Minor • Lighting: No Impact	• Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning. • The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers. • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
Property Values	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible • Lighting: Negligible	• The SFEC - Onshore cable will be buried; therefore, minimizing potential impacts to adjacent properties. • The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers. • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
Public Services	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air emissions: No Impact	• The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC – Onshore construction to minimize local traffic impacts.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Visible Structures: No Impact • Lighting: No Impact	• A comprehensive communication plan will be implemented during offshore construction. SFW will submit information to the U.S. Coast Guard (USCG) to issue Local Notice to Mariners during offshore installation activities.
Recreation & Tourism	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• The location of SFWF WTGs restricts available views from visually sensitive public resources and population centers. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Project website, public notices to mariners and vessel float plans, and a fisheries liaison. SFW will submit information to the USCG to issue Local Notice to Mariners during offshore installation activities. • The communication plan will also include outreach to stakeholders in the offshore recreational and tourism industry to minimize impacts to recreational events (e.g., sailboat races). • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.
Commercial and Recreational Fishing	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Minor • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Minor • Air Emissions: No Impact • Visible Structures: Minor • Lighting: No Impact	• SFW is committed to a spacing of approximately 1.15 mile (1.8 km), or one nautical mile (nm), between turbines. • The Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including. sensitive shoreline habitats and shoreline fishing areas. • As appropriate and feasible, Best Management Practices will be implemented to minimize impacts on fisheries, as described in the *Guidelines for Providing Information on Fisheries Social and Economic Conditions for*

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		Renewable Energy Development (BOEM, 2015). • Siting of the SFWF and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys. • SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction. • Each WTG will be marked and lit with both USCG and approved aviation lighting. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • Communications and outreach with the commercial and recreational fishing industries will be guided by the Project-specific Fisheries Communications Plan (Appendix B). This outreach will be led by the SFW Fisheries Liaisons. Fisheries Representatives from the ports of Montauk, Point Judith, and New Bedford represent the fishing community. • SFW is committed to a gear loss SFW is committed to a Gear Loss Prevention and Claim Procedure for the commercial fishing industry. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, a Project website, and public notices to mariners and vessel float plans (in coordination with USCG).

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Commercial Shipping and Other Marine Uses	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible – Minor • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: Negligible	• SFW is committed to a spacing of approximately 1.15 mile (1.8 km), or one nautical mile, between turbines. • Each WTG will be marked and lit with both USCG and approved aviation lighting. An Automatic Identification System will be installed at the SFWF marking the corners of the wind farm to assist in safe navigation. • All appropriate lighting and marking schemes, based on current regulations, will be implemented. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • Project construction, O&M, and decommissioning activities will be coordinated with appropriate contacts at USCG and U.S. Department of Defense command headquarters. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, Project website, and public notices to mariners and vessel float plans (in coordination with USCG).
Coastal Land Use & Infrastructure	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: No Impact • Noise: Negligible - Minor • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible - Minor • Air Emissions: No Impact • Visible Structure: Negligible • Lighting: Negligible	• SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROW. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - onshore construction to minimize local traffic and noise impacts. • A Stormwater Pollution Prevention Plan, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to adjacent lands uses during construction of the SFEC - Onshore.

Table ES-1. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Environmental Justice	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible • Lighting: No Impact	• The use of wind to generate electricity will have a beneficial impact on air emissions in East Hampton, as it reduces the need for electricity generation from traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions. • Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.

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Acronyms and Abbreviations

§	Part or Section
μg/m^3	microgram(s) per cubic meter
μPa	micropascal(s)
μT	microtesla(s)
AC	alternating current
ACCSP	Atlantic Coastal Cooperative Statistics Program
ACS	American Community Survey
ADLS	Aircraft Detection Lighting System
AEP	auditory evoked potential
AIA	American Institute of Architects
AIS	Automatic Identification System
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AMI	area of mutual interest
ANSI	American National Standards Institute
APE	Area of Potential Effects
APPEA	Australian Petroleum Production and Exploration Association
ASMFC	Atlantic States Marine Fisheries Commission
ATON	Aids to Navigation
ATT	Admiralty Total Tide
AWOIS	Automated Wreck and Obstruction Information System
BACT	best available control technology
BEA	Bureau of Economic Analysis
BERR	U.K. Department for Business Enterprise and Regulatory Reform
bgs	below ground surface
BIL	Basic Insulation Level
BIWF	Block Island Wind Farm
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BP	before present day
BSEE	Bureau of Safety and Environmental Enforcement
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAA	Clean Air Act
CDP	Census Designated Place
CECPN	Certificate of Environmental Compatibility and Public Need
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CFR	*Code of Federal Regulations*
CFSR	Climate Forecast System Reanalysis
CH4	methane
cm	centimeter(s)

C-MAN	Coastal-Marine Automated Network
CMECS	Coastal and Marine Ecological Classification Standard
CMR	Code of Massachusetts Regulations
CO	carbon monoxide
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
COA	corresponding onshore area
COLREGs	International Regulations for Preventing Collisions at Sea 1972
COP	Construction and Operations Plan
CPT	cone penetration testing
CRESLI	Coastal Research and Education Society of Long Island, Inc.
CRIS	Cultural Resources Information System
CRMP	Coastal Resource Management Program
CT DEEP	Connecticut Department of Energy and Environmental Protection
CTV	crew transfer vessel
CVA	Certified Verification Agent
CWA	Clean Water Act of 1972
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibel
dBA	A-weighted decibel
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DFO	Fisheries and Oceans Canada
DFWMR	Division of Fish, Wildlife & Marine Resources (New York State)
DO	dissolved oxygen
DOI-MMS	Department of the Interior, Minerals Management Service
DoN	U.S. Department of the Navy
DP	dynamic positioning
DPS	distinct population segment
DPV	dynamically positioned vessel
DSM	digital surface model
DTM	digital terrain model
DVAR	dynamic volt-amperes-reactive
DWT	dead-weight tonnage
EC4	Executive Climate Change Coordinating Council
ECNYS	Ecological Communities of New York State
EcoMon	Ecosystem Monitoring
EFH	essential fish habitat
EM&CP	environmental management and construction plan
EMF	electromagnetic field
EMS	emergency medical services

ENC	Electronic Navigational Charts
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERC	Emission Reduction Credits
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FD	Fire Department
FDR	Facility Design Report
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FIR	Fabrication and Installation Report
FMP	Fishery Management Plan
FPV	fallpipe vessel
FRES	Fire, Rescue, and Emergency Services
ft/s	foot (feet) per second
ft^2	square foot (feet)
FTE	full-time equivalent
FWRAM	Full Waveform Range-dependent Acoustic Model
g	gram(s)
$g\ C\ m^{-2}\ day^{-1}$	gram(s) of carbon per meter square per day
G&G	geophysical and geotechnical
GARFO	NOAA Greater Atlantic Regional Fisheries Office
GBS	gravity-based structure
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GLD	Geographic Location Description
GW	gigawatt(s)
HAP	hazardous air pollutant
HDD	horizontal directional drilling
HDPE	high-density polyethylene
HF	high-frequency
HFC	high-frequency cetaceans
hp	horsepower
HRG	high-resolution geophysical
HRVEA	Historic Resources Visual Effects Analysis
HSD	hydro sound damper
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
HYCOM	Hybrid Coordinate Ocean Model

Hz	hertz
IBTrACS	International Best Tracks for Climate Stewardship
IHA	Incidental Harassment Authorization
IOWAGA	Integrated Ocean Waves for Geophysical and Other Applications
IPF	impact-producing factor
km	kilometer(s)
KOP	key observation point
kV	kilovolt(s)
kW	kilowatt(s)
LE	exposure thresholds
LF	low-frequency
LFC	low-frequency cetaceans
LICAP	Long Island Commission on Aquifer Protection
lidar	light detection and ranging
LIPA	Long Island Power Authority
LIRR	Long Island Railroad
LNMs	Local Notice to Mariners
LOA	length overall
L_P	unweighted sound pressure level
$L_{P,flat}$	flat-peak sound pressure
L_{PK}	peak sound pressure
LSZ	landscape similarity zone
m	meter(s)
M.G.L.	Massachusetts General Law
m/s	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
MACEC	Massachusetts Clean Energy Center
MACZM	Massachusetts Office of Coastal Zone Management
MADMF	Massachusetts Department of Marine Fisheries
MARPOL	marine pollution
MassDEP	Massachusetts Department of Environment Protection
MBES	multibeam echo sounder
MERRA-2	Modern-Era Retrospective Analysis for Research and Applications, Version 2
MFC	mid-frequency cetaceans
Mft^3	million cubic feet
mG	milligauss
mg/L	milligram(s) per liter
MHWL	mean high water line
mm	millimeter(s)
Mm^3	million cubic meters
MMPA	Marine Mammal Protection Act of 1972
MMS	Minerals Management Service

MNL	Marine Navigation Lighting
MPa	megaPascal(s)
MRE	Marine Renewable Energy
MRIP	Marine Recreational Information Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	mean sea level
mV/m	millivolt(s)/meter
MVA	megavolt(s) amperes
MVAr	megavolt(s) amperes-reactive
MW	megawatt(s)
MWA	Maximum Work Area
N_2O	nitrous oxide
NAA	nonattainment area
NAAQS	National Ambient Air Quality Standards
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NBPA	New Bedford Port Authority
NCCA	National Coastal Condition Assessment
NCCR	National Coastal Condition Report
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NCODA	Navy Coupled Ocean Data Assimilation
NDBC	National Data Buoy Center
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NESEC	Northeast States Emergency Consortium
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGO	nongovernmental organization
NHPA	National Historic Preservation Act
NJDEP	New Jersey Department of Environmental Protection
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NNSR	nonattainment new source review
NO2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NODE	Navy OPAREA Density Estimate
NOx	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NRHP	National Register of Historic Places
NSRA	navigational safety risk assessment
NSR	new source review
NTL	Notice to Lessee

NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NYAC	New York Archaeological Council
NYCRR	New York Codes, Rules and Regulations
NYISO	New York Independent System Operator
NYNHP	New York Natural Heritage Program
NYPSC	New York Public Service Commission
NYSDAM	New York State Department of Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
NYSDPS	New York State Department of Public Service
NYSERDA	New York State Energy Research and Development Authority
NYSOGS	New York State Office of General Services
NYSOPRHP	New York State Office of Parks, Recreation and Historic Preservation
NYSPSC	New York State Department of Public Service Commission
O&M	operations and maintenance
OCS	outer continental shelf
OCS Lands Act	Outer Continental Shelf Lands Act
OPAREA	Special Operating Area
OSAMP	Ocean Special Area Management Plan
OSRP	Oil Spill Response Plan
OSS	offshore substation
OW	otariid pinnipeds in water
PAH	polycyclic aromatic hydrocarbon
PBN	*Providence Business News*
PCB	polychlorinated biphenyl
PD	Police Department
PLGR	pre-lay grapnel run
PM	particulate matter
PM_{10}	particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in aerodynamic diameter
PPA	Power Purchase Agreement
ppm	part(s) per million
PPW	phocid pinnipeds in water
Project	South Fork Wind Farm and South Fork Export Cable
PSD	Prevention of Significant Deterioration
PSL	New York Public Service Law
PSO	Protected Species Observer
PTS	permanent threshold shift
PV	Plan View
QMA	Qualified Marine Archaeologist

RCNM	Roadway Construction Noise Model
RI CRMC	Rhode Island Coastal Resources Management Council
RI CRMP	Rhode Island Coastal Resources Management Program
RI DEM	Rhode Island Department of Environmental Management
RI HPHC	Rhode Island Historical Preservation and Heritage Commission
RI-MA WEA	Rhode Island/Massachusetts Wind Energy Area
rms	root mean square
ROI	region of influence
ROW	right(s)-of-way
RV	recreational vehicle
SAP	site assessment plan
SAPVE	Study Area for Potential Visual Effects
SASS	Scenic Area of Statewide Significance
SAV	submerged aquatic vegetation
SCADA	Supervisory Control and Data Acquisition
SCFWH	Significant Coastal Fish and Wildlife Habitats
SD	standard deviation
SEL	sound exposure limit
SERDP	Strategic Environmental Research and Development Program
SFEC	South Fork Export Cable
SFEC - NYS	South Fork Export Cable – New York State Territorial Waters
SFEC - OCS	South Fork Export Cable – Outer Continental Shelf Waters
SFEC - Onshore	South Fork Export Cable – Onshore East Hampton
SFW	South Fork Wind, LLC
SFWF	South Fork Wind Farm
SHPO	State Historic Preservation Office
SIP	state implementation plan
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasure
SPDES	State Pollutant Discharge Elimination System
SPI	Sediment Profile Imaging
SPL	sound pressure level
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional Cultural Property
THPO	Tribal Historic Preservation Office(r)
TNC	The Nature Conservancy
tpy	tons per year
TSS	total suspended solids
TTS	temporary threshold shift
U.S.C.	*United States Code*
UDP	unanticipated discovery plan
URI	University of Rhode Island

USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USN	Unique Site Number
UTC	Coordinated Universal Time
UXO	unexploded ordnance
VIA	Visual Impact Assessment
VMS	vessel monitoring system
VOC	volatile organic compound
VRA	Visual Resource Assessment
VRAP	Visual Resource Assessment Procedure
VTR	Vessel Trip Report
WEA	Wind Energy Area
WTG	wind turbine generator
WTS	Waterson Terminal Services
XLPE	cross-linked polyethylene
yd^3	cubic yard(s)
ZOI	zone of influence
ZVI	zone of visual influence

Glossary and Terms

Term	Definition
Certified Verification Agent (CVA)	An individual or organization, experienced in the design, fabrication, and installation of offshore marine facilities or structures, who will conduct specified third-party reviews, inspections, and verifications in accordance with 30 CFR 585.705.
South Fork Wind, LLC (SFW)	Owner and future operator of the Project, the Project Applicant.
Environmental Protection Measure (EPM)	Measure proposed to avoid or minimize potential impacts.
Foundation	The bases to which the WTGs and OSS are installed on the seabed. Three types of foundations have been considered and reviewed for the project: jacket, monopile, or gravity-based structure (GBS). Monopile is the selected foundation type for the project.
horizontal directional drill (HDD)	Subsurface installation technique that will create an underground conduit through which the SFEC – Offshore will come ashore and join the SFEC - Onshore within a transition vault (i.e., the sea-to-shore transition). HDD avoids impacts to the beach and near shore environment.
Jet plow	Method of submarine cable installation equipment that primarily uses water jets to fluidize soil, temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor.
Impact determinations	Direct or indirect; short term or long term; and negligible, minor, moderate, or major.
Impact Producing Factor (IPF)	Project activities and infrastructure that could impact resources were identified as IPFs.
Inter-array Cable	AC cable that connects individual WTGs and transfers power between the WTGs and the OSS. The cable contains three conductors and a series of screens, insulators, fillers, sheathing, armor, and fiber optic communications cables.
Landing site	Locations on the shore of East Hampton, New York considered for the Sea-to-Shore Transition.
Mechanical cutter	Method of submarine cable installation equipment that involves a cutting wheel or excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor.
Mechanical plow	Method of submarine cable installation equipment that involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share.
Offshore Substation (OSS)	Collects electric energy generated by the WTG through the Inter-array Cables for transmission through the SFEC. Mounted on dedicated foundation or co-located on one foundation with a WTG.

Term	Definition
Operations and Maintenance (O&M) Facility	An ancillary facility of the SFWF that will be located either in a port in Montauk in East Hampton, New York or at Quonset Point in North Kingstown, Rhode Island. The SFWF O&M facility will support remote monitoring of the wind farm and offshore maintenance activities.
Power Purchase Agreement (PPA)	A financial agreement between two parties. This Project has a PPA with Long Island Power Authority.
pre-lay grapnel run (PLGR)	Process to remove possible obstructions and debris, such as abandoned fishing nets, wires, and hawsers, along the inter-array and SFEC - Offshore.
scour protection	Consists of engineered rock that may be placed at the base of each foundation to prevent undesirable seabed erosion.
Sea-to-Shore Transition	Connects the SFEC – NYS to the SFEC - Onshore. Comprised of the onshore transition vault where the offshore cable and the onshore cable will be spliced together and the underground conduit that leads from onshore transition vault to the exit point of the horizontal directional drill (HDD).
SFEC – Interconnection Facility	New facility to be located adjacent to the existing LIPA East Hampton substation. This facility is also referred to as "SFEC Onshore Substation" in the COP Appendices.
SFEC - Offshore	The export cable located in both federal waters (SFEC – OCS) and New York State territorial waters (SFEC – NYS), and the sea-to-shore transition vault in East Hampton, New York. SFEC – OCS: the submarine segment of the export cable buried beneath the seabed within federal waters on the OCS from the OSS to the boundary of New York State territorial waters. SFEC – NYS: the submarine segment of the export cable buried beneath the seabed within state territorial waters from the boundary of New York State territorial waters to a sea-to-shore transition vault located in the town of East Hampton on Long Island, Suffolk County, New York.
SFEC - Onshore	The terrestrial underground segment of the export cable from the sea-to-shore transition vault to a new SFEC - Interconnection Facility where the SFEC will interconnect with the Long Island Power Authority (LIPA) electric transmission and distribution system in the town of East Hampton on Long Island, Suffolk County, New York.
South Fork Export Cable (SFEC)	Comprised of an alternating current (AC) electric cable that will connect the SFWF to the existing mainland electric grid in East Hampton, New York. The SFEC includes both the SFEC – Offshore and SFEC – Onshore.
South Fork Wind Farm (SFWF)	Comprised of up to 15 wind turbine generators (WTGs, turbines), submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located within federal waters on the outer continental shelf (OCS). SFWF also includes an Operations and Maintenance (O&M) facility that will be located onshore.
Supervisory Control and Data Acquisition (SCADA)	Fiber optic system embedded in the Project cables that provides remote wind farm monitoring and control between the WTG, substations, and remote operation center(s). The SCADA provides a live status of environmental conditions within the SFWF, as well as mechanical and electrical state of each WTG.
Wind Turbine Generator (WTG)	Electricity-generating wind turbine made of a tower, nacelle, rotor, and blades, with a nameplate capacity of 6 to 12 megawatts (MW) per turbine.

Section 1 - Introduction

This Construction and Operations Plan (COP) is being submitted by South Fork Wind, LLC (SFW, the Applicant) to support the siting and development of the South Fork Wind Farm (SFWF) and the South Fork Export Cable (SFEC), collectively the Project.

The purpose of this COP is to provide information about the Project to the Bureau of Ocean Energy Management (BOEM) and other federal and state agencies. The COP was prepared in accordance with Title 30 of the *Code of Federal Regulations* (CFR) Part 585 (30 CFR § 585), BOEM's *Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP)* (BOEM, 2016), and other BOEM policy, guidance and regulations as summarized in Table 1.0-1. Table 1.0-2 includes the relevant lease stipulations for the Project. The COP includes the following:

- A description of all planned facilities, including onshore and support facilities
- A description of all proposed activities, including construction activities, commercial operations, maintenance, and conceptual decommissioning plans
- The basis for the analysis of the environmental and socioeconomic impacts and operational integrity of the proposed construction, operation, maintenance, and decommissioning activities
- Information to support relevant federal permit applications and consultations.

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Table 1.0-1. Summary of Information Requirements for a Construction and Operations Plan
Details on the federal requirements for a COP and where to find relevant information for the SFWF and SFEC

Requirement	Compliance Statement/Location within COP
30 CFR §585.105(a)	
1) Design your projects and conduct all activities in a manner that ensures safety and will not cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components to the extent practicable; and take measures to prevent unauthorized discharge of pollutants including marine trash and debris into the offshore environment.	Sections 1-4 Appendices A-AA
30 CFR §585.621(a-g)	
a) The project will conform to all applicable laws, implementing regulations, lease provisions, and stipulations or conditions of the lease.	Section 1.3, Regulatory Framework
b) The project will be safe.	Appendix E, Safety Management System Appendix F, Project Supplemental Information Appendix G, Project Plans and Conceptual Drawings Appendix H, Geophysical and Geotechnical Survey Reports Appendix X, Navigational Safety Risk Assessment
c) The project will not unreasonably interfere with other uses of the outer continental shelf (OCS), including those involved with National security or defense.	Section 4.6.4, Recreation and Tourism Section 4.6.5, Commercial and Recreational Fishing Section 4.6.6, Commercial Shipping Section 4.6.7, Coastal Land Use and Infrastructure Section 4.6.8, Other Marine Uses Appendix X, Navigational Safety Risk Assessment
d) The project will 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 archeological significance.	Executive Summary, specifically Table ES-1 Section 4, Site Characterization and Assessment of Potential Impacts
e) The project will use the best available and safest technology.	Section 2.3 Appendix G, Project Plans and Conceptual Drawings

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<table>
<tr><th colspan="2">Requirement</th><th>Compliance Statement/Location within COP</th></tr>
<tr><td colspan="2">f) The project will use best management practices.</td><td>Executive Summary, specifically Table ES-1
Section 4.7, Summary of Potential Impacts and Environmental Protection Measures</td></tr>
<tr><td colspan="2">g) The project will use properly trained personnel.</td><td>SFW will comply.</td></tr>
<tr><td colspan="3">30 CFR § 585.626(a) - You must submit the results of the following surveys for the proposed site(s) of your facility(ies). Your COP must include the following information:</td></tr>
<tr><td colspan="2">1) Shallow hazards: The results of the shallow hazards survey with supporting data.
Information sufficient to determine the presence of the following features and their likely effects on your proposed facility, including:
(i) Shallow faults;
(ii) Gas seeps or shallow gas;
(iii) Slump blocks or slump sediments;
(iv) Hydrates; or
(v) Ice scour of seabed sediments.</td><td>Appendix H, Geophysical and Geotechnical Survey Reports</td></tr>
<tr><td>2) Geological survey relevant to the design and siting of your facility.</td><td>The results of the geological survey with supporting data.
Assessment of:
(i) Seismic activity at your proposed site;
(ii) Fault zones;
(iii) The possibility and effects of seabed subsidence; and
(iv) The extent and geometry of faulting attenuation effects of geologic conditions near your site.</td><td>Appendix H, Geophysical and Geotechnical Survey Reports
Appendix I, Hydrodynamic and Sediment Transport Modeling Results
SFW requested to submit the information necessary to satisfy 30 CFR § 585.626(a)(2) for the entire MWA following completion of additional survey in that area; that survey has been completed and is included in Appendix H.</td></tr>
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Requirement		Compliance Statement/Location within COP
3) Biological: The results of the biological survey with supporting data. A description of the results of biological surveys used to determine the presence of:	Live bottoms and hard bottoms.	Section 4.2.3, Geological Resources Section 4.3.2, Benthic and Shellfish Resources Appendix H4, Sediment Profile Imaging and Benthic Survey Report Appendix N1, Pre-Construction Sediment Profile and Plan View Imaging Benthic Assessment Report Appendix N2, Benthic Habitat Mapping to Support Essential Fish Habitat Consultation SFW requested to submit the information necessary to satisfy 30 CFR §§ 585.626(a)(3) for the entire MWA following completion of additional survey in that area; that survey has been completed and is included in Appendix H4 and Appendix N1.
	Topographic features.	Section 4.2.3, Geological Resources Section 4.2.4, Physical Oceanography and Meteorology Appendix H, Geophysical and Geotechnical Survey Reports SFW requested to submit the information necessary to satisfy 30 CFR §§ 585.626(a)(3) for the entire MWA following completion of addition survey in that area; that survey has been completed and is included in Appendix H.
	Surveys of other marine resources such as fish populations (including migratory populations).	Section 4.3.2, Benthic and Shellfish Resources Section 4.3.3, Finfish and Essential Fish Habitat Appendix N1, Pre-Construction Sediment Profile and Plan View Imaging Benthic Assessment Report Appendix O, Essential Fish Habitat Assessment

Table 1.0-1. Summary of Information Requirements for a Construction and Operations Plan
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Requirement		Compliance Statement/Location within COP
	Marine mammals.	Section 4.3.4, Marine Mammals Appendix P1, Assessment of Impacts to Marine Mammals, Sea Turtles, and Sturgeon Appendix P2, Animal Exposure Modelling for Foundation Installation
	Sea turtles.	Section 4.3.5, Sea Turtles Appendix P1, Assessment of Impacts to Marine Mammals, Sea Turtles and Sturgeon Appendix P2, Animal Exposure Modelling for Foundation Installation
	Sea birds.	Section 4.3.6, Avian Species Appendix Q, Avian and Bat Risk Assessment
4) Geotechnical survey: The results of your sediment testing program with supporting data, the various field and laboratory test methods employed, and the applicability of these methods as they pertain to the quality of the samples, the type of sediment, and the anticipated design application. You must explain how the engineering properties of each sediment stratum impact the design of your facility. In your explanation, you must describe the uncertainties inherent in your overall testing program, and the reliability and applicability of each test method.	(i) The results of a testing program used to investigate the stratigraphic and engineering properties of the sediment that may impact the foundations or anchoring systems for your facility.	Section 4.2.3, Geological Resources Appendix H, Geophysical and Geotechnical Survey Reports Appendix I, Hydrodynamic and Sediment Transport Modeling Results SFW has requested to submit additional information necessary to satisfy 30 CFR §§ 585.626(a)(4)(ii) following completion of additional survey in that area.
	(ii) The results of adequate *in situ* testing, boring, and sampling at each foundation location, to examine all important sediment and rock strata to determine its strength classification, deformation properties, and dynamic characteristics.	
	(iii) The results of a minimum of one deep boring (with soil sampling and testing) at each edge of the project area and within the project area as needed to determine the vertical and lateral variation in seabed conditions and to provide the relevant geotechnical data required for design.	

Table 1.0-1. Summary of Information Requirements for a Construction and Operations Plan
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Requirement		Compliance Statement/Location within COP
5) Archaeological resources. The results of the archaeological resource survey with supporting data.	A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act (NHPA) (54 *United States Code* [U.S.C.] 300101 *et. seq.*), as amended.	Section 4.4, Cultural Resources Appendix R, Marine Archaeological Resources Assessment Appendix S - Archaeological Resources Report-Onshore Appendix T - Historic Architectural Resources Survey Report SFW requested to submit the information necessary to satisfy 30 CFR §§ 585.626(a)(5) for the entire MWA following completion of additional survey in that area; that survey has been completed and is included in Appendix R.
6) Overall site investigation. An overall site investigation report for your facility that integrates the findings of your shallow hazards surveys and geologic surveys, and, if required, your subsurface surveys with supporting data.	An analysis of the potential for: (i) Scouring of the seabed;	The site investigation report, provided in Appendix H (Geophysical and Geotechnical Survey Reports), integrates the findings of the shallow hazards survey and geological surveys. SFW has requested to submit the information necessary to satisfy 30 CFR §§ 585.626(a)(6)(i) through (xi) in the Facility Design Report (FDR).
	(ii) Hydraulic instability;	
	(iii) The occurrence of sand waves;	
	(iv) Instability of slopes at the facility location;	
	(v) Liquefaction, or possible reduction of sediment strength due to increased pore pressures;	
	(vi) Degradation of subsea permafrost layers;	
	(vii) Cyclic loading;	
	(viii) Lateral loading;	
	(ix) Dynamic loading;	
	(x) Settlements and displacements;	
	(xi) Plastic deformation and formation collapse mechanisms; and	
	(xii) Sediment reactions on the facility foundations or anchoring systems.	

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Requirement		Compliance Statement/Location within COP
30 CFR § 585.626(b) - Your COP must include the following project-specific information, as applicable.		
1) Contact Information.	The name, address, e-mail address, and phone number of an authorized representative.	Section 1.6.1, Authorized Representative and Operator
2) Designation of operator, if applicable	As provided in § 585.405.	Section 1.6.1, Authorized Representative and Operator
3) The construction and operation concept	A discussion of the objectives,	Section 1.2, Project Purpose
	Description of the proposed activities,	Section 1.1, Project Overview Section 3, Project Description
	Tentative schedule from start to completion, and	Section 1.5, Tentative Schedule
	Plans for phased development, as provided in § 585.629.	Not applicable - the Project is a single, complete, and independent project that will not be developed in phases
4) Commercial lease stipulations and compliance	A description of the measures you took, or will take, to satisfy the conditions of any lease stipulations related to your proposed activities.	Section 1.1, Project Overview, Table 1.0-2
5) A location plat	The surface location and water depth for all proposed structures, facilities, and appurtenances located both offshore and onshore, including all anchor/mooring data.	Section 1.1, Project Overview, Figure 1.1-1 Appendix F, Project Supplemental Information Appendix G, Project Engineering Plans and Construction Drawings
	The surface location and water depth for all existing structures, facilities, and appurtenances located both offshore and onshore, including all anchor/mooring data.	Section 1.1, Project Overview, Figures 1.1-1 and 1.1-2 Section 3.1.3.1, Ports, Vessels and Vehicles, and Material Transportation, Figure 3.1-7

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Requirement		Compliance Statement/Location within COP
6) General structural and project design, fabrication, and installation.	Information for each type of structure associated with your project and, unless BOEM provides otherwise, how you will use a Certified Verification Agent (CVA) to review and verify each stage of the project.	Section 1.6.3, Certified Verification Agent Nominations Section 3.1.1, (SFWF) Project Location Section 3.1.2, SFWF Facilities Section 3.2.1, (SFEC) Project Location Section 3.2.2, SFEC Facilities Appendix C, CVA Nomination Appendix F, Project Supplemental Information Appendix G, Project Plans and Conceptual Drawings
7) All cables and pipelines, including cables on project easements.	Location, design and installation methods, testing, maintenance, repair, safety devices, exterior corrosion protection, inspections, and decommissioning.	Section 2, Project Siting and Future Activities Section 3.1.2.3, (SFWF) Inter-Array Cable Section 3.1.3.3, Inter-Array Cable Installation Section 3.1.5.4, (Operations and Maintenance) Inter-Array Cable Section 3.2, South Fork Export Cable Appendix E, Safety Management System Appendix F, Project Supplemental Information
8) A description of the deployment activities	Safety, prevention, and environmental protection features or measures that you will use.	Section 1.6.5, Safety Management System Section 4.2.2, Water Quality and Water Resources Section 4.7, Summary of Potential Impacts and Environmental Protection Measures Appendix D, Oil Spill Response Plan Appendix E, Safety Management System Appendix F, Project Supplemental Information Appendix X, Navigational Safety Risk Assessment
9) A list of solid and liquid wastes generated	Disposal methods and locations.	Section 4.1.5, Discharges and Releases Appendix F, Project Supplemental Information

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Requirement		Compliance Statement/Location within COP
10) A listing of chemical products used (if stored volume exceeds Environmental Protection Agency (EPA) Reportable Quantities).	A list of chemical products used; the volume stored on location; their treatment, discharge, or disposal methods used; and the name and location of the onshore waste receiving, treatment, and/or disposal facility. A description of how these products will be brought onsite, the number of transfers that may take place, and the quantity that that will be transferred each time.	Appendix D, Oil Spill Response Plan Appendix F, Project Supplemental Information
11) A description of any vessels, vehicles, and aircraft you will use to support your activities.	An estimate of the frequency and duration of vessel/vehicle/aircraft traffic.	Section 2.3, Review of Technologies and Installation Methods Section 3.1.3, (SFWF) Construction Section 3.2.3, (SFEC) Construction Section 4.1.7, Traffic (Vessels, Vehicles, and Aircraft) Appendix X, Navigational Safety Risk Assessment
12) A general description of the operating procedures and systems.	(i) Under normal conditions.	Section 1.6, Other Project Information Section 3.1.5, (SFWF) Operations and Maintenance Section 3.2.5, (SFEC) Operations and Maintenance Appendix F, Project Supplemental Information
	(ii) In the case of accidents or emergencies, including those that are natural or manmade.	Section 3.1.5, (SFWF) Operations and Maintenance Section 3.2.5, (SFEC) Operations and Maintenance Appendix D, Oil Spill Response Appendix E, Safety Management System Appendix F, Project Supplemental Information

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Requirement		Compliance Statement/Location within COP
13) Decommissioning and site clearance procedures	A discussion of general concepts and methodologies.	Section 2.3, Review of Technologies and Installation Methods Section 3.1.6, (SFWF) Conceptual Decommissioning Section 3.2.6, (SFEC) Conceptual Decommissioning
14) A listing of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations.	(i) The U.S. Coast Guard (U.S. Coast Guard), U.S. Army Corps of Engineers (USACE), and any other applicable authorizations, approvals, or permits, including any Federal, State or local authorizations pertaining to energy gathering, transmission or distribution (e.g., interconnection authorizations).	Section 1.3, Regulatory Framework Appendix A, Coastal Zone Management Consistency Statements
	(ii) A statement indicating whether you have applied for or obtained such authorization, approval, or permit.	Section 1.3.1, Federal Permits, Approvals, and Consultations
15) Your proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts.	A description of the measures you will use to avoid or minimize adverse impacts and any potential incidental take before you conduct activities on your lease, and how you will mitigate environmental impacts from your proposed activities, including a description of the measures you will use as required by subpart H of this part.	Section 4.7, Summary of Potential Impacts and Proposed Environmental Protection Measures
16) Information you incorporate by reference	A listing of the documents you referenced.	Section 5, References
17) 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.	Contact information and issues discussed.	Section 1.4, Agency and Stakeholder Outreach
18) Reference	A list of any document or published source that you cite as part of your plan. You may reference information and data discussed in other plans you previously submitted or that are otherwise readily available to BOEM.	Section 5, References Appendices A–BB

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Requirement		Compliance Statement/Location within COP
19) Financial assurance	Statements attesting that the activities and facilities proposed in your COP are or will be covered by an appropriate bond or security, as required by §§ 585.515 and 585.516.	Section 1.6.2, Financial Assurance
20) CVA nominations for reports required in subpart G of this part.	CVA nominations for reports in subpart G of this part, as required by § 585.706, or a request for a waiver under § 585.705(c).	Section 1.6.3, Certified Verification Agent Nomination Appendix C, Certified Verification Agent Nomination
21) Construction schedule	A reasonable schedule of construction activity showing significant milestones leading to the commencement of commercial operations.	1.5, Tentative Schedule
22) Air quality information	As described in § 585.659 of this section.	Section 4.1.8, Air Emissions Section 4.2.1, Air Quality Appendix L, Air Emissions Inventory
23) Other information	Additional information as required by BOEM.	N/A
30 CFR § 585.627(a) - You must submit with your COP detailed information to assist BOEM in complying with NEPA and other relevant laws. Your COP must describe those resources, conditions, and activities listed in the following table that could be affected by your proposed activities, or that could affect the activities proposed in your COP, including:		
1) Hazard Information	Meteorology and oceanography.	Section 4.2.4, Physical Oceanography and Meteorology
	Sediment transport, geology, and shallow geological or manmade hazards.	Section 4.2.3, Geological Resources Appendix H, Geophysical and Geotechnical Survey Reports Appendix I, Hydrodynamic and Sediment Transport Modeling Results

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Requirement		Compliance Statement/Location within COP
2) Water Quality	Turbidity and total suspended solids from construction.	Section 2.3, Review of Technologies and Installation Methods Section 4.1.2, Sediment Suspension and Deposition Section 4.2.2, Water Quality and Water Resources Appendix I, Hydrodynamic and Sediment Transport Modeling Results
3) Biological resources	Benthic communities.	Section 4.3.2, Benthic and Shellfish Resources Appendix N1, Pre-Construction Sediment Profile and Plan View Imaging Benthic Assessment Report Appendix N2, Benthic Habitat Mapping to Support Essential Fish Habitat Consultation
	Marine mammals.	Section 4.3.4, Marine Mammals Appendix P1, Assessment of Impacts to Marine Mammals, Sea Turtles, and Sturgeon Appendix P3, Protected Species Mitigation and Monitoring Plan
	Sea turtles.	Section 4.3.5, Sea Turtles Appendix P1, Assessment of Impacts to Marine Mammals, Sea Turtles, and Sturgeon Appendix P3, Protected Species Mitigation and Monitoring Plan
	Coastal and marine birds.	Section 4.3.6, Avian Species Appendix Q, Avian and Bat Risk Assessment

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Requirement		Compliance Statement/Location within COP
	Fish and shellfish.	Section 4.3.3, Finfish and Essential Fish Habitat Appendix N1, Pre-Construction Sediment Profile and Plan View Imaging Benthic Assessment Report Appendix N2, Benthic Habitat Mapping to Support Essential Fish Habitat Consultation Appendix O, Essential Fish Habitat Assessment
	Plankton.	Section 4.3.3, Finfish and Essential Fish Habitat Appendix O, Essential Fish Habitat Assessment
	Seagrasses.	Section 4.3.1, Coastal and Terrestrial Habitat Section 4.3.2, Benthic and Shellfish Resources Appendix O, Essential Fish Habitat Assessment
	Plant life.	Section 4.3.1, Coastal and Terrestrial Habitat Section 4.3.3, Finfish and Essential Fish Habitat Appendix O, Essential Fish Habitat Assessment
4) Threatened or endangered species	As defined by the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.).	Section 4.3, Biological Resources Appendix P1, Assessment of Impacts to Marine Mammals, Sea Turtles, and Sturgeon Appendix Q, Avian and Bat Risk Assessment
5) Sensitive biological resources or habitats	Essential fish habitat.	Section 4.3.3, Finfish and Essential Fish Habitat Appendix O, Essential Fish Habitat Assessment
	Refuges and preserves.	Section 4.6.8, Other Marine Uses
	Special management areas identified in coastal management programs, sanctuaries, rookeries.	Section 4.6.8, Other Marine Uses

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Requirement		Compliance Statement/Location within COP
	Hard bottom habitat.	Section 4.3.2, Benthic and Shellfish Resources Appendix H, Geophysical and Geotechnical Survey Reports Appendix N1, Pre-Construction Sediment Profile and Plan View Imaging Benthic Assessment Report Appendix N2, Benthic Habitat Mapping to Support Essential Fish Habitat Consultation
	Chemosynthetic communities.	N/A
	Calving grounds.	N/A
	Barrier islands, beaches, and dunes.	Section 4.3.1, Coastal and Terrestrial Habitat
	Wetlands.	Section 4.3.1, Coastal and Terrestrial Habitat
6) Archaeological resources	As required by the NHPA (54 U.S.C. 300101 et seq.), as amended.	4.4, Cultural Resources Appendix R, Marine Archaeological Resources Assessment Appendix S, Archaeological Resources Report-Onshore Appendix T, Historic Architectural Resources Survey Appendix W – Historic Resources Visual Effects Analysis Appendix BB1 – O&M Facility (Visual Effects Analysis) Appendix BB2 – O&M Facility (Archaeology)
7) Social and Economic resources	Employment.	4.6, Socioeconomic Resources 4.6.1, Population, Economy, and Employment Appendix AA, Economic Development and Jobs Analysis Report

Table 1.0-1. Summary of Information Requirements for a Construction and Operations Plan
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Requirement		Compliance Statement/Location within COP
	Existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water).	4.6.3, Public Services 4.6.6, Commercial Shipping 4.6.7, Coastal Land Use and Infrastructure 4.6.8, Other Marine Uses
	Land use.	4.4.1, Above Ground Historic Properties 4.6.7, Coastal Land Use and Infrastructure
	Subsistence resources and harvest practices.	4.6.5, Commercial and Recreational Fishing 4.6.9, Environmental Justice
	Recreation, recreational and commercial fishing (including typical fishing seasons, location, and type).	Section 4.6.5, Commercial and Recreational Fishing Appendix B, Fisheries Communication and Outreach Plan Appendix Y, Commercial and Recreational Fisheries Technical Report
	Minority and lower income groups.	Section 4.6.1, Population, Economy, and Employment Section 4.6.2, Housing and Property Values Section 4.6.9, Environmental Justice
	Coastal zone management programs.	Section 1.3.4, Coastal Zone Management Act Consistency Appendix A, Coastal Zone Management Federal Consistency Statements
	Viewshed.	Section 4.1.9, Visible Structures Section 4.5, Visual Resources Appendix U, Visual Resource Assessment, SFEC Onshore Substation Appendix V, Visual Impact Assessment, SFWF Appendix W, Historic Resources Visual Effects Analysis
8) Coastal and marine uses	Military activities.	

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Requirement		Compliance Statement/Location within COP
	Vessel traffic.	Section 4.6.6, Commercial Shipping Section 4.6.8, Other Marine Uses Appendix X, Navigational Safety Risk Assessment
	Energy and nonenergy mineral exploration or development.	
9) Consistency Certification	As required by the Coastal Zone Management Act (CZMA): (i) 15 CFR part 930, subpart D, for noncompetitive leases. (ii) 15 CFR part 930, subpart E, for competitive leases.	Section 1.3.4, Coastal Zone Management Act Consistency Appendix A, Coastal Zone Management Consistency Statements
10) Other resources, conditions, and activities	As identified by BOEM.	N/A
30 CFR § 585.627(b) - You must submit one paper copy and one electronic copy of your consistency certification. Your consistency certification must include:		
CZMA Consistency Certification	1) One copy of your consistency certification under subsection 307(c)(3)(B) of the CZMA (16 U.S.C. 1456(c)(3)(B)) and 15 CFR 930.76 stating that the proposed activities described in detail in your plans comply with the State(s) approved coastal management program(s) and will be conducted in a manner that is consistent with such program(s); 2) ''Information,'' as required by 15 CFR 930.76(a) and 15 CFR 930.58(a)(2), and ''Analysis,'' as required by 15 CFR 930.58(a)(3).	Section 1.3.4, Coastal Zone Management Act Consistency Appendix A, Coastal Zone Management Consistency Statements
30 CFR § 585.627(c)		
Oil Spill Response Plan	In accordance with 30 Part 254.	Appendix D, Oil Spill Response Plan
30 CFR § 585.627(d)		
Safety Management System	In accordance with 30 CFR 585.810.	Appendix E, Safety Management System

Table 1.0-2. Summary of Lease Requirements for SFWF and SFEC
Details on the lease termss and stipulations relevant to construction and operations for SFWF and SFEC

Lease Requirements	Description	Compliance Statement/ Location within COP
Section 4: Payments (a)	The lessee must make all rent payments to the Lessor in accordance with applicable regulations, unless otherwise specified Appendix B.	SFW will comply.
Section 4: Payments (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".	SFW will comply.
Section 5: Plans	The Lessee may conduct those activities described in Addendum "A" only in accordance with a Site Assessment Plan (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.	Understood.
Section 6: Associated Project Easements	Pursuant to 30 CFR 585.200(b), the Lessee has the right to one or more project easements, without further competition, for the purpose of installing, gathering, transmission, and distribution cables, pipelines, and appurtenances on the OCS, as necessary for the full enjoyment of the lease, and under applicable regulations in 30 CFR Part 585. As part of submitting a COP for approval, the Lessee may request that one or more easement(s) be granted by the Lessor. If the Lessee requests that one or more easements by granted when submitting a COP for approval, such project easements will be granted by the Lessor in accordance with the Act and applicable regulations in 30 CFR Part 585 upon approval of the COP in which the Lessee has demonstrated a need for such easements. Such easements must be in a location acceptable to the Lessor and will be subject to such conditions as the Lessor may require. The project easements that would be issued in conjunction with an approved COP under this lease will be described in Addendum "D" to this lease, which will be updated as necessary.	With approval of this COP, SFW requests that BOEM issue a project easement for the portions of SFEC located in federal waters, under the applicable regulations in 30 CFR Part 585.
Section 7: Conduct of Activities	The Lessee must conduct, and agrees to conduct, all activities in the leased area in accordance with an approved SAP or COP, and with all applicable laws and regulations.	SFW will comply.
Section 10: Financial Assurance	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."	Section 1.6.2, Financial Assurance

Table 1.0-2. Summary of Lease Requirements for SFWF and SFEC

Details on the lease termss and stipulations relevant to construction and operations for SFWF and SFEC

Lease Requirements	Description	Compliance Statement/ Location within COP
Section 13: Removal of Property and Restoration of the Leased Area on Termination of Lease.	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 seabed of all obstructions created by activities on the leased area, including any project easements 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.	Section 3.1.6, (SFWF) Conceptual Decommissioning Section 3.2.6, (SFEC) Conceptual Decommissioning
Section 14: Safety Requirements	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 areas 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.	Section 1.3, Regulatory Framework Appendix E, Safety Management System Appendix F, Project Supplemental Information Appendix G, Project Engineering Plans and Construction Drawings Appendix H, Geophysical and Geotechnical Survey Reports
Section 15: Debarment Compliance	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.	SFW will comply.

Table 1.0-2. Summary of Lease Requirements for SFWF and SFEC
Details on the lease termss and stipulations relevant to construction and operations for SFWF and SFEC

Lease Requirements	Description	Compliance Statement/ Location within COP
Section 16: Notices	All notices or reports provided from one party to the other under the terms of this lease must be in writing except as provided herein and in the applicable regulations in 30 CFR Part 585. Written notices must be delivered to the party's Lease Representative, as specifically listed in Addendum "A," either electronically, by hand, by facsimile, or by United States first class mail, adequate postage prepaid. Either party may notify the other of a change of address by doing so in writing. Until notice of any change of address is delivered as provided in this section, the last recorded address of either party will be deemed the address for all notices required under this lease. For all operational matters, notices must be provided to the party's Operations Representative, as specifically listed in Addendum "A," as well as the Lease Representative.	SFW will comply.
Addendum B - Lease Term and Financial Schedule; 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 (see Lease document for payment schedule).	SFW will comply.

1.1 Project Overview

SFW will be responsible for the construction, operations and maintenance (O&M), and decommissioning of the Project, which consists of the following components:

- **South Fork Wind Farm (SFWF):** includes up to 15 wind turbine generators (WTGs, turbines) with a nameplate capacity of 6 to 12 megawatts (MW) per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located within federal waters on the OCS, specifically in BOEM Renewable Energy Lease Area OCS-A 0517 (Lease Area),[3] approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. The SFWF also includes an O&M facility that will be located onshore at either Montauk in East Hampton, New York or Quonset Point in North Kingstown, Rhode Island.
- **South Fork Export Cable (SFEC):** an alternating current (AC) electric cable that will connect the SFWF to the existing mainland electric grid in East Hampton, New York. The SFEC includes both offshore and onshore segments.
  - **SFEC - OCS:** the submarine segment of the export cable buried beneath the seabed within federal waters on the OCS from the OSS to the boundary of New York State territorial waters.
  - **SFEC - New York State** (**NYS):** the submarine segment of the export cable buried beneath the seabed within state territorial waters from the boundary of New York State waters to a sea-to-shore transition vault located in the Town of East Hampton on Long Island, Suffolk County, New York. The SFEC - NYS includes the sea-to-shore transition.
  - **SFEC - Onshore**: the terrestrial underground segment of the export cable from the sea-to-shore transition vault to the interconnection facility where the SFEC will interconnect with the Long Island Power Authority (LIPA) electric transmission and distribution system East Hampton. The SFEC - Onshore includes the SFEC - Interconnection Facility.

The general operational concept for the Project is shown on Figure 1.1-1. The kinetic energy in the wind turns the WTG rotor by creating lift on the blades to generate electricity. Electricity generated from each WTG is collected through a series of Inter-array Cables that terminate at an offshore substation. The offshore substation connects to an export cable that carries the power to the onshore interconnection facility, which will connect to an existing substation where power is transmitted to the electric grid.

The approximate location of the Project is shown on Figure 1.1-2.

SFW has committed to an indicative layout scenario with WTGs sited in a grid with approximately 1.15 mile (1.9 km, 1.0 nm) by 1.15 mile (1.9 km, 1.0 nm) spacing that aligns with other proposed adjacent offshore wind projects in the Rhode Island/Massachusetts Wind Energy Area (RI-MA WEA).

The proposed location of the SFEC - NYS and SFEC - Onshore, including two landing sites, are shown in detail on Figure 1.1-3. Section 3 provides a detailed description of the SFWF and SFEC.

Port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, and/or Virginia may be utilized to support construction, O&M, and decommissioning (described in Section 3.1.3.1).

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[3] The leaseholder of Renewable Energy Lease Area OCS-A 0517 is South Fork Wind, LLC. On March 23, 2020 BOEM approved the assignment of a portion of lease OCS-A 0486 to Deepwater Wind South Fork, LLC which had the effect of segregating this portion into a new lease, which was given lease number OCS-A 0517. Subsequent to BOEM's approval of this lease assignment, Deepwater Wind South Fork, LLC changed its name to South Fork Wind, LLC.

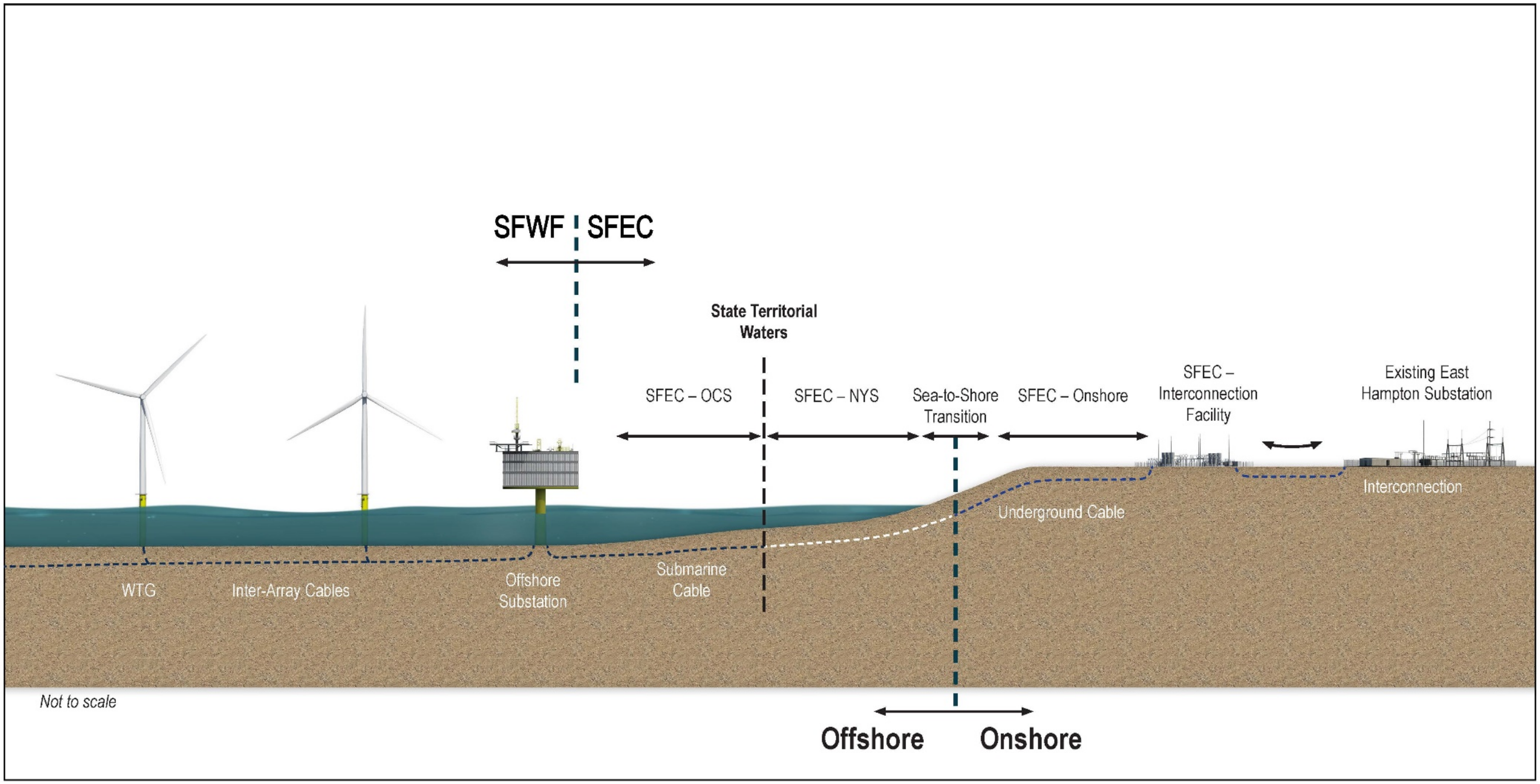

Figure 1.1-1. Project Operational Concept
Illustrated components of the Project.

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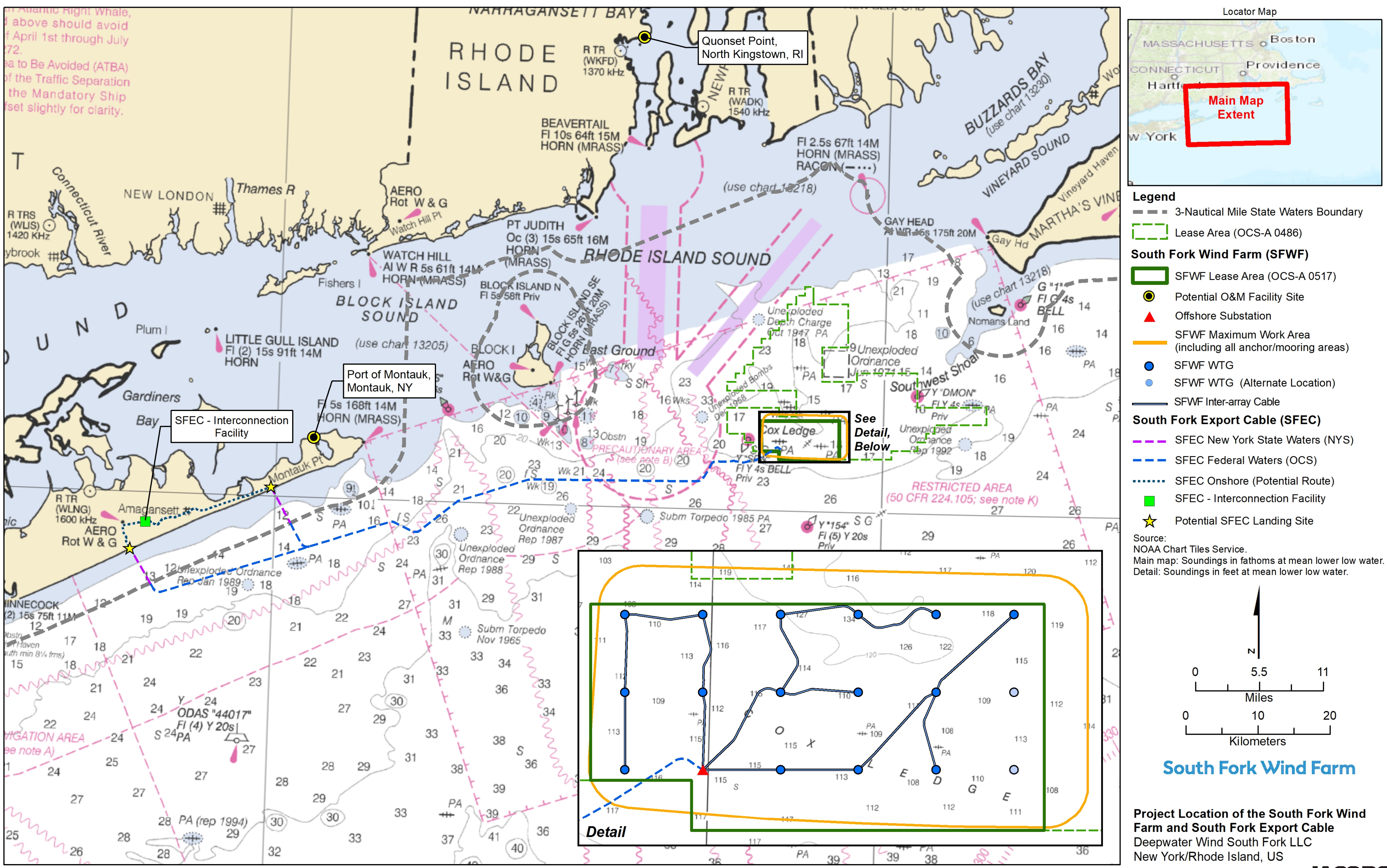

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Figure 1.1-2. Project Location of SFWF and SFEC

Depiction of the SFWF and SFEC, shown on a nautical chart.

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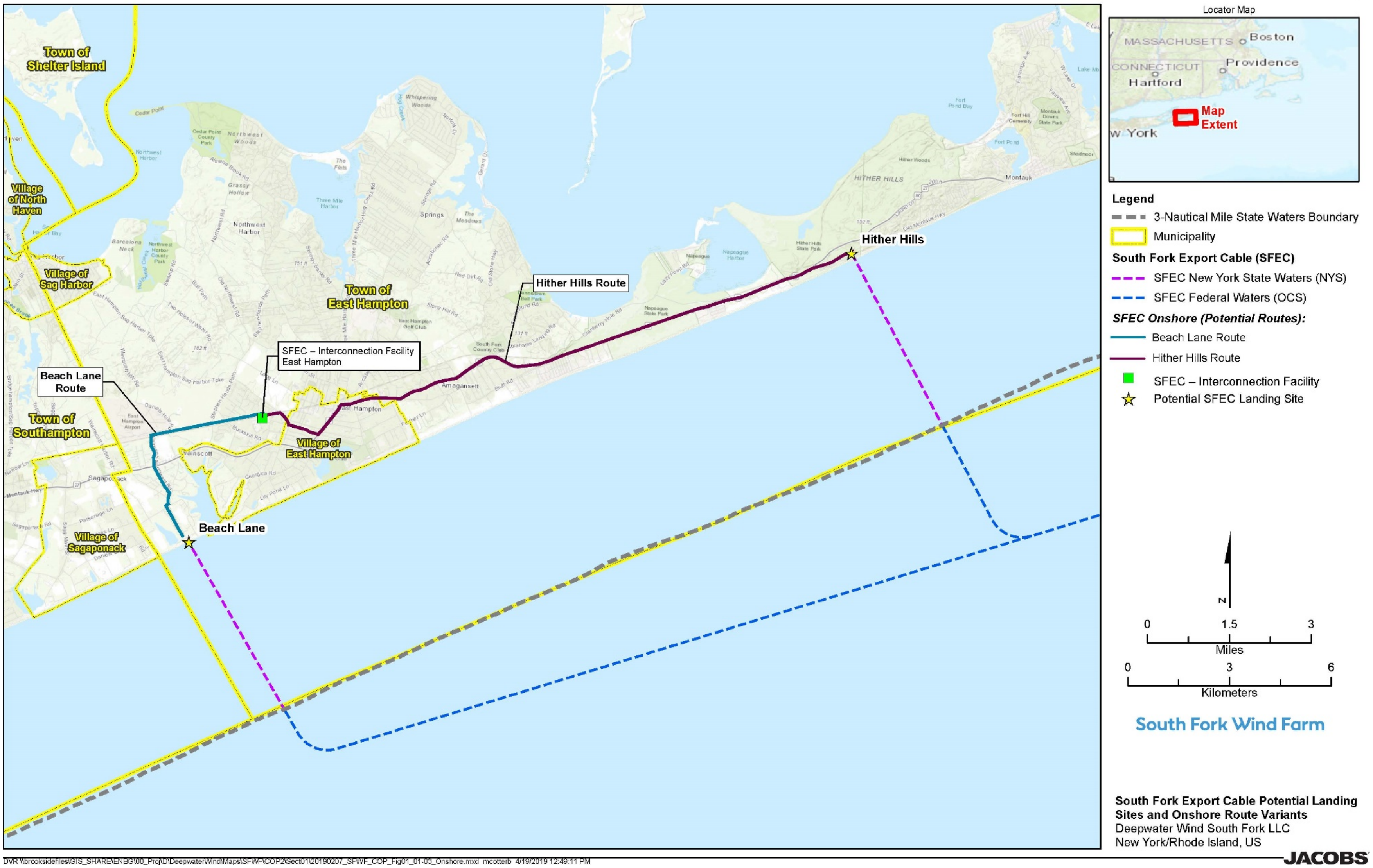

Figure 1.1-3. SFEC – Potential Landing Sites and Onshore Route Variants

Depiction of the SFEC - NYS and SFEC - Onshore, including landing site options, and interconnection point at SFEC - Interconnection Facility.

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1.2 Project Purpose

The purpose of the Project is to generate electricity from an offshore wind farm located in the Lease Area and to transmit it to the East Hampton Substation. The Project addresses the need identified by the LIPA for new sources of power generation that can cost-effectively and reliably supply the South Fork of Suffolk County, Long Island, as an alternative to constructing new transmission facilities. The Project will also help LIPA achieve its renewable energy goals. The Project will enable SFW to fulfill its contractual commitments to LIPA pursuant to a Power Purchase Agreement (PPA) executed in 2017 resulting from LIPA's technology-neutral competitive bidding process.

1.3 Regulatory Framework

As described in Section 1.1, Project components are proposed in federal waters on the OCS, waters of New York State, and at onshore locations in Long Island, New York. As a result, multiple federal and state agencies have regulatory authority over components of the Project. The SFWF and SFEC - OCS are proposed in federal waters on the OCS. The SFEC - NYS and SFEC - Onshore are proposed in waters of New York State, and onshore in New York State, respectively.

BOEM has the responsibility to regulate activities associated with the production, transportation, or transmission of renewable energy resources on the OCS under the Outer Continental Shelf Lands Act (OCS Lands Act) (43 U.S.C. § 1337). Associated with this authority, BOEM has issued a lease to the Applicant to develop renewable energy projects within the Lease Area. With approval of this COP, SFW requests that BOEM issue a project easement for the portions of the SFEC located in federal waters. In addition, BOEM is expected to be the lead federal agency during the review of the Project under the NEPA.

The New York State Department of Public Service Commission (NYSPSC) will lead the review of the SFEC - NYS and SFEC - Onshore within the territory of the State of New York under Article VII of the New York Public Service Law (PSL), which will include review under Section 401 of the Clean Water Act of 1972 (CWA).

Table 1.3-1 includes a list of the required federal and state permits and approvals, and the date of anticipated issuance. A listing of agency consultations relating to those permits and approvals are included in Table 1.4-1. Due to the preemptive effect of PSL § 130, the procedural requirements to obtain any local approval, consent, permit, certificate or other condition for the construction and operation of the Project do not apply.

1.3.1 Federal Permits, Approvals, and Consultations

The construction and operation of the Project will require a COP that is compliant with BOEM regulations (30 CFR § 585) and approved by BOEM prior to the start of construction.

The Applicant will also obtain various other federal approvals including:

- USACE Individual Permit
  - Clean Water Act Section 404 (33 U.S.C. § 1344) - Required for activities associated with the discharge of dredged or fill material in waters of the United States, in accordance with 33 CFR 328.4. These activities may include side-casting of material during installation of the SFEC, temporary excavation material associated with a temporary offshore cofferdam, placement of concrete matting associated with cable protection, and any temporary or permanent fill associated with the SFEC – Onshore. In addition, installation of the O&M Facility at Montuak may include dredging (Appendix BB3).
  - Rivers and Harbors Act of 1899 Section 10 (33 U.S.C. § 403) - Required for all structures and work conducted in waters of the United States, as well as fixed structures on the OCS. These activities include installation of foundations on the OCS, as well as installation of the SFEC under the seabed.

- U.S. Environmental Protection Agency (EPA) Clean Air Act (CAA) Outer Continental Shelf Air Permit(42 U.S.C. § 7627; 40 CFR Part 55, 60) – EPA regulates air quality on the OCS, including emissions from the construction, operation, and decommissioning of the SFWF and SFEC, including any equipment, activity, or facility that emits, or has the potential to emit, any air pollutant; is regulated or authorized under the OCS Lands Act; and is located on the OCS or in or on waters above the OCS. This definition includes vessels when they are permanently or temporarily attached to the seabed (40 CFR 55.2), as well as vessels associated with the Project while operating at the SFWF or within 25 nm (46.3 km) of the activity.
- National Marine Fisheries Service (NMFS) Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization (IHA) - For the unintentional “take” of marine mammals incidental to certain noise producing activities associated with the Project, including pile driving.

The Project is also required to undergo environmental review under NEPA (42 U.S.C. § 4321 *et seq*.) and comply with a variety of other federal regulations. Consultation and review will occur with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and the Marine Mammal Protection Act; with U.S. Fish and Wildlife Service (USFWS) and NMFS under Section 7 of the ESA; with National Park Service (NPS) for the Abandoned Shipwreck Act; and with the USCG, the U.S. Department of Defense, and the Bureau of Safety and Environmental Enforcement (BSEE). In addition, federal agency review of the Project must also occur under Section 106 of the NHPA and Section 307 of the CZMA.

1.3.2 National Environmental Policy Act

The NEPA and implementing regulations (40 CFR §§ 1500-1508) require that federal agencies consider the impacts of their actions on the environment. Actions that are not listed as categorically excluded or considered an administrative action not subject to NEPA must be reviewed, and an Environmental Assessment or an Environmental Impact Statement, must be prepared to document the analysis. Approval of the COP by BOEM and issuance of an Individual Permit by USACE are both considered federal actions for the Project that will trigger review under NEPA. It is expected that BOEM will act as the Lead Federal Agency for the NEPA review of the Project.

Table 1.3-1. Summary of Permits and Approvals
Details on the status for required permits and approvals

Permit / Approval and Statute/Regulation	Regulatory Authority	Date of Approval or Date of Anticipated Approval
FEDERAL		
Approval of SAP, pursuant to BOEM Regulations (30 CFR 585.606, 610, 611)	BOEM	Approved, 10/12/2017
Approval of COP, pursuant to BOEM regulations (30 CFR 585.626) and National Environmental Policy Act	BOEM	Q1 2022
Issuance of Individual Permit, pursuant to Section 10, Rivers and Harbors Act (33 U.S.C. 333, 403) and Section 404, CWA (33 U.S.C. 1344)	USACE, New York District	Q1 2022
Issuance of OCS Air Permit, pursuant to Clean Air Act (40 CFR 55, 60; 42 U.S.C. 7627)	EPA Region 1	Q1 2022
Approval of IHA, pursuant to the Marine Mammals Protection Act (50 CFR 216, 16 U.S.C. 1361 et seq)	NMFS	Q4 2021
Approval for Private Aids to Navigation, pursuant to USCG regulations (33 CFR 64.11)	USCG	3–6 months prior to construction start
STATE		
New York		
Certificate of Environmental Compatibility and Public Need (CECPN), pursuant to Article VII of the New York Public Service Law (16 New York Codes, Rules and Regulations [NYCRR] Parts 85 through 88), Article 15 (6 NYCRR Part 608 and 621), and Article 25 (6 NYCRR Part 661)	NYSPSC, New York State Department of Public Service (NYSDPS)	Q3 2021
Environmental Management and Construction Plan, pursuant to Article VII (16 NYCRR Parts 85 through 88)		
Section 68 Petition (permission to exercise the grants of municipal rights), pursuant to Article VII (Section 68(1))		
Water Quality Certification, pursuant to Section 401 of the CWA and Implementing Regulations (6 NYCRR Parts 701, 702, 704, 754 and Part 800 to 941)		
State Pollutant Discharge Elimination System (SPDES) General Permit GP-0-15-002 for Stormwater Discharges from Construction Activity, pursuant to 6 NYCRR Part 750-757	New York State Department of Environmental Conservation (NYSDEC)	6–9 months prior to construction start

Table 1.3-1. Summary of Permits and Approvals
Details on the status for required permits and approvals

Permit / Approval and Statute/Regulation	Regulatory Authority	Date of Approval or Date of Anticipated Approval
Utility Work Permit - Form Perm 32, pursuant to New York State Highway Law (Article 3, design2)	NYSDOT - Region 10	3–6 months prior to construction start
Grant to use New York State Lands Under Water, pursuant to New York State Public Lands Law (Article 2, Section 3, Subsection 2)	New York State Office of General Services (NYSOGS), Bureau of Land Management	Q3 2021
Concurrence with Coastal Zone Management Program (CZMP) Federal Consistency Certification, pursuant to Coastal Zone Management Act (CZMA) (16 U.S.C. 1451 et seq, 15 CFR Part 930, and 30 CFR 585.611(b), 627(b)) and State Article 42 of the Executive Law (19 NYCRR Part 600 and 6 NYCRR Part 617)	New York State Department of State (NYSDOS) - Division of Coastal Resources	Prior to Record of Decision
Rhode Island		
Concurrence with CZMP Federal Consistency Determination, pursuant to CZMA (16 U.S.C. 1451 et seq, 15 CFR 930, and 30 CFR 585.611(b), 627(b)) and Rhode Island Coastal Resources Management Program (RI CRMP) (Section 400)	Rhode Island Coastal Resources Management Council (RI CRMC)	Prior to Record of Decision
Massachusetts		
Concurrence with CZMP Federal Consistency Determination, pursuant to CZMA (16 U.S.C. 1451 et seq, 15 CFR 930, and 30 CFR 585.611(b), 627(b)), Massachusetts General Law (M.G.L.) (21A, Subpart 4A) and Massachusetts Coastal Zone Management Program Policies (310 Code of Massachusetts Regulations [CMR] 20.00 and 21.00)	Massachusetts Office of Coastal Zone Management (MACZM)	Prior to Record of Decision

Notes:
Q1 = first quarter (Jan, Feb, Mar)
Q2 = second quarter (Apr, May, Jun)
Q3 = third quarter (Jul, Aug, Sep)
Q4 = fourth quarter (Oct, Nov, Dec)

1.3.3 New York State Permits, Approvals, and Consultations

The SFEC has a design capacity that exceeds 125 kilovolts (kV) and extends more than 1 mile (1.6 km, 0.87 nm); therefore, it is considered an electric transmission facility (16 New York Codes, Rules and Regulations [NYCRR] Subpart 85-2.1). As such, the portion of the SFEC in New York State territorial waters (3 miles [4.8 km, 2.6 nm] offshore) to its onshore interconnection point with the LIPA transmission system (SFEC - NYS and SFEC - Onshore) is subject to review and approval by the NYSPSC under Article VII of the New York Public Service Law (16 NYCRR Parts 85 through 88), which authorizes the Siting of Major Utility Transmission Facilities.

The Article VII process provides a full review of the need for and environmental impact of the siting, design, construction, and operation of the SFEC and results in the issuance of a Certificate of Environmental Compatibility and Public Need (CECPN). The CECPN will include Water Quality Certification, pursuant to Section 401 of the CWA and Implementing Regulations (6 NYCRR Parts 701, 702, 704, 754 and Part 800 to 941), and relevant authorizations under Article 15 (6 NYCRR Part 608 and 621), and/or Article 25 (6 NYCRR Part 661).

Prior to construction, the NYSPSC must also approve an Environmental Management and Construction Plan that describes the practices during construction that will demonstrate compliance with the CECPN. In addition, prior to the start of construction, SFW will apply for coverage under the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity from New York State Department of Environmental Conservation (NYSDEC), a Utility Work Permit from New York State Department of Transportation (NYSDOT), and a Grant to Use New York State Lands Under Water from New York State Office of General Services (NYSOGS), Bureau of Land Management.

Consultation and review will also occur with NYSDEC for state-listed threatened and endangered species and unique or significant habitats; New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) for cultural and historic resources; and New York State Department of Agriculture and Markets (NYSDAM) for agricultural lands.

1.3.4 Coastal Zone Management Act Consistency

The CZMA requires that federal actions impacting any coastal use or resource (defined as land or water use, or natural resource of a state's coastal zone), be conducted in a manner that is consistent with the enforceable policies of a state's federally approved CZMP or CRMP. Within this authority of the CZMA, state coastal programs that have been approved by National Oceanic and Atmospheric Administration (NOAA) may review federal actions impacting their coastal uses or resources or both, to verify that such activities are consistent with the state's enforceable program policies.

The federal actions associated with the Project include approval of the COP by BOEM and issuance of an Individual Permit by USACE, under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. The specific components and activities associated with those federal actions include construction, O&M, and decommissioning of the SFWF, SFEC -OCS, and SFEC - NYS. The construction, operations and maintenance, and decommissioning of the SFEC - NYS and SFEC - Onshore will also be reviewed and authorized under Article VII of the PSL by the NYSPSC. Their review will include review for consistency with the New York State CZMP.

SFW has prepared consistency statements for review by each of New York, Rhode Island, and Massachusetts to confirm consistency with each state's enforceable policies impacting any coastal use or resource, see Appendix A. In accordance with the "consistency" requirement of the CZMA (16 U.S.C. § 1456), as well as 307(c)(3)(A) and 15 CFR Part 930, Appendix A presents a tabular summary of applicable enforceable policies under the CZMP or CRMP for these states and an evaluation of how the SFWF and/or SFEC will be consistent with each policy, as well as cross references to specific sections of the COP where the policy is addressed.

1.4 Agency and Stakeholder Outreach

Since 2010, SFW has been engaged in extensive outreach relating to the Project with federal and state agencies, federally-recognized Native American tribes (tribes), municipal organizations in East Hampton, New York, stakeholders representing a broad range of perspectives, and the public.

SFW is committed to stakeholder communications and public outreach during Project development. A wide and varied range of communication methods will allow stakeholders and the public to be informed respecting the Project, such that appropriate outreach is occurring to meet the information needs of a diverse audience of stakeholders. The public involvement program for the Project includes:

- Regular briefings with federal and state agencies, tribes, elected officials, and other stakeholders to provide Project updates, solicit input and concerns, and respond to inquiries.
- Communications and regular briefings with the commercial and recreational fishing industry, including individual discussions and open house meetings in ports to provide Project updates, identify key concerns, and share relevant survey findings. Appendix B includes the Fisheries Communication Plan for the Project, including a summary of fisheries outreach to date. This outreach has been led by:
  - Rodney Avila, SFW Fisheries Liaison, who has knowledge and understanding of the regional fishing industry, leads outreach with the commercial and recreational fishing industries. Mr. Avila is supported by Ms. Julia Prince, Long Island Fisheries Liaison who is a resident of Montauk in the Town of East Hampton, NY. Both Mr. Avila and Ms. Prince have made it a priority to engage with fishermen in home ports whenever possible.
  - Fisheries Industry Representatives from the ports of Montauk, Point Judith and New Bedford.
- Regular outreach and briefings to civic, community, and business groups to encourage them to join advisory working groups, attend public information meetings, and sign-up for email updates and newsletters.
- A community outreach office in Amagansett, New York with regular offices hours that provides a central location where Project information is available to the public and where small group meetings can be held.
- Informational meetings that will be conducted on a regular basis to keep the public informed and provide opportunities for input on topics related to the Project.

Table 1.4-1 identifies the federal and state agencies, federally-recognized Native American tribes, and municipal entities with which SFW has met to discuss the Project through May 2019.

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
February 2011	USFWS	Avian and Bat Survey Protocol
April 2011	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)	Introduction Meeting

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
May 2011	BOEMRE; Rhode Island Historical Preservation and Heritage Commission (RIHPHC); Rhode Island Senate Policy, RI CRMC; Massachusetts Executive Office of Energy and Environmental Affairs	BOEMRE RI Public Meeting
June 2011	BOEMRE	BOEMRE RI Public Meeting re: leasing process
April 2014	BOEM; NYSDOS; New York State Energy Research and Development Authority (NYSERDA)	Workshop to Discuss the Offshore Leasing Process and Best Management Practices to Reduce User Conflict
May 2015	BOEM	SAP Survey, Pre-Survey Meeting
August 2015	Narragansett Indian Tribe	SAP Survey, Pre-Survey Meeting
May 2016	BOEM; Massachusetts Department of Marine Fisheries (MADMF); Massachusetts Clean Energy Center (MassCEC)	Offshore Wind Habitat Working Group Meeting
June 2016	BOEM; MADMF; MassCEC; Habitat Working Group	MA Offshore Wind Habitat Working Group Meeting
June 2016	BOEM; MADMF; MassCEC; Fisheries Working Group	MA Offshore Wind Fisheries Working Group Meeting
October 2016	BOEM	Survey planning and Pre-Application Meeting
November 2016	NYS Parks, Recreation, and Historic Preservation	Project Intro Meeting
February 2017	NYSDPS; NYSOGS; NYSDOS; NYSDEC	Project Intro Meeting
February 2017	RI CRMC	Project Intro Meeting
February 2017	MACZM	Project Intro Meeting and Discussion of Coastal Zone Management
March 2017	BOEM	Project Intro Meeting and Pre-Application Consultation for COP
March 2017	USACE; BOEM	Project Intro Meeting
March 2017	USCG	Project Intro Meeting
March 2017	EPA; BOEM	Project Intro Meeting, Air Quality and Emissions
March 2017	Shinnecock Indian Nation	Project Intro Meeting
March 2017	NYSDEC; NYSDPS	Project Intro Meeting
March 2017	NYS State Historic Preservation Office (SHPO)	Project Intro Meeting
March 2017	RI CRMC	Habitat Advisory Board and Fisheries Advisory Board Meeting

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
April 2017	BOEM	COP Pre-Survey Meeting
April 2017	New England Fisheries Management Council (NEFMC)	Project Discussion Meeting
April 2017	NMFS; BOEM	Project Intro Meeting and Fisheries Discussion
April 2017	USFWS; BOEM	Project Intro Meeting
April 2017	East Hampton Trustees	Project Intro Meeting
April 2017	RI CRMC	Rhode Island Fisheries Advisory Board Meeting
May 2017	BOEM	Rhode Island and Massachusetts Task Force Meeting
May 2017	Mashpee Wampanoag Tribe; Wampanoag Tribe of Gay Head Aquinnah; Narragansett Indian Tribe; Shinnecock Indian Nation	COP Tribal Pre-Survey Meeting
May 2017	NYS Parks, Recreation, and Historic Preservation	Project Intro Meeting
May 2017	RI CRMC	Rhode Island Fisheries Advisory Board Meeting
May 2017	BOEM; MADMF; MassCEC; Habitat Working Group	Massachusetts Offshore Wind Habitat Working Group Meeting
May 2017	BOEM; MADMF; MassCEC; Fisheries Working Group	Massachusetts Offshore Wind Fisheries Working Group Meeting
June 2017	BOEM	COP Work Session
June 2017	MACZM	MACZM Coastal Energy Conference
June 2017	BOEM; Multiple Agencies	Agency Webinar on Foundations
June 2017	Wampanoag Tribe of Gay Head Aquinnah; Mashantucket Pequot Tribal Nation; Shinnecock Indian Nation	COP Survey Data Training
June 2017	NYSDPS; NYSDEC	Agency Webinar on Foundations
June 2017	NYSDOS; USACE	COP Survey Plan Discussion
June 2017	RI CRMC	Project Update Meeting
June 2017	East Hampton Trustees	Project Intro Meeting with Harbor Management Committee
June 2017	East Hampton Trustees	Fisheries Discussion with Harbor Management Committee
July 2017	BSEE; BOEM	COP Discussion - Oil Spill Response Plan

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
July 2017	Wampanoag Tribe of Gay Head Aquinnah; Mohegan Indian Tribe	Tribal Field review of Onshore Routes and Facilities
July 2017	RI CRMC	Fisheries Discussion
August 2017	NMFS; BOEM	Fisheries Discussion
August 2017	EPA; BOEM	OCS Air Permitting; Conformity Determination
August 2017	USFWS; BOEM	Project Update and Discussion of Wildlife and Protected Species
August 2017	Wampanoag Tribe of Gay Head Aquinnah; Mohegan Indian Tribe; Mashantucket Pequot Tribal Nation	Visual/Indirect Effects Meeting
August 2017	Mashantucket Pequot Tribal Nation	Beach Lane & Napeague Lane Archaeology Tribal Monitoring
August 2017	Wampanoag Tribe of Gay Head Aquinnah; Mohegan Indian Tribe	Geophysical Data Review Webinar
August 2017	Rhode Island Department of Environmental Management (RI DEM)	Fisheries Discussion
August 2017	MACZM	Fisheries Discussion
August 2017	East Hampton Trustees	Project Discussion with Trustee Harbor Management Committee
September 2017	BOEM	COP Outline Review
September 2017	NMFS; BOEM	Fisheries Discussion, including Essential Fish Habitat
September 2017	Wampanoag Tribe of Gay Head Aquinnah; Shinnecock Indian Nation; Mohegan Indian Tribe; Mashantucket Pequot Tribal Nation	Geophysical Review Webinar
September 2017	NYSDPS	Project Discussion
September 2017	NYSDEC; NYSDPS; NYSDOS; NYSOGS	Project Update and Fisheries Discussion
September 2017	Connecticut Department of Energy and Environmental Protection (CT DEEP)	Project Intro Meeting
October 2017	BOEM	New York State Task Force Meeting
October 2017	BOEM	COP Survey Update Meeting
October 2017	Wampanoag Tribe of Gay Head Aquinnah	Visual Effects - Aquinnah Tribal Trust Land
October 2017	Wampanoag Tribe of Gay Head Aquinnah; Shinnecock Indian Nation; Mashpee Wampanoag Tribe; Mashantucket Pequot Tribal Nation	Geophysical Data Review Webinar

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
October 2017	NYSDOS	Project Update and Discussion of CZMA
October 2017	East Hampton Trustees	Presentation to Harbor Management Committee and Energy Sustainability Committee
October 2017	NEFMC	NEFMC Habitat Advisory Board Meeting
November 2017	NMFS; BOEM	Project Update Meeting
November 2017	RI DEM	Project Update Meeting
November 2017	CT DEEP Fisheries Division	Marine Fisheries Science Overview
November 2017	East Hampton Trustees	Project Discussion
December 2017	BOEM	Project Discussion and Air Emissions Inventory and Modeling
December 2017	BOEM	COP Discussion
December 2017	BOEM; NYSDEC, NYSDPS, NYSDOS; RI DEM	Cod Spawning Survey Plan
December 2017	Mashantucket Pequot Tribal Nation; Wampanoag Tribe of Gay Head Aquinnah	Geotechnical Core Splitting Presentation
December 2017	NYSDOS	Project Update and Discussion of CZMA Consistency Review
December 2017	East Hampton Town Board	Project Discussion
December 2017	East Hampton Trustees	Project Discussion, Science at Block Island Wind Farm
December 2017	East Hampton Trustees	Project Discussion with Trustee Harbor Management Committee
December 2017	NEFMC	NEFMC Habitat Advisory Board Meeting
January 2018	BSEE; BOEM	COP Discussion - Safety Management System
January 2018	USACE; BOEM	Project Update and Permitting Discussion
January 2018	East Hampton Town Board	Project Discussion
January 2018	East Hampton Trustees	Project Discussion with Trustee Harbor Management Committee
February 2018	NYSDEC; USFWS; BOEM; USACE	Project Update and Discussion of Protected Species
February 2018	BOEM; MADMF; MassCEC; Fisheries Working Group	Massachusetts Offshore Wind Fisheries Working Group Meeting

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
March 2018	NYSDPS; NYSDOS	Project Update and Discussion of Protected Species
March 2018	NMFS; BOEM	Project Discussion and Review of Benthic Habitat Surveys
April 2018	NYSDPS	Project Update Meeting
April 2018	RI CRMC	Habitat Advisory Board and Fisheries Advisory Board Meeting
April 2018	RI SHPO	Project Update Meeting
April 2018	East Hampton Town Board	Project Discussion
April 2018	NEFMC Habitat Committee	Project Update Meeting
April 2018	NYS Park Recreation, and Historic Preservation	Project Update Meeting
April 2018	BOEM	Rhode Island and Massachusetts Task Force Meeting
April 2018	USCG, Niantic CT	Offshore Wind Informational Meeting
May 2018	EPA; BOEM; Massachusetts Department of Environment Protection (MassDEP)	OCS Air Permitting; Conformity Determination
May 2018	NYSDOS	Project Update and Discussion of CZMA Consistency Review
May 2018	USCG; New Bedford Port Authority (NBPA); BOEM; MassCEC	USCG discussion on fishing traffic
May 2018	BOEM; NMFS; MassCEC; NBPA	Fisheries Regional Research Discussions
May 2018	Massachusetts Clean Energy Center; BOEM; NMFS	Workshop on Marine Mammals and Offshore Wind
May 2018	BOEM; MADMF; MassCEC; Fisheries Working Group	MA Offshore Wind Fisheries Working Group Meeting
June 2018	BOEM	CVA Nomination Meeting
June 2018	BOEM	COP Geotechnical Survey Pre-Survey Meeting
June 2018	Mashpee Wampanoag Tribe; Wampanoag Tribe of Gay Head Aquinnah; Narragansett Indian Tribe; Shinnecock Indian Nation	COP Geotechnical Survey Tribal Pre-Survey Meeting
June 2018	MACZM	MACZM Coastal Energy Meeting
June 2018	NYSDPS	Project Update Meeting
July 2018	NYS DOS, DPS, DEC	Additional Geophysical and Geotechnical Survey Meeting
August 2018	RI CRMC	Project Update Meeting

Table 1.4-1. Summary of Federal, Tribal, State, and Municipal Meetings
Overview of Project meetings with federal and state agencies, tribes, and municipal entities

Date	Entity	Topic
August 2018	RI CRMC Habitat and Fishermen's Advisory Boards	Project Update Meeting
August 2018	Mashpee Wampanoag Tribe; Wampanoag Tribe of Gay Head Aquinnah; Shinnecock Indian Nation; Mashantucket Pequot Tribal Nation	COP Expanded Geophysical and Geotechnical Tribal Pre-Survey Meeting
August 2018	RI SHPO	Project Update Meeting
September 2018	USCG	Project Update Meeting
September 2018	EPA	Air Modeling Meeting
September 2018	BOEM	Interagency Meeting and Project Update
November 2018	Narragansett Indian Tribe; Mashantucket Pequot Tribal Nation; Mohegan Tribe	COP and Technical Reports Overview Meeting
November 2018	NYSDOS	Project Update Meeting
November 2018	USACE	Project Discussion
November 2018	BOEM	NEPA Scoping Meetings
December 2018	Wampanoag Tribe of Gay Head Aquinnah; Narragansett Indian Tribe	Marine Geotechnical Coring
January 2019	Mashpee Wampanoag Tribe; Wampanoag Tribe of Gay Head Aquinnah; Mashantucket Pequot Tribal Nation; Mohegan Tribe; Narragansett Indian Tribe; Shinnecock Indian Nation	Roadside Archaeology and Marine Geotechnical Meeting
January 2019	Wampanoag Tribe of Gay Head Aquinnah; Mashantucket Pequot Tribal Nation; Narragansett Indian Tribe;	Geophysical Data Review Workshop
February 2019	NYSDOS	Project Update Meeting
February 2019	New York Office of General Services (NYOGS)	Project Introduction and Easement Request
February 2019	Wampanoag Tribe of Gay Head Aquinnah; Narragansett Indian Tribe; Mashantucket Pequot Tribal Nation	Geotechnical Core Splitting and Analysis
March 2019	BOEM; NOAA/NMFS; NYSDOS; NYSDEC; MACZM; MADMF; USACE; CT DEEP; RI CRMC; RI DEM	Fisheries Research and Monitoring Discussions
April 2019	RI CRMC	Project Update Meeting
May 2019	NYSDOS	Project Update Meeting
May 2019	NYSDOT	Project Update Meeting
May 2019	New York State Parks, Recreation, and Historic Preservation (NYSOPRHP)	Project Update Meeting

In addition to these meetings, SFW has met with the following organizations and will continue to conduct outreach throughout Project development. These organizations include:

- American Association of Retired Persons
- Amagansett Citizens Advisory Committee
- Audubon Society of Rhode Island
- Brown Learning Collaborative
- Citizens Campaign for the Environment
- College of Staten Island, City University of New York
- Concerned Citizens of Montauk
- Conservation Law Foundation
- Cornell Cooperative Extension
- East Hampton Historical Society
- East Hampton Rotary Club
- Eastern Fisheries
- ECO Rhode Island
- Environment Business Council of New England
- Environment Massachusetts
- Environmental League of Massachusetts
- Fisherman's Advisory Board and Habitat Advisory Board
- Group for the East End
- Inlet Seafood Corp
- Long Island Commercial Fishing Association
- Long Island Pine Barrens Society
- Massachusetts Audubon Society
- Massachusetts Clean Energy Center
- Massachusetts Fishermen's Partnership and Support Services
- Massachusetts Fishery Working Group
- Massachusetts Habitat Working Group
- Massachusetts Lobstermen's Association
- Mid Atlantic Fisheries Management Council
- Montauk Captain's Association
- Montauk Chamber of Commerce
- Montauk Citizens Advisory Committee
- National Oceanic and Atmospheric Administration
- National Wildlife Federation
- Natural Resources Defense Council

- New Bedford Economic Development Council
- New Bedford Port Authority
- New England Aquarium
- New England Energy and Commerce Association
- New England Fisheries Management Council – Habitat Working Group
- New England Fisheries Science Center
- New York State Fisheries Technical Working Group
- North Fork Environmental Council
- *Providence Business News* (PBN)
- Peconic Chapter of the American Institute of Architects (AIA)
- Port of New Bedford
- Propeller Club
- Responsible Offshore Development Alliance (RODA) / Responsible Offshore Science Alliance (ROSA)
- Rhode Island Building Owner's Association School of Marine and Atmospheric Sciences at Stonybrook
- Sierra Club
- Surfrider Foundation, Eastern Long Island Chapter
- The Nature Conservancy (TNC)
- Town of East Hampton Energy Sustainability Committee
- Town of Southampton Sustainability Committee
- University of Rhode Island (URI) – Offshore Energy Department
- URI Labor Focus Group
- Wainscott Citizens Advisory Committee

SFW has also conducted outreach activities with local stakeholders on Long Island and in ports in New York, Massachusetts, Rhode Island, and Connecticut. These activities include:

- American Planning Association Long Island Chapter-Fall East End Conference
- AIA, Peconic Chapter May Program Host
- Building Blocks Workshop: Parrish Art Museum
- East End Environmental Nongovernmental Organization (NGO) Meeting (North Fork Environmental Council, Group for East End, Long Island Pine Barrens Society, Concerned Citizens of Montauk)
- East Hampton Good Government Panel
- East Hampton Trustee Harbor Management Committee Meeting
- East Hampton Village Spring Fair
- Environmental NGO Roundtable at Guild Hall (Group for East End, Defend H20, TNC, Surfrider Foundation, Concerned Citizens of Montauk, and others)
- Environmental NGO Science Presentations (Group for East End, TNC, Riverhead Marine Foundation, Perfect Earth Project, Surfrider Foundation, Concerned Citizens of Montauk)

- Fisheries Open House at Port in Montauk, NY
- Fisheries Open House at Port in Shinnecock Inlet, NY
- Fisheries Open House at Port in Jones Inlet, NY
- Fisheries Open House at Port in New Bedford, MA
- Fisheries Open House at Port in Point Judith, RI
- Fisheries Open House at Port in Stonington, CT
- Fisheries discussions with local stakeholders
- International Energy and Sustainability Conference 2017 at Farmingdale State College
- Long Island Association Meeting and Advanced Energy Research and Technology Center (AERTC) Boat Trip to Block Island Wind Farm (BIWF)
- Long Island Fisherman's Expo
- Long Island Traditions – Working the Waters
- Massachusetts Coastal Zone Management Nantucket Energy Conference
- MTK Water Life Events: Sole East Resort
- Nantucket Energy Conference
- National Academy of Sciences, Offshore Renewable Energy Development and Fisheries Conference
- NY Bight Taskforce Meeting
- NY Workforce Development Institute Presentation
- Ocean Frontiers III Film Screening and Panel Discussion at Farmingdale State College
- Office Open House Event
- Offshore Wind Habitat Working Group Meeting
- Open House at Clinton Academy in East Hampton
- Presentation to League of Women Voters at Rogers Memorial Library in Southampton
- Rhode Island Public Meeting (TNC, URI, others)
- Sag Harbor Expressions Event: Renewable Energy Panel
- Southampton Village Earth Day Panel & Fair
- The 2nd Annual South Fork 100 percent Renewable Energy Forum
- Tours to BIWF
- Town of Southampton Earth Day Event at Good Ground Park
- Trustee Harbor Management Committee Meeting
- United States Coast Guard Offshore Wind Training
- URI Energy Lecture Series
- URI Offshore Wind Science Forum
- West Long Beach, NJ Fisheries Meeting Host

1.5 Tentative Schedule

As summarized in Table 1.5-1, installation of the SFWF and SFEC is scheduled to occur in 2022 and 2023 with the Project commissioned and operational by the end of 2023. The Project schedule assumes that permits will be obtained starting in 2021 in order to allow for several months of final engineering and design, contract negotiations, procurement, and manufacturing prior to the start of installation.

The installation schedule is based on several factors, including the timeframe when permits are received; regulatory time of year restrictions; environmental conditions; planning, construction, and installation logistics.

Table 1.5-1. Tentative Schedule
Installation schedule for the SFWF and SFEC

Project Component	Milestone	Expected Duration	Expected Timeframe
SFWF	Contracting, Mobilization, Fabrication, Transportation, and Verification	Up to 30 months	Q2 2021 to Q4 2023
	Foundation installation [a]	4 months	Q2-Q4 2023
	Inter-array Cable installation	4 months	Q2-Q3 2023
	WTG installation	2 months	Q3-Q4 2023
	OSS installation	1 month	Q2-Q3 2023
	Commissioning	3 months	Q3-Q4 2023
	Construction and installation of SFWF O&M facility	9 to 12 months	2023-2024
SFEC	Contracting, Mobilization, Fabrication, Transportation, and Verification	Up to 30 months	Q2 2021 to Q4 2023
	Interconnection facility construction	12 to 18 months	Q1 2022 to Q3 2023
	Sea-to-Shore installation (including horizontal directional drilling [HDD])	4 to 7 months	Q4 2022 to Q2 2023
	Offshore cable installation	4 months	Q1-Q2 2023
	Onshore cable installation	12 to 15 months	Q1 2022 to Q2 2023
	Commissioning	6 months	Q3-Q4 2023

[a] Pile driving activities will occur at the SFWF between May 1 and December 31, thereby mitigating impacts to North Atlantic right whale migration.

1.6 Other Project Information

The following sections provide other relevant Project-specific information to meet the requirements of the OCS Lands Act, NEPA, and other applicable laws and regulations, as recommended in the COP information requirements guidance document (BOEM, 2016).

1.6.1 Authorized Representative and Operator

SFW will be the operator of the SFWF and the SFEC. The contact information for the Authorized Representative for the SFWF and SFEC is included in Table 1.6-1.

Table 1.6-1. Authorized Representative and Operator
Contact information for SFW Representative and Operator

Required Detail	Contact Information
Name of Authorized Representative	Peter Allen
Title	Director
Phone Number	617-373-0208
Email	PEALL@orsted.com
Address	One International Place, Suite 2610, Boston, MA 02110

SFW is a wholly-owned indirect subsidiary of North East Offshore, LLC, a joint venture between Ørsted, the global leader in offshore wind, and Eversource, New England's largest energy delivery company. North East Offshore, LLC and its subsidiaries are actively planning offshore wind projects to serve Rhode Island, Connecticut, and New York.

Ørsted is the global industry leader in offshore wind and has significant experience with the rigors and challenges of the offshore wind business. Over the past 25 years, Ørsted has constructed 5.6 gigawatts (GW) of offshore wind capacity (just under 30 percent of globally installed offshore wind capacity), with an additional 3.4 GW currently under construction. Ørsted's existing activities span a number of markets, including the United States, Denmark, the United Kingdom, Germany, the Netherlands, and Taiwan. It is the current Ørsted leadership team that—within the short span of the past three to four years—has driven dramatic cost reductions and paved the way for exponential market growth. In 2018, Ørsted acquired Deepwater Wind, the company that built the United States' first offshore wind farm, off Block Island, Rhode Island. Ørsted's legacy Deepwater Wind team gained invaluable experience working with regulators, stakeholders, vendors, and U.S. construction contractors through the development and execution of the Block Island Wind Farm project. Together, Ørsted's expanded team is leading a stakeholder-centric approach to development that has made it the go-to partner for States up and down the eastern seaboard as they seek to develop offshore wind resources. In addition to successfully constructing and now operating the first offshore wind farm, and to being awarded the contract for the South Fork Wind Farm, Ørsted—through the North East Offshore, LLC joint venture—has also been awarded contracts for the aforementioned Connecticut/Rhode Island offshore wind projects (Revolution Wind). Outside of the North East Offshore, LLC joint venture, Ørsted is also developing offshore wind projects to serve Maryland (Skipjack Wind) and Virginia (Coastal Virginia Offshore Wind) and has submitted a proposal for a project to serve New Jersey. Currently, Ørsted has in its U.S. portfolio commitments for nearly 1,000 MW of offshore wind serving five states. In connection with the Block Island Wind Farm project, Ørsted also fully developed the Block Island Transmission System, which includes a thirty-mile onshore and offshore transmission system that connected Block Island to the mainland of Rhode Island for the first time. This was the first offshore renewable-energy transmission system developed in the United States.

Eversource is an industry leader in constructing and maintaining large transmission and distribution projects, including high-voltage and extra high-voltage overhead, underground, submarine, and hybrid transmission lines, and associated terminal equipment. Throughout New England and New York, Eversource has successfully completed hundreds of capital projects over the past decade, with a proven track record in: successful single state and multi-state project siting and permitting; working closely with other companies to develop major projects; and safely and efficiently constructing transmission and distribution projects. It has successfully completed hundreds of traditional and major capital projects over the past decade, employing innovative solutions to technical and environmental challenges such as: the first and most extensive 345-kV applications of solid core crosslinked polyethylene (XLPE) underground cables in the United States; laying marine cable in Long Island Sound from a purpose-built ship; and constructing overhead transmission support structures from the air, using helicopters. Eversource is only one of four North American energy companies certified as an Environmental, Social and Governance leader, and is recognized as a leader in providing top-tier reliability with the utmost focus on safety.

1.6.2 Financial Assurance

SFW will provide financial assurance in accordance with 30 CFR § 585.516, prior to BOEM approval of this COP.

Ørsted and Eversource are stable and diversified publicly traded energy companies, with a combined market capitalization of approximately $49 billion, and combined operating cash flows of approximately $3 billion annually. Ørsted is the global leader in financing, constructing and operating offshore wind, and—as a result of the recent acquisition of Deepwater Wind—its team now includes the individuals responsible for the first ever financing of an offshore wind farm in the United States, and the first tax-equity financing of an offshore wind farm anywhere in the world.

1.6.3 Certified Verification Agent Nominations

Pursuant to 30 CFR § 585.705, a CVA must be used to certify to BOEM that the proposed facility is designed to withstand the environmental and functional load conditions for the intended life of the Project at its proposed location. The CVA will also review the relevant design standards and environmental loading for the structural design of the facilities.

Nomination Statement

In accordance with 30 CFR § 585.706, SFW nominates DNV-GL to serve as the CVA.

Qualification Statement

The Statement of Qualifications for CVA Services is provided in Appendix C. The Statement addresses:

- Previous experience of the nominated CVA in third-party verification and BOEM procedures
- Technical capabilities of the CVA and staff members
- Size and type of organization
- Availability of technology
- Ability to perform
- Conflict of interest
- Professional Engineer supervision

Scope of Work and Verification Plan

The CVA Scope of Work and Verification Plan are also provided in Appendix C. This document specifies the level of work to be performed by the CVA at all phases of the Project and identifies the list of documents and subject matter that the CVA will review.

1.6.4 Oil Spill Response Plan

Pursuant to 30 CFR § 585.627(c), an Oil Spill Response Plan must be submitted to the BSEE. In accordance with 30 CFR Part 254, SFW has developed an Oil Spill Response Plan which is provided in Appendix D.

1.6.5 Safety Management System

Pursuant to 30 CFR § 585.627(d), a Safety Management System must be submitted to BOEM. In accordance, with 30 CFR § 55.810, SFW has developed a Safety Management System which is provided in Appendix E.

Section 2 - Project Siting

This section presents a description of the siting and route selection process for the SFWF and SFEC as conducted by SFW. Section 2.1 presents the siting history leading to the proposed location of the SFWF. Section 2.2 provides a summary of the steps taken to identify and evaluate the potential offshore and onshore SFEC routes. Section 2.3 presents a description of the construction methods, equipment, and installation technologies SFW has reviewed and considered for the SFWF and SFEC.

2.1 South Fork Wind Farm Siting History

In 2013, BOEM divided and auctioned the RI-MA WEA as two lease areas (North Lease OCS-A 0486 and South Lease OCS-A 0487). It opened competitive bidding and eventually awarded both leases to Deepwater Wind New England, LLC. The North Lease Area consisted of 97,498 acres and the South Lease Area consists of approximately 67,250 acres (Figure 2.1-1). In January 2020, Deepwater Wind New England, LLC requested that BOEM assign a portion of Lease Area OCS-A 0486 to SFW to be given the designation OCS-A 0517. Lease OCS-A 0517 and the SFWF MWA are both located within a portion of the North Lease Area. This section provides the history of the siting and screening of the RI-MA WEA, and how the SFWF was located.

2.1.1 Siting and Screening of the Deepwater Wind Lease Areas

The location of the RI-MA WEA was the result of a multi-year effort by state and federal regulatory agencies to identify OCS areas suitable for offshore renewable energy development. The area was identified based on 4 years of preliminary site characterization, environmental assessment, and stakeholder discussions occurring primarily during the development of the Rhode Island Ocean Special Area Management Plan (OSAMP). Significant investment of public resources went into the compilation and review of site characterization data and the assessment of potential environmental impacts. A wide range of impacts were examined including environmental, economic, cultural and visual resources, and use conflicts.

Several planning efforts organized by federal and state entities involving private and public interest groups, as well as members of the academic community and the public, led to the identification of the areas that were eventually leased. The primary efforts and process milestones were as follows:

- BOEM's 2009 Intergovernmental Renewable Energy Task Forces in Massachusetts and Rhode Island
- Massachusetts Ocean Management Plan, 2015 (update of 2009 version)
- *Rhode Island Ocean Special Area Management Plan*, 2010, assessed environmental, economic, cultural and visual resource data, and use conflicts of the entire OSAMP region, creating a baseline of information that was considered during the designation of the RI-MA WEA (RI CRMC, 2015).
- Executive Order (EO) 13547 of July 19, 2010, which was signed on July 19, 2010, established the National Ocean Policy and provided a national framework and governance structure for sustainable management of U.S. ocean, coastal, and Great Lakes resources. This EO began a multi-year process which resulted in the Northeast Regional Ocean Plan (The White House, 2010).
- Memorandum of Understanding signed by the Governors of Rhode Island and Massachusetts in 2010, forming a partnership to collaborate with BOEM and defining an Area of Mutual Interest (AMI) for wind energy project development (Figure 2.1-2). The AMI was a contiguous block of 45 OCS lease blocks (256,199 acres or 1,035 square kilometers [km^2] or 302 square nm) (BOEM et al., 2010)

- In 2011, BOEM published in the *Federal Register* a Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore Rhode Island and Massachusetts-Call for Information and Nominations (Docket No. BOEM-2011-0049, 76 *Federal Register* 51383-51391), requesting expressions of interest from potential wind project developers (BOEM, 2011a).
- In compliance with its obligations under NEPA, BOEM published in the *Federal Register* a *Notice of Intent to Prepare an Environmental Assessment* (Docket No. BOEM-2011-0063, 76 Federal Register 51391-51393) in 2011 (BOEM, 2011b).
- On July 2, 2012, BOEM published a Notice of Availability for the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Rhode Island and Massachusetts Environmental Assessment (77 *Federal Register* 39508). A 30-day comment period was opened, and BOEM held public informational meetings in Massachusetts and Rhode Island (BOEM, 2012).
- BOEM revised the 2012 environmental assessment for the RI-MA WEA in May 2013 to address issues raised by stakeholders and agency consultation about lease issuances and site assessment activities. BOEM issued a Finding of No Significant Impact for these activities within the RI-MA WEA (BOEM, 2013a).

BOEM reduced the original area considered for leasing based on environmental constraints, efforts to decrease user group conflicts, navigational safety, public health and safety, and stakeholder concerns (e.g., commercial fishing) (Figure 2.1-2). Much of the information assessed during the OSAMP supported the BOEM siting process. The result was the RI-MA WEA and eventually the North and South Lease Areas. The key considerations used to refine the RI-MA WEA included:

- The Governors of Massachusetts and Rhode Island agreement to a boundary that was at least 6 nm (16.7 km or 10.4 miles) away from any coastal area of either state.
- A lengthy stakeholder and scientific review process that identified "high value" fishing grounds and excluded those areas from the RI-MA WEA (Figure 2.1-2, exclusion zone). High value fishing includes the overlap between fixed gear fisheries (traps, pots, and gillnets) and mobile fisheries (trawls, dredges). Areas excluded from the RI-MA WEA had three to four types of fishing pressure from participating fisheries such as bottom trawling, scallop dredging, and lobster trap fisheries.
- Removal of certain aliquots to avoid marine traffic, navigation zones, and an area of unexploded ordinance.

The RI-MA WEA was designated for offshore renewable energy development as the result of a coordinated, rigorous, and thorough siting and screening process consistent with the objectives of the National Ocean Policy and NEPA.

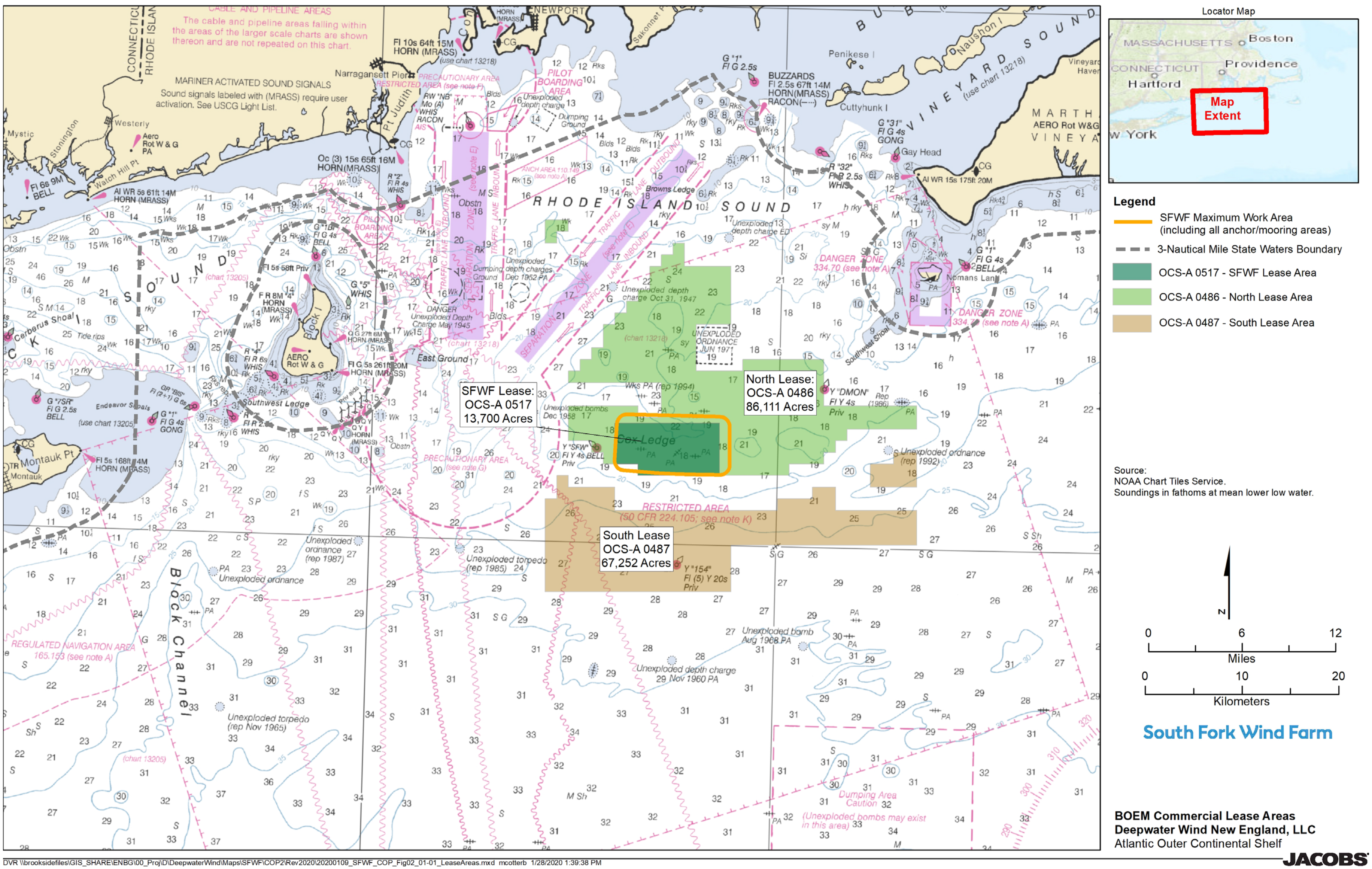

Figure 2.1-1. Deepwater Wind New England, LLC Commercial Lease Areas

Illustration of the lease areas held by Deepwater Wind New England, LLC.

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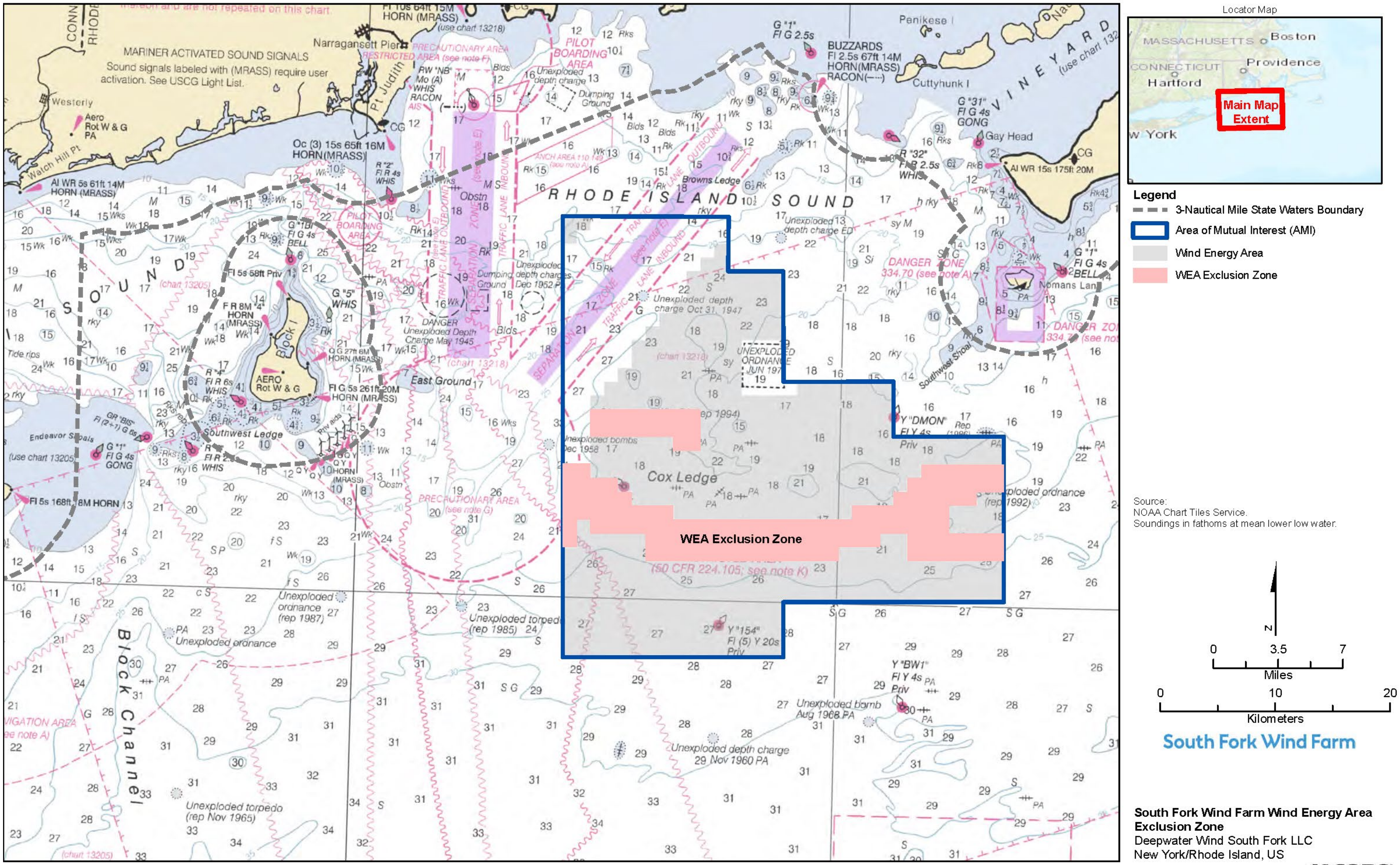

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Figure 2.1-2. Rhode Island-Massachusetts Wind Energy Area Siting History

Map depicting the area of mutual interest, current Rhode Island-Massachusetts wind energy area and areas excluded from the wind energy area.

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2.1.2 South Fork Wind Farm Siting and Location

As described in Section 1, the Project purpose is driven by SFW's PPA with the LIPA, which requires that power from the SFWF be delivered to the LIPA substation in East Hampton, New York. The southwestern corner of the North Lease Area was selected as the preliminary investigation area for the SFWF due to its proximity to Long Island (Figure 2.1-3, top panel). This portion of the North Lease Area minimizes the length of the interconnection to LIPA's system.

SFW conducted comprehensive desktop studies of oceanographic, geologic, shallow hazards, archeological, and environmental resources in the North Lease Area. These desktop studies informed the Project COP survey plan, which was submitted to BOEM in 2017. The area proposed for survey in the 2017 COP survey plan is shown on Figure 2.1-3, middle panel. In 2018, a second COP survey plan was submitted for additional surveys. The purpose of both the 2017 and 2018 COP surveys was to conduct site characterization, marine archeological, and benthic studies necessary to further evaluate the seabed in the southwestern corner of the North Lease Area and along potential export cable routes. The 2017 and 2018 COP survey plans were submitted in accordance with the stipulations of the North Lease, as well as BOEM regulations and BOEM's guidelines:

- *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to CFR Title 30, Part 585* dated July 2, 2015 (BOEM, 2015a)
- *Guidelines for Submission of Spatial Data for Atlantic Offshore Renewable Energy Development Site Characterization Survey* dated February 1, 2013 (BOEM, 2013b)
- *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* dated July 2015 (BOEM, 2015b)
- *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf* dated November 2013 (BOEM, 2013c)
- *Guidelines for Information Requirements for a Renewable Energy COP* dated October 22, 2014 (Version 2.0) (BOEM, 2014)

On June 22, 2017, BOEM notified SFW that the 2017 COP Survey Plan was compliant and survey activities were initiated. SFW conducted the 2017 COP survey between June and December 2017 in accordance with the approved COP Survey Plan. On October 19, 2018, BOEM notified SFW that the 2018 COP Survey Plan was compliant and survey activities were conducted between October 2018 and January 2019 in accordance with the approved COP Survey Plan.

During the execution of the 2017 geophysical survey, the detection of potentially challenging seabed conditions led to the decision to shift the SFWF area eastward. Multi-beam survey data identified the presence of dense cobble, rock, and boulders on the seabed in the western-most region of the originally proposed SFWF survey area (Figure 2.1-3, middle panel). In contrast, areas just to the east were observed to have sparser rock and boulders with larger expanses of sand and mud on the seabed. Based on these findings, SFW shifted the SFWF area and consequently the SFEC-OCS to the east shown on Figure 2.1-3 (bottom panel, dotted line, original MWA). Since the conclusion of the 2017 COP surveys, in response to feedback from federal and state agencies, and both commercial and recreational fishing, SFW identified an additional wider spaced layout and expanded the MWA for the SFWF further to the east, as shown on Figure 2.1-3 (bottom panel, solid line, current MWA).

Positioning and siting of the foundations, as well as the Inter-array Cable, is constrained and complicated by the heterogeneous composition of the seabed (e.g., boulders) in the MWA. The current MWA is inclusive of all layout scenarios that have been considered by SFW.[4]

[4] The SFW COP submitted in September 2018 included a layout with WTG spacing of 1.0 mile (1.6 km, 0.86 nm). This layout was refined based on results of 2018 COP surveys and feedback from stakeholders and is presented in Section 3.1. The

SFW evaluated various layout scenarios with WTGs oriented in east to west rows,

SFW has committed to an indicative layout scenario with WTG sited in a grid with approximately 1.15 mile (1.8 km, 1 nm) by 1.15 mile (1.8 km, 1 nm) spacing that aligns with other proposed adjacent offshore wind projects in the RI-MA WEA.

SFW COP updated in May 2019 included two layout scenarios, including a layout with east to west corridors that were approximately 1.15 mile (1.8 km, 1 nm) between turbine rows, and a layout with east to west corridors that were approximately 0.8 mile (1.3 km, 0.70 nm). Both layouts maintained north to south corridors with an average spacing of 0.8 mile (1.3 km, 0.70 nm), and a minimum of 0.7 mile (1.1 km, 0.6 nm).

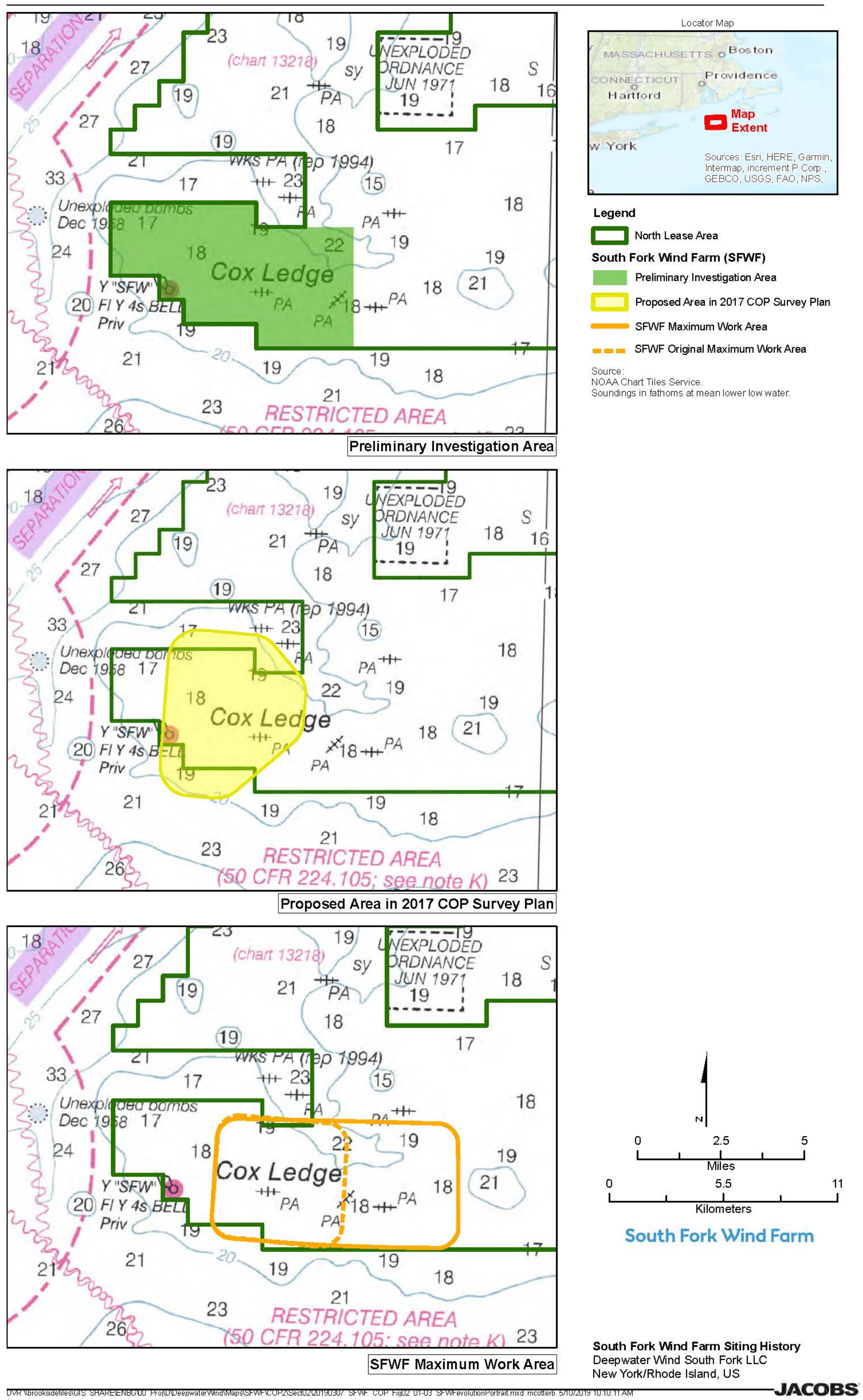

Figure 2.1-3. South Fork Wind Farm Siting History

Graphical illustration of the evolution of siting the South Fork Wind Farm based on site evaluations.

2.2 South Fork Export Cable Siting History

SFW identified several potential offshore and onshore cable routes for the SFEC based on both desktop analysis and field assessment activities, all of which supported the Project purpose.

Pursuant to 30 CFR § 585.200(b), SFW has the right to one or more project easements for the purpose of installing cables on the OCS to support activities within the lease. As part of the approval of this COP, SFW requests that BOEM issue a Project easement for the portions of the SFEC located in federal waters. In New York State, review of a preferred and alternative cable routes, via analysis of a wide variety of siting factors, occurs under Article VII of the New York State PSL. This section provides a synopsis of the routing assessment completed to identify both the offshore and onshore routes for the SFEC.

2.2.1 South Fork Export Cable - Offshore Route Siting

SFW completed a desktop evaluation for the SFEC route corridors based on publicly available information on oceanographic, geologic, shallow hazards, archeological, and environmental resources. Bottom conditions, bathymetry, as well as environmental constraints were mapped and investigated. Both the northern and the southern route options were included in the 2017 COP survey plan (Figure 2.2-1).

SFW initially identified one potential offshore corridor to reach the eastern end of Long Island. This corridor ran southwest from the SFWF, passing north of Montauk Point and into Napeague Bay on the north shore of the South Fork in the town of Easthampton, New York (Northern Route) (Figure 2.2-1). SFW met with local, state, and federal agencies, tribes, and stakeholders (commercial and recreational fishing, environmental non-governmental organizations) to discuss the locations of the SFEC route. Stakeholders identified concerns with the Northern Route into Napeague Bay. Both the commercial fishing community and the Town of East Hampton voiced strong concerns and requested that SFW consider landing the SFEC at a location on the south shore of the South Fork. Therefore, SFW added three potential landing sites on the south shore and developed an associated SFEC route (Southern Route) (Figure 2.2-1).

Initial geophysical field surveys during the 2017 COP survey were conducted for both the Northern and Southern Routes to obtain more detailed site-specific information. Based on the preliminary results of these surveys and through continued agency and stakeholder consultation, SFW determined that the Northern Route would have limited viability due to engineering constraints and environmental considerations including commercial fisheries interests. Several engineering constraints were identified, such as significant portions of shallow water in Napeague and Gardiners Bays and areas near Endeavor Shoals east of Montauk Point where large dynamic sand waves exist. Environmental constraints were identified along the Northern Route including heavily utilized fishing grounds (e.g., fixed gear areas to the east and north of Montauk), nearby shellfish and eelgrass beds, and the presence of municipal aquaculture lease areas in Napeague Bay. Napeague Bay, as a more sheltered coastal embayment, has high ecological sensitivity and supports significant populations of finfish and shellfish.

The south shore of Long Island is an open ocean environment as compared to the lower energy Napeague Bay. The Southern Route presented fewer engineering and environmental constraints as compared to the Northern Route. There is commercial fishing activity along the Southern Route including fixed and mobile gear; however, there are no known aquaculture lease areas. The subtidal coastal habitat along the south shore is subjected to higher wave action and, thus, has coarser sandy deposits. The benthic community along the south shore will recover faster from any potential impacts caused by the Project as compared to Napeague Bay. Given these results and agency and stakeholder preference, SFW selected the Southern Route as the preferred route.

Geophysical data along the Southern Route were collected as the 2017 COP survey continued. Data were collected over a 590-foot (180-meter [m])-wide corridor. The position of the route centerline was revised and micro-sited as data were collected and reviewed during the survey in an iterative fashion. Feedback from the fishing community during the siting process also helped refine the location of the route. The Southern Route corridor was adjusted to avoid or minimize possible impacts to heavily commercially fished areas, archeological resources such as shipwrecks, and hazard areas identified as having greater potential for unexploded ordinances. The resulting adjusted Southern Route corridor is pictured in Figure 2.2-1 as the blue-hashed line.

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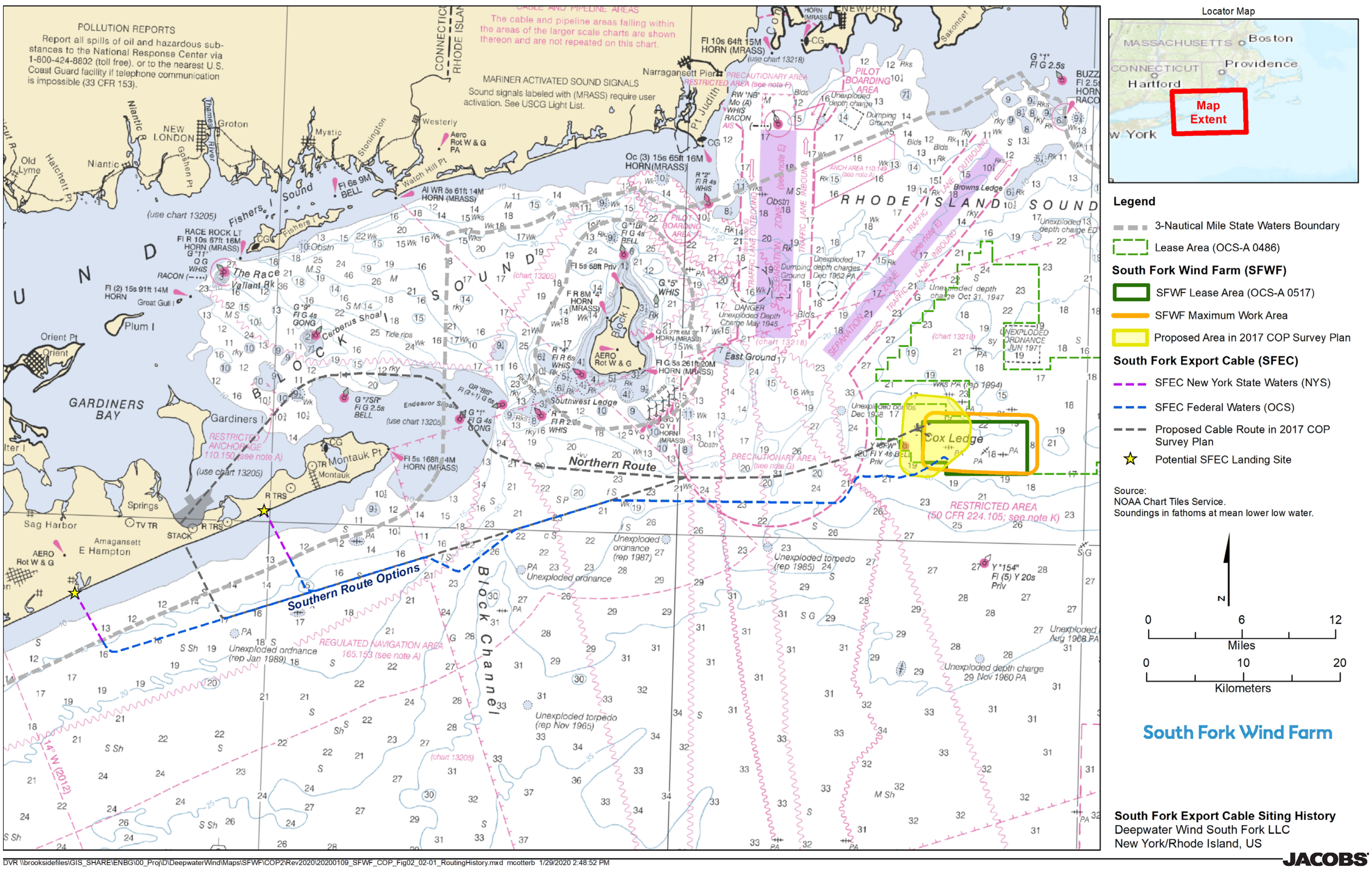

Figure 2.2-1. South Fork Export Cable Siting History

Northern and Southern South Fork export cable options considered during site assessment activities.

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2.2.2 South Fork Export Cable - Onshore Route Siting

As discussed in Section 1, a Certificate of Environmental Compatibility and Public Need under Article VII of the New York State Public Service Law is required. The segment of the SFEC from the point it enters New York State territorial waters at the 3-mile (4.8-km, 2.6-nm) state seawater boundary to the SFEC - Interconnection Facility will be subject to comprehensive routing, economic, and environmental evaluations set forth in the rules and regulations under Article VII.

A total of five landing sites were investigated in East Hampton, New York.

Two landing sites associated with the offshore Northern Route were identified on the north shore in East Hampton. Both landing sites, described as Fresh Pond and Promised Land, are located in Napeague Bay (Figure 2.2-2). Fresh Pond landing site is located on town of East Hampton-owned right-of-way (ROW), while Promised Land is located in New York State park land. These landing sites were deemed not viable by SFW based on the offshore route siting process described in the previous section.

Three landing sites associated with the offshore Southern Route were investigated on the south shore in East Hampton (Figure 2.2-2):

- Beach Lane - The Beach Lane landing site is located at the south end of Beach Lane on town of East Hampton-owned ROW. The Beach Lane landing site is comprised of paved parking in its northern extent and the remainder of the ROW is beach.
- Hither Hills - The Hither Hills landing site is located within an upper parking lot of the eastern portion of state-owned Hither Hills State Park, south of Old Montauk Highway.
- Napeague Lane - The Napeague Lane landing site is located at the end of Napeague Lane on town of East Hampton-owned ROW, south of Marine Boulevard. The Napeague Lane landing site is comprised of approximately 20 marked parking spots and beach.

After engineering and environmental analysis as well as discussion with municipal and state agencies, the Beach Lane and Hither Hills landing sites were identified as the two viable landing sites for the SFEC. The topographic conditions at Beach Lane and Hither Hills were found to be suitable for horizontal directional drilling (HDD) operations and conduit installation. Based on this evaluation, SFW originally identified several route variants or options from the Beach Lane and Hither Hills landing sites (Figure 2.2-3).

Routes associated with the Beach Lane landing site have the shortest distance to the existing East Hampton Substation; therefore, impacts of linear route construction are minimized. The Beach Lane route options utilize, to the extent possible, less traveled roadways and leverage the Long Island Railroad ROW. Of the Beach Lane route variants investigated, Beach Lane - Route A minimizes impacts to onshore traffic, heavily traveled roadways (e.g., Montauk Highway), and sensitive terrestrial habitats (e.g., wetlands). Therefore, Beach Lane - Route B, Beach Lane - Route C, and Beach Lane - Route D were removed from consideration as variants. These routes required obtaining property rights from additional entities such as the Village of East Hampton or private homeowners. In addition, of the four Beach Lane variants investigated, Beach Lane - Route C and Beach Lane - Route D did not minimize impacts to traffic or wetlands. Hither Hills - Route B primarily utilizes State-owned roadways and LIRR ROWs, whereas the Hither Hills - Route A and Hither Hills - Route C require obtaining property rights from additional entities, such as the Town and Village of East Hampton.

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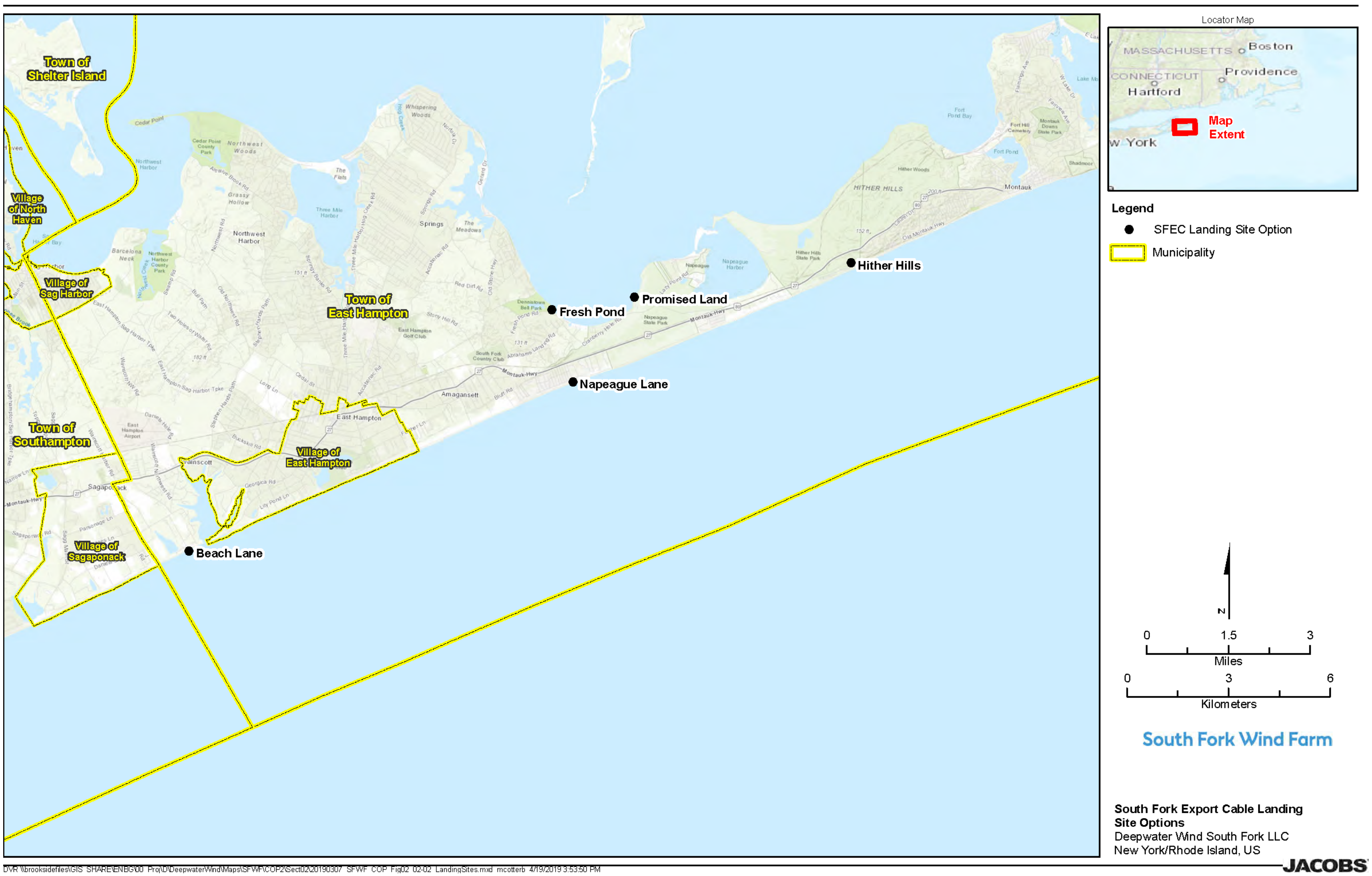

Figure 2.2-2. South Fork Export Cable Landing Site Options

Five landing site options considered for the South Fork Export Cable landing site on the South Fork of Long Island, New York.

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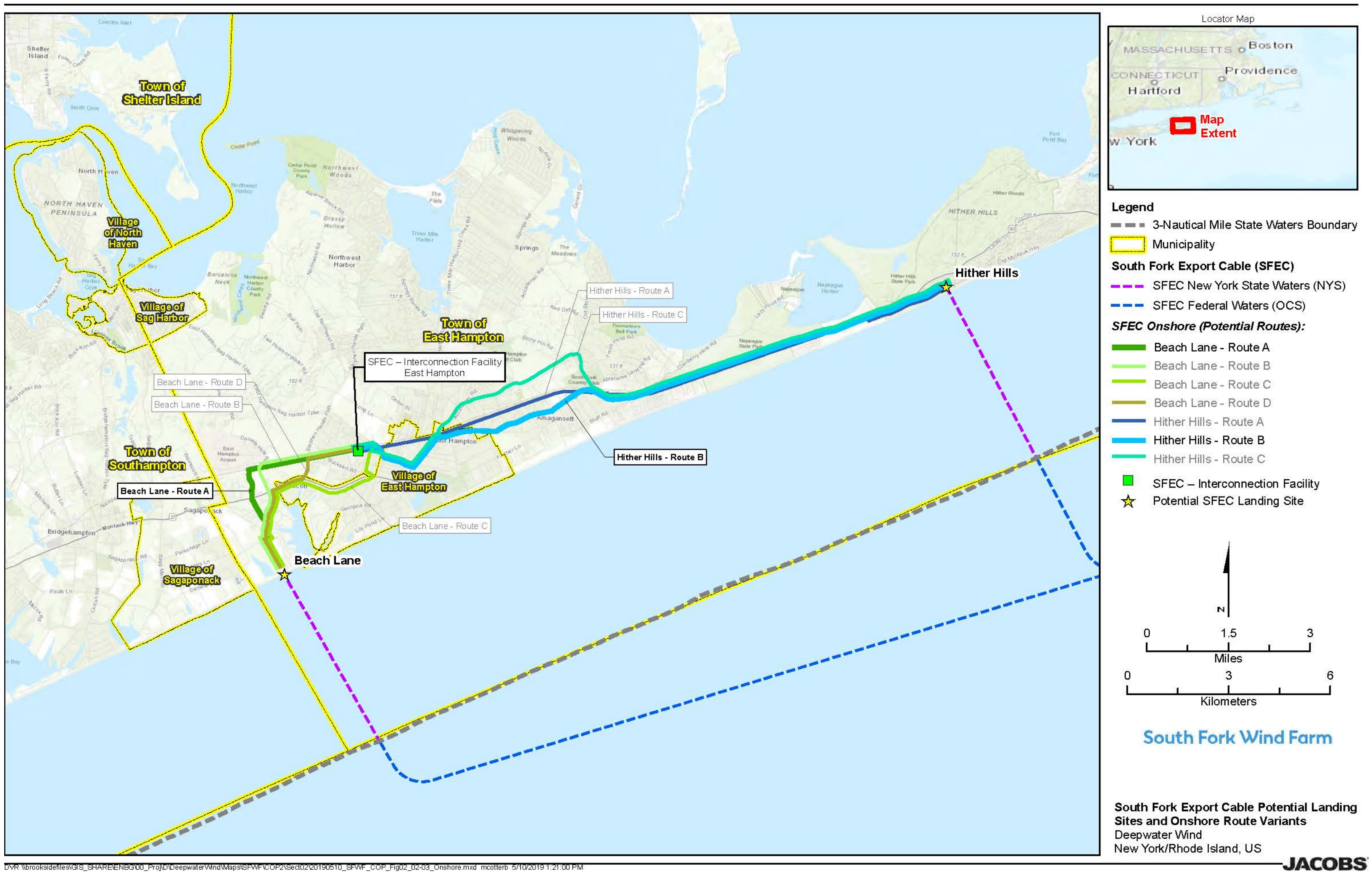

Figure 2.2-3. South Fork Export Cable Onshore Route Options

Seven onshore cable route variants considered to interconnect with the Long Island Power Authority transmission system at the East Hampton Substation.

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2.3 Review of Technologies and Installation Methods

SFW considered several potential technologies and installation methods for the SFWF and SFEC. The feasible technologies and installation methods are described in detail in Section 3. Technologies and installation methods that are not considered viable are described in this section.

2.3.1 South Fork Wind Farm - Technologies and Methods

Turbines

SFW considered multiple offshore turbine models based on various sizes of WTGs that are commercially available. SFW evaluated WTG sizes based on environmental, technical, and financial suitability for the SFWF. Selection of a turbine model will define the total number of WTGs required to meet the power supply need identified by LIPA in the PPA. Smaller, lower-capacity turbine models would require installation of a greater number of WTGs compared to larger, higher-capacity turbine models. The use of fewer WTGs improves the cost effectiveness of the Project by streamlining installation and minimizing environmental and socio-economic impacts, particularly visual impacts and bottom disturbances. Due to economies of scale and lack of commercial availability, WTG models smaller than 6 MW are not considered feasible for the SFWF.

Foundations

SFW evaluated several types of WTG foundations; however, monopiles are the preferred foundation type for the SFWF and is described in Section 3. Four foundation types, including suction bucket foundation, floating platforms, gravity-based structure (GBS) foundation, and jacket foundation, were initially evaluated and then removed from consideration. In general, monopiles are the preferred foundation for offshore wind because of significant advancements of this technology. As a result, a majority of the offshore wind supply chain is geared towards monopiles. The vast majority of turbine foundations in Europe and the rest of the world consists of monopiles. SFW selected the monopile foundation type based on suitability for subsurface conditions and water depths at the SFWF (as described in the Site Characterization Report in Appendix H1).

Suction bucket foundations have been installed at a few offshore wind projects in Europe and are planned for one project within the United States (Icebreaker in Lake Erie). The majority of these foundations have been installed via mono-bucket due to shallow water depths (less than 66 feet [20 m]). In deeper waters, this foundation type has not been fully evaluated and is considered to be suitable only for specific soil types and subsurface conditions. As such, suction bucket foundations are not considered feasible for the SFWF.

Floating platforms are still in the prototype development stage and have not been deployed for commercial offshore wind projects. Floating platforms are generally considered appropriate for installations at much deeper water depths than are present at the SFWF. Floating platforms are not considered appropriate for the SFWF given the prototypical nature of the platform and because the water is not deep enough to justify the additional costs and engineering considerations. As such, floating platforms are not considered feasible for the SFWF.

GBS foundations have been installed at only a few offshore wind projects in Europe. These foundations include a large seabed footprint, installation of significant scour protection, and could require significant dredging. Port facilities where GBS foundations would be fabricated may require significant upgrades, including extensive load bearing reinforcements and establishing possible concrete batch plants requiring air emission permitting. The site assessment surveys for SFWF documented numerous surface boulders that limit the suitability for GBS foundations. As such, GBS foundations are not considered for the SFWF.

Jacket foundations have been installed at other offshore wind projects, including one project in the United States (Block Island Wind Farm in Rhode Island). Jacket foundations have limited commercial availability and require a custom-made jacket to match the seabed and water depth at the siting location. The logistics for construction and transportation can also be significant. As such, jacket foundations are not considered for the SFWF.

2.3.2 South Fork Export Cable - Technologies and Methods

SFW evaluated different current types for the SFEC. The SFEC is designed to use high-voltage alternating current (HVAC), rather than high-voltage direct current (HVDC) transmission lines due to the considerably lower costs to connect HVAC into a primarily alternating current LIPA system. HVDC is a considerably larger investment than HVAC and is only cost-effective for wind farms with a larger nameplate capacity than planned for the SFWF or for long transmission lines carrying very large power capacities. The transmission distance and power rating of the SFEC makes it suitable for the more cost-effective HVAC system. Therefore, HVDC was not selected for the SFEC.

South Fork Export Cable - Offshore Installation Methods

SFW considered various options for installation of the SFEC - Offshore, including placement on the seabed and burial beneath the seabed. Although placement on the seabed would minimize installation time and cost as well as potential sediment disturbance, SFW plans to bury the cable beneath the seabed. Burying the cable is a means of protecting it from potential damage caused by various external forces (e.g., fishing equipment, anchors). Burying the cable also minimizes the need for maintenance and associated potential for seabed disturbance. The smallest available cable with the appropriate conductor size has been selected. The burial depth has been selected to balance two design criteria: 1) a burial depth deep enough to avoid physical damage from anchors, vessels, or other equipment that might penetrate the seabed; and 2) a burial depth shallow enough to allow heat to flow away from the cable fast enough so that the temperature does not exceed the design basis of the cable. The Site Characterization Report (Appendix H1) includes additional information about the cable burial assessment.

SFW also considered various installation methods for the SFEC - Offshore, including hydraulic plow, mechanical plow, and mechanical dredging. Due to the variability of surface and subsurface seabed conditions, SFW may use a combination of cable installation equipment (e.g., mechanical cutter, mechanical plow, jet plow) to install the cable at the target burial depth.

Mechanical dredging is not considered a feasible installation method because it requires mobilization of a dredge operation for an extended period of time due to the considerable route length and water depths. Mechanical dredging results in both a significant seabed footprint, suspended sediments, and greater potential impacts to marine navigation.

SFW considered multiple installation methods for the sea-to-shore transition at the cable landing site. Jet plowing (i.e., trenching via high pressure seawater) could be used to bury the cable in the nearshore zone up to the mean high-water line (MHWL) on the beach. In this scenario, either an open trench or an HDD (likely with a cofferdam on the beach) would be used to install the cable from the MHWL to the transition vault located at an onshore location. These methods are not considered feasible based on impacts to intertidal, beach, and dune habitats during construction.

Instead, SFW plants to conduct a longer HDD from the transition vault onshore, boring deep under the dunes and beach, and terminating offshore in deeper water (well past the MHWL). SFW recognizes the importance of preserving the coastal habitats along the south shore of Long Island. This method avoids impacts to intertidal, beach, and coastal habitats and maintains safety for beachgoers.

South Fork Export Cable - Onshore Installation Methods

SFW considered various options for installation of the SFEC - Onshore, including use of aboveground structures and burying the cable. Although aboveground installation would minimize construction time and cost, a buried cable increases safety and reliability, particularly during adverse weather conditions, and reduces noise, interference with communications, and visual impact. Therefore, SFW plans to bury the cable within existing ROWs.

Section 3 - Project Description

This section provides a description of the Project components for the SFWF and SFEC. Activities associated with construction and installation, commissioning, O&M, and conceptual decommissioning are also discussed in this section.

- **SFWF:** includes up to 15 WTGs with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an OSS, all of which will be located within federal waters on the OCS, specifically in BOEM Renewable Energy Lease Area OCS-A 0517, approximately 19 miles (30.6 km, 16.6 nm) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York.
- **SFEC:** an AC electric cable (138 kV) that will connect the SFWF to the existing mainland electric grid. The SFEC includes the following:
  - **SFEC - OCS:** the submarine segment of the export cable within federal waters on the OCS from the OSS to the boundary of New York State territorial waters.
  - **SFEC - NYS:** the submarine segment of the export cable from the boundary of New York State waters to a sea-to-shore transition vault located in the Town of East Hampton on Long Island, Suffolk County, New York.
  - **SFEC - Onshore**: the terrestrial underground segment of the export cable from the sea-to-shore transition vault to the interconnection facility where the SFEC will interconnect with the LIPA electric transmission and distribution system in the town of East Hampton on Long Island, Suffolk County, New York.
- **SFWF O&M facility:** SFW expects that the SFWF O&M facility will be located on an existing waterfront parcel at either Montauk in the Town of East Hampton, New York, or in Quonset Point in the Town of North Kingstown, Rhode Island.

Port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, and/or Virginia will support offshore installation activities for the SFWF and SFEC - Offshore, and construction activity for the SFEC - Onshore will occur in East Hampton, New York.

Figure 1.1-1 (Section 1) depicts the operational concept of the Project and Figure 1.1-2 (Section 1) provides an overview map of the location of the various Project components.

Appendix F includes supplemental information on Project location and activities that occur during construction, O&M, and decommissioning. Appendix F includes a location plat, including a table that lists surface locations and water depths for Project components. Appendix F also presents a tabular summary of the information identified in Attachment B of BOEM's *Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP)* (BOEM, 2016). In addition, Appendix F includes information, pursuant to 30 CFR 585.626(b)(9) and (10), including a sample inventory of materials consistent with the expected methods for installation and an inventory of anticipated chemical use and management. Finally, Appendix F includes information on locations where the SFEC will cross existing telecommunications cables, including copies of SFW correspondence with owners of those cables.

Appendix G includes conceptual plans and drawings for both the SFWF and SFEC, as referenced throughout Section 3. Appendix G also includes figures showing the corridor for the SFEC - Offshore, in both plan and profile format, as well as the corridor for the SFEC - Onshore.

The SFWF and SFEC are being developed based on an envelope approach, consistent with BOEM's Draft *Guidance Regarding the Use of a Project Design Envelope in a COP* (January 2018). This approach results in a range of characteristics and locations for components that will be considered in the environmental review for the Project. As such, the components and locations for the SFWF and SFEC have been selected based on environmental and engineering site characterization studies completed to date and will be refined and then finalized in the FDR and Fabrication and Installation Report (FIR), which also will be reviewed by BOEM pursuant to

30 CFR § 585.700-702, before installation begins. In addition, a CVA, approved by BOEM, will conduct an independent assessment of the engineering design described in the FDR. The CVA will also verify, based on monitoring and inspections conducted during construction, that the Project components are fabricated and installed in accordance with both the COP and FIR.

The Project Envelope for the SFWF and SFEC includes several general characteristics that vary by component (Table 3.0-1). These characteristics are further described in Sections 3.1 and 3.2.

Table 3.0-1. Project Components and Envelope
Project characteristics by component, and range of options within project envelope of that characteristic (if applicable).

Project Component		Project Envelope Characteristic
SFWF	Foundation	Monopile with pile diameter up to 11 m
	WTG	• Up to 15 WTGs (includes 15 positions, plus 2 alternate positions) • 6 to 12 MW each
	Inter-Array Cable	34.5 kV or 66 kV
	OSS	Mounted on a dedicated foundation or co-located with a WTG
	O&M Facility	Located in Montauk, New York, or Quonset Point, Rhode Island
SFEC	Export Cable (Offshore and Onshore)	• 138 kV • Offshore located within a surveyed corridor 590-feet (180-m) wide, target burial depth 4–6 feet (1.2–1.8 m) • Onshore duct bank located within existing paved road and railroad ROWs, maximum burial 3-5 feet (0.9-1.5 m)
	Sea-to-Shore Transition	• Landing site located at either Beach Lane or Hither Hills in East Hampton, New York • Installed using HDD between onshore underground cable transition vault and the offshore HDD exit location • HDD exit location may utilize offshore sheet pile cofferdam, gravity cell cofferdam, or no cofferdam
	Interconnection Facility	Newly constructed, air-insulated facility located adjacent to existing East Hampton substation

Installation of the SFWF and SFEC is scheduled to take place over a 2-year period. Construction will be completed in the following general sequence:

- Transportation of the foundations to the SFWF
- Installation of the foundations
- Installation of the OSS
- Installation of the cable systems
- Installation of the WTGs and OSS

3.1 South Fork Wind Farm

3.1.1 Project Location

The SFWF will be located in federal waters. The WTG closest to land will be approximately 19 miles (30.6 km, 16.5 nm) southeast of Block Island, Rhode Island, and approximately 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York (Figure 1.1-2). Water depths, in the area where WTGs are proposed to be installed, range from approximately 108 to 134 feet (33 to 41 m).

The SFWF will also include an O&M facility in either New York or Rhode Island, as well as offshore construction staging areas located at port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, and/or Virginia.

Site-specific investigations were conducted in 2017 and 2018 at the SFWF (described further in Section 4 and Appendix H). The survey data collected over both years encompassed the entire MWA. These surveys informed the positioning of the WTGs and Inter-array Cable (Figures 3.1-1).

SFW has committed to an indicative layout scenario with WTG sited in a grid with approximately 1.15 mile (1.9km, 1.0 nm) by 1.15 mile (1.9 km, 1.0 nm) spacing that aligns with other proposed adjacent offshore wind projects in the RI-MA WEA.

The MWA shown on Figure 3.1-1 is the designated area where installation and supporting activities having seabed disturbance (e.g., anchoring) will occur. The MWA has an approximate buffer of at least 2,070 feet (631 m) around the outer edge of the WTG layout for increased work space. While the MWA includes limited areas outside the boundary of the Lease Area, all WTGs and foundations will be installed inside the Lease Area.

Positioning of foundations for WTG and OSS, as well as the Inter-array Cable is constrained and complicated by the heterogeneous composition of the seabed (e.g. boulders, hard bottom) and other potential constraints, including cultural and archeological resources in the MWA. Boulder density on the seabed is shown on Figure 3.1-1. Layout of the SFWF may be refined based on further consultation with agencies and stakeholders, ongoing offshore geophysical and geotechnical surveys, and detailed engineering and design. As such, SFW requires flexibility to micro-site foundations. In accordance with 30 CFR § 585.634(c)(6), micro-siting of foundations will occur within a 500-feet (152-m) radius around locations identified in the indicative layout scenario, while maintaining the 0.6-nm-wide northwest–southeast transit lanes as recommended by the USCG (USCG 2020).

Required engineering criteria considered for the final SFWF layout include:

- WTG size and number
- Seabed soil and sub-bottom characteristics must align with foundation design requirements
- Seabed surface characteristics must align with constructability requirements, including:
  - Areas clear of boulders where foundations can be installed, and installation vessels can anchor or jack-up
  - Areas accessible to cable lay operations, where Inter-array Cables can be installed to and from the foundation.

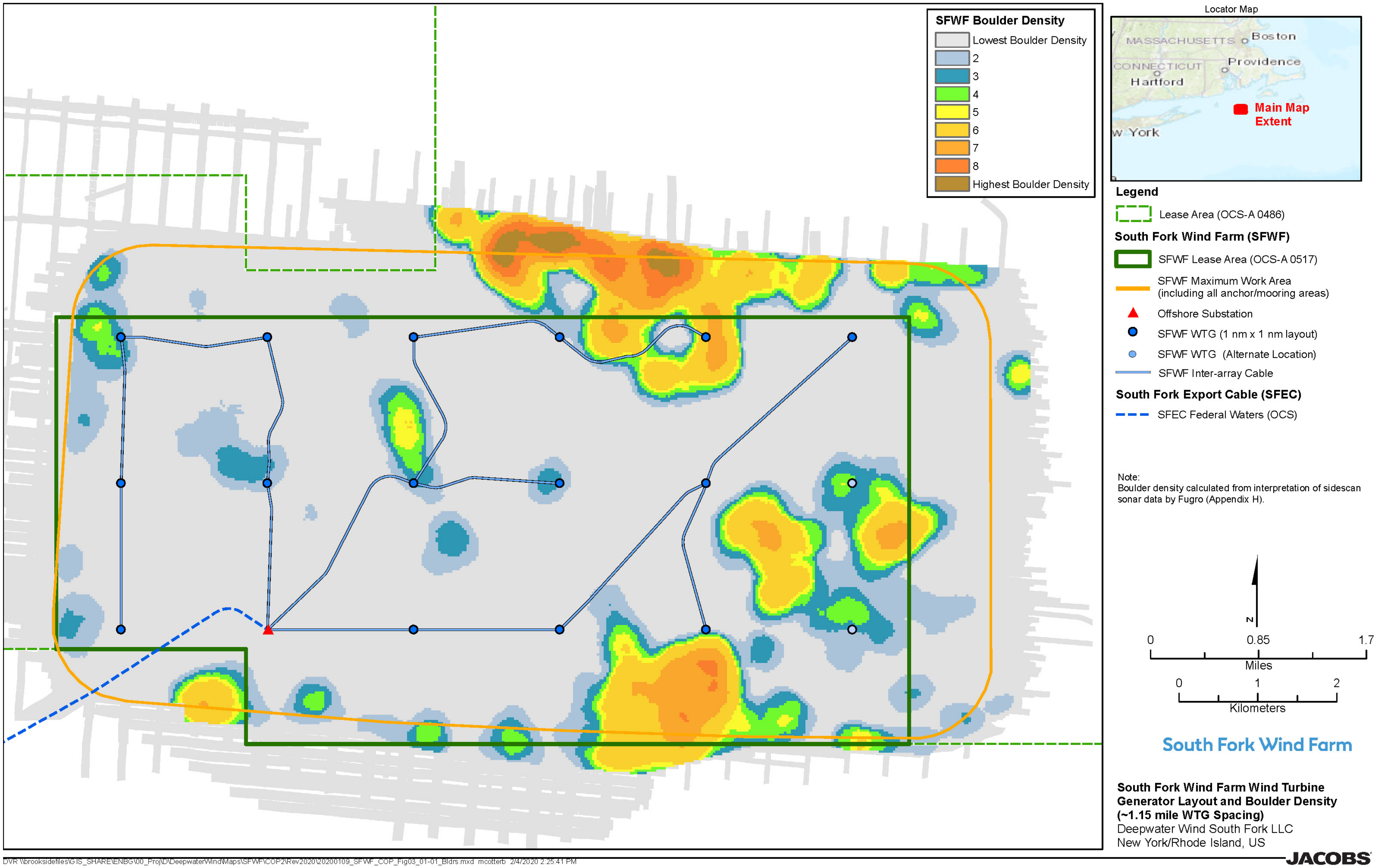

Figure 3.1-1. South Fork Wind Farm Wind Turbine Generator Layout and Boulder Density (~1.15 mile WTG Spacing)

Illustration of area where components will be located, where work will occur, and where boulder obstruction on the seabed exists.

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3.1.2 South Fork Wind Farm Facilities

The SFWF will consist of foundations, WTGs, Inter-array Cables, and an OSS, as well as the O&M facility located onshore. The major characteristics that may vary, including Project construction staging areas (i.e., ports), within the SFWF Project Envelope are listed in Table 3.0-1. The temporary and permanent footprints on the seabed for each SFWF component or activity are summarized in Table 3.1-1. Each of the SFWF components are described in the following sections. The tables included further describe parameters that may vary by each component. Where applicable, these estimates are presented with a range of minimum and maximum values.

Table 3.1-1. Footprint of South Fork Wind Farm Project Component or Activity
Maximum temporary and permanent seabed footprint for components of South Fork Wind Farm.

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Monopile Foundations [a]	14.8 acres (6 ha)	14.6 acres (5.9 ha)
Foundation cable protection [a]	N/A	7.5 acres (4.2 ha)
Vessel anchoring/mooring [c]	820.8 acres (332 ha)	N/A
Inter-array Cable [b]	340 acres (137.6 ha)	2.5 acres (1.0 ha)
Inter-array Cable protection [b]	N/A	10.2 acres (4.2 ha)

Notes:

[a] Conservatively assumes up to 16 foundations will be installed, including 15 foundations for WTGs and 1 foundation for the OSS. Permanent footprint also includes scour protection for 16 foundations and secondary cable protection for 16 foundations. Temporary disturbance includes seafloor preparation.

[b] Conservatively assumes the Inter-array Cable has a maximum length of 21.4 miles (34.4 km, 18.6 nm) and a diameter of 12 inches (0.3 m). Permanent footprint also includes secondary cable protection. Temporary disturbance includes seafloor preparation.

[c] Conservatively assumes that, during typical installation, three vessels will use anchors, three vessels will use spud cans, and all six vessels will visit each of the 16 foundations.

ha = hectare(s)

3.1.2.1 Foundations

Each WTG will be supported by one steel monopile foundation embedded into the sea floor (Figure 3.1-2 includes a conceptual diagram).

A monopile foundation typically consist of a single steel tubular section, comprised of several sections of rolled steel plate welded together. A transition piece is fitted over the top of the monopile and secured via bolts or grout. The transition piece may include boat landing features, ladders, a crane, and other ancillary components as well as an interface connection to the WTG. The transition piece will be painted yellow and marked according to USCG requirements. The transition piece will typically be installed separately following the monopile installation. It is also possible for the monopile and transition piece to be fabricated and installed as one component (a “one-piece monopile”), with the boat landing and other ancillary features installed subsequently as appropriate.

The SFWF Project Envelope includes a conservative range of design parameters (Table 3.1-2) and includes potential scour protection (see Section 3.1.3.2 for more details on scour protection). Typical figures are included in Appendix G and will be confirmed in the FDR.

Table 3.1-2. South Fork Wind Farm Parameters: Foundations
Summary of maximum parameters for monopile foundation.

Foundation Parameter	Maximum Footprint
Foundation base diameter (feet per foundation)	36 feet (11.0 m)
Maximum Permanent Footprint	
Seabed footprint per foundation with no scour protection (ft^2 [m^2] per foundation)	1,025 ft^2 (95 m^2)
Seabed footprint per foundation with scour protection (ft^2 [m^2] per foundation) [a]	39,765 ft^2 (3,694 m^2)
Total Maximum Permanent Footprint	635,976 ft^2 (59,084 m^2) 14.6 acres (5.9 ha)
Temporary Seabed Disturbance	
Seafloor preparation per foundation (ft^2 [m^2] per foundation) [b]	40,365 ft^2 (3,750 m^2)
Vessel anchoring/mooring (ft^2 [m^2] per foundation) [c]	2,234,089 ft^2 (207,554 m^2)
Total Temporary Seabed Disturbance	36,391,264 ft^2 (3,380,859 m^2) 835.6 acres (338 ha)

Notes:

[a] Conservatively assumes scour protection is placed around the base of each foundation in a circle with a diameter of 225 feet (68 m).

[b] Conservatively assumes temporary seabed disturbance from boulder relocation may occur near each foundation. The total seabed disturbance for all 16 foundations will be up to 14.8 acres (6 ha); not all foundations will require boulder relocation.

[c] Conservatively assumes that temporary seabed disturbance from vessel anchoring/mooring will occur during typical foundation installation. The total seabed disturbance for all 16 foundations will be up to 820.8 acres (332 ha). Three vessels will use anchors and three vessels will use spud cans; all six vessels will visit each of the 16 foundations. The vessels with anchors will have a total maximum ground disturbance of 4.51 acres (1.8 ha) per foundation and this ground-disturbing activity will happen 11 times at 16 foundations. The vessels with spud cans will have a total maximum ground disturbance of 0.15 acre (0.06 ha) per foundation and this ground-disturbing activity will happen 11 times at 16 foundations. Table 3.1-7 includes additional details about the maximum ground disturbance for each of these vessels.

ft^2 = square feet

m^2 = square meters

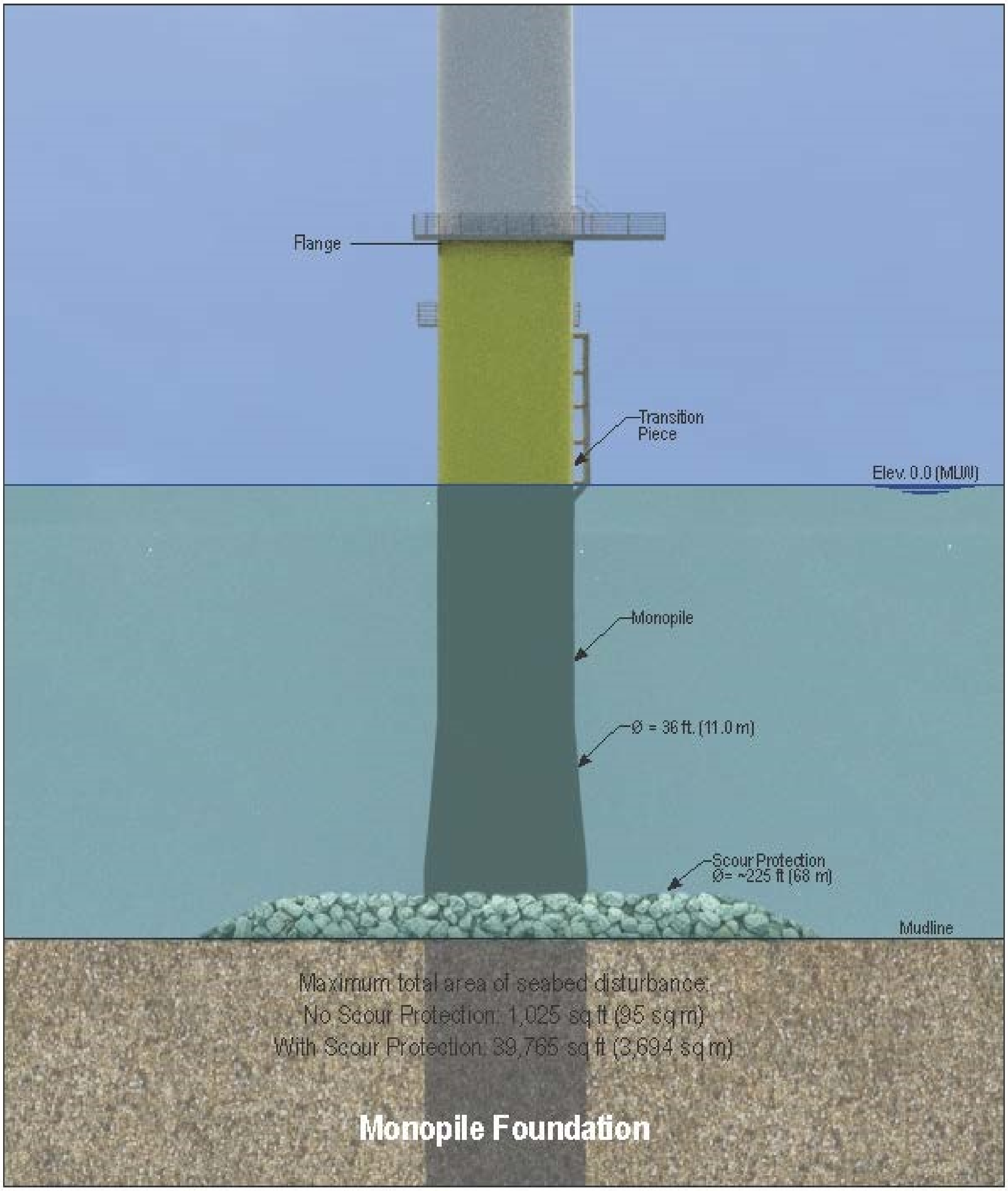

Figure 3.1-2. South Fork Wind Farm Monopile Foundation

Conceptual illustration of monopile foundation with transition piece, diameter (Ø) of foundation base and scour protection rings shown.

3.1.2.2 Wind Turbine Generators

The SFWF will consist of up to 15 WTGs. SFW will select the WTG model that is best suited for the Project and that is commercially available to support the Project schedule. The selected WTG model and nameplate capacity will ultimately determine the number of WTGs to be installed for the SFWF. Figure 3.1-4 depicts the project envelope area where the WTGs will be installed. The SFWF Project Envelope includes a conservative range of minimum and maximum parameters for the anticipated class of WTGs that could be used for the Project, which is expected to range from 6 to 12 MW (Figure 3.1-3, Table 3.1-3).

Table 3.1-3. South Fork Wind Farm Parameters: Turbines
Summary of parameters for the anticipated class of turbines.

WTG Parameter	Minimum Turbine Size (6 MW)	Maximum Turbine Size (12 MW)
Hub height (mean sea level [MSL])	331 feet (100.9 m)	472 feet (143.9 m)
Rotor diameter	492 feet (150 m)	735 feet (224 m)
Total height (top of the blade above MSL)	577 feet (175.9 m)	840 feet (256 m)
Rotor swept zone area	190,117 ft^2 (17,662 m^2)	424,173 ft^2 (39,406 m^2)
Air gap (bottom of the blade above MSL)	85 feet (25.9 m)	132 feet (40 m)
Blade length (feet)	246 feet (75 m)	358 feet (109.1 m)
Deck height above MSL	66 feet (20.1 m)	75 feet (22.9 m)

Each WTG will be comprised of the following major components: a tower, nacelle and rotor which includes the blades. Control, lighting, marking, and safety systems will be installed on each WTG; the specific systems will vary depending on the turbine selected, and will be reviewed by the CVA in the FDR. There will be small amounts of lubrication, grease, oil and cooling fluids within the WTG to support the operation of the WTG bearing, pitch, and hydraulic systems as well as the WTG transformer. In addition, there will be lubrication oil if the selected WTG has a gearbox. Heating, ventilation, and air conditioning, used for climate control, will be included within the WTG; the specific systems will vary depending on the WTG selected, and will be reviewed by the CVA in the FDR. There also may be a small, temporary diesel generator at each WTG location on the work deck of the foundation. If present, the generator would have a maximum power of 200 horsepower (hp) and up to a 50-gallon diesel tank with secondary containment. Each WTG will also have helicopter access by means of winching personnel onto/from a landing area.

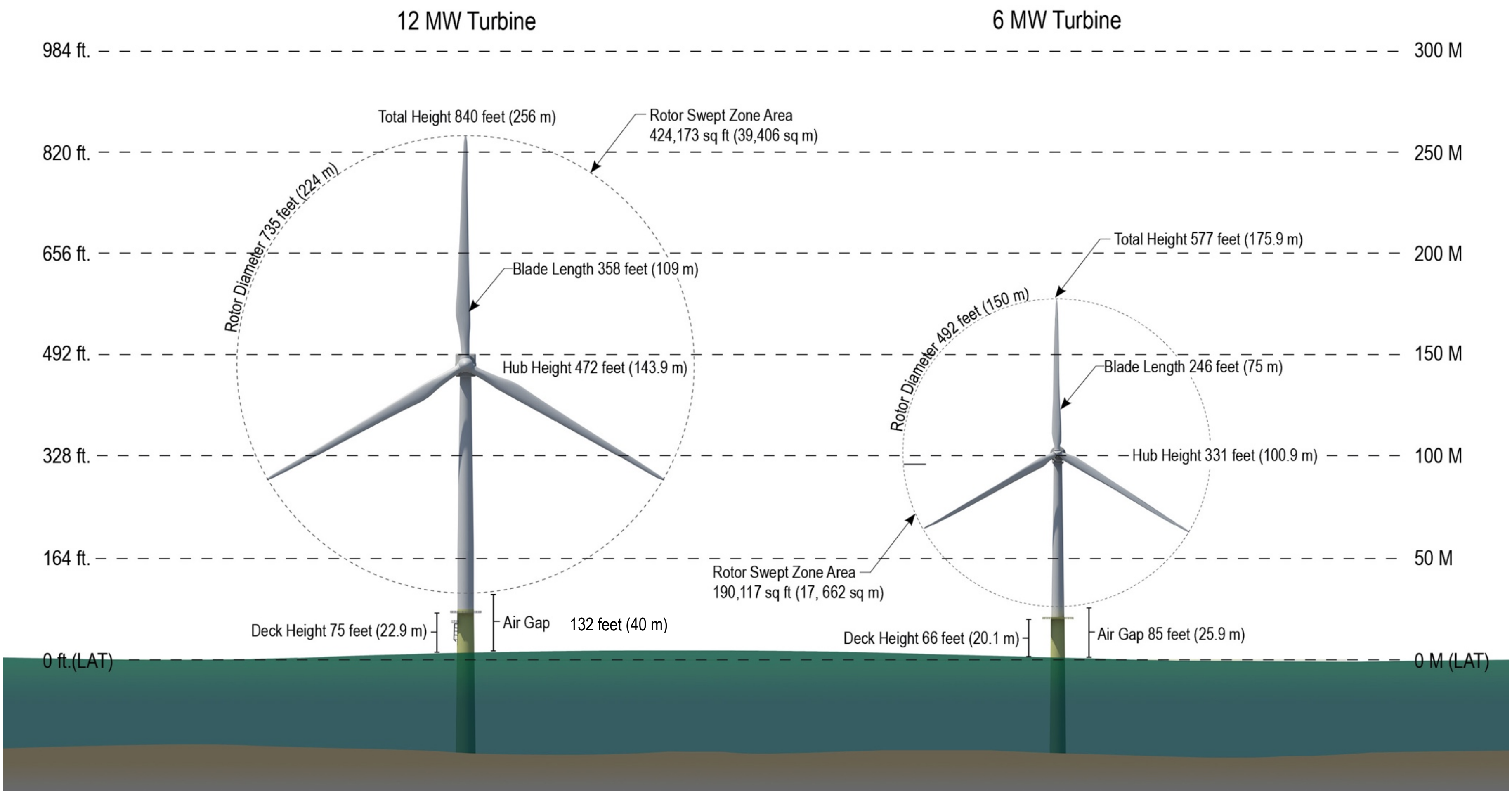

Figure 3.1-3. South Fork Wind Farm Wind Turbine Generator Illustration
Illustration of minimum and maximum range for wind turbine generator dimensions.

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3.1.2.3 Inter-Array Cable

Inter-array Cables will connect the individual WTGs and transfer power between the WTGs and the OSS. Figure 3.1-1 depict the approximate route where the Inter-array Cable will be installed between the WTG foundations. The SFWF Project Envelope includes a cable design that encompasses a conservative range of parameters (Table 3.1-4). The Inter-array Cable will either be a 34.5 kV or 66 kV 3-phase alternating current cable. Depending on the WTG selected, a 33-kV cable may be identified during the FDR. However, the physical characteristics of this 33-kV cable fall within the same range as the 34.5-kV cable described in Table 3.1-4. The final voltage of the Inter-array Cable will be determined based upon the finalized engineering design specifications for the SFWF, and will be reported in the FDR, which will be reviewed by the CVA.

The Inter-array Cable contains three conductors, screens, insulators, fillers, sheathing, and armor, as well as fiber optic cables; it does not contain lubricants, liquids, oils, or other insulating fluids.

The Inter-array Cable will have a target burial depth of 4 to 6 feet (1.2 to 1.8 m) in the seabed. Where the Inter-array Cable emerges from the trench and is attached to the foundation, cable protection (e.g., engineered concrete mattresses or rock) may be placed on the seabed near the WTG foundation.

Secondary cable protection may be applied to avoid risk of interaction with external hazards where sufficient burial depth cannot be achieved. The need for secondary cable protection in specific locations will be based on the cable burial design documents (e.g., Cable Burial Risk Assessment) to be completed during the FDR/FIR. Based on the assumption that these cable burial design documents will be used to determine the need for secondary cable protection, it is estimated that up to 10 percent of Inter-array Cable (2.0 miles [3.2 km, 1.8 nm]) will require secondary cable protection .

Appendix G includes a typical cross-section of the Inter-array Cable, a conceptual drawing of the typical burial depth for the cable, a conceptual drawing of concrete mattresses to be used near the foundation, and where burial depth cannot be achieved. The Site Characterization Report (Appendix H1) includes additional information about the cable burial assessment.

Table 3.1-4. South Fork Wind Farm Parameters: Inter-array Cable
Summary of anticipated parameters for the Inter-array Cable.

Inter-array Cable Parameter	Design Specifications
Cable diameter	6–12 inches (15.2–30.5 centimeters [cm])
Target burial depth [a]	4–6 feet (1.2–1.8 m)
Maximum trench depth	10 feet (3 m)
Cable length	21.4 miles (34.4 km, 18.6 nm)
Maximum Permanent Footprint	
Inter-array Cable [b]	2.5 acres (1.0 ha)
Secondary cable protection for Inter-array Cable [c]	10.2 acres (4.1 ha)
Cable protection at approach to foundations [d]	7.5 acres (4.2 ha)
Total maximum permanent footprint	20.2 acres (9.3 ha)
Temporary Seabed Disturbance (not including permanent footprint)	
Inter-array Cable installation [e]	85.0 acres (34.4 ha)
Boulder relocation [f]	255 acres (103.2 ha)

Table 3.1-4. South Fork Wind Farm Parameters: Inter-array Cable
Summary of anticipated parameters for the Inter-array Cable.

Total temporary disturbance	340 acres (137.6 ha)

Notes:

[a] Burial depth is measured from the seabed to the top of the cable.

[b] Conservatively assumes a length of 21.4 miles (34.4 km, 18.6 nm) and a diameter of 12 inches (0.3 m).

[c] Conservatively assumes secondary cable protection will be needed for up to 10 percent of the Inter-array Cable (2.1 miles [3.4 km, 1.9 nm]). Cable protection will consist of concrete matting, fronded mattresses, rock bags, or rock placement (8 feet long by 39 feet wide [2.4 m long by 12 m wide]).

[d] Conservatively assumes each cable approach to a foundation will require approximately 300 feet (91.4 m) of cable protection, including rock or concrete matting (8 feet long by 39 feet wide [2.4 m long by 12 m wide]). The number of cable approaches per foundation will vary by foundation; 5 WTG may have one cable approach (11,700 ft^2 [1,087 m^2]) of cable protection) 8 WTG may have two cable approaches (23,400 ft^2 [2,173.9 m^2]), two WTG may have three cable approaches (35,100 ft^2 [3260.9 m^2]), and the OSS may have up to four cable approaches (46800 ft^2 [4348 m^2]). Under these assumptions, total cable protection for the approach to all foundations will be 7.5 acres (4.2 ha), based on a total length of 1.8 miles (2.8 km, 1.5 nm) and a width of 39 feet (12 m).

[e] Conservatively assumes that temporary seabed disturbance will include a maximum temporary disturbance of 33 feet (10 m), based on a total length of 21.4 miles (34.4 km, 21.4 nm). Temporary disturbance includes installation equipment with a maximum disturbance of 25 feet (7.5 m) and use of controlled flow excavator with additional disturbance of 8.2 feet (2.5 m) width.

[f] Additional temporary disturbance may also include boulder relocation during seafloor preparation. Boulder relocation may occur within 65 feet (20 m) of each side of the inter-array centerline. The temporary seabed disturbance includes 98.4 feet (30.0 m) width, in addition to cable installation of the Inter-array Cable.

3.1.2.4 Offshore Substation

The OSS will collect electric energy generated by the WTGs through the Inter-array Cables for transmission through the SFEC to the SFEC - Interconnection Facility. While the equipment on the OSS will serve several purposes, its primary purpose is to transform and step up voltage from the Inter-array Cable to the SFEC. A rendering of the conceptual design for the OSS is provided on Figure 3.1-4.

The OSS will also house the Supervisory Control and Data Acquisition (SCADA) system that serves as the means for wind farm monitoring and control between the WTGs, substation, and onshore remote operation center(s). Power metering and protection relays will be in the OSS, which will be coordinated with similar relays located in the SFEC - Interconnection Facility so that the Inter-array Cable and the SFEC operate within design boundaries and can be disconnected from all power sources, if necessary.

The OSS will consist of high voltage power transformer, reactor, and switchgears together with secondary medium voltage transformers, switchgears, and utility equipment, including heating, ventilation, and air conditioning systems. The substation may also include a small permanent diesel generator, which will have a maximum power up to 400 hp and up to a 500-gallon diesel tank with secondary containment. The OSS may include boat landing and helicopter access (i.e., helideck) for emergency transport and limited maintenance activities, including transport of crew and supplies.

The OSS will be above the water located either on a platform supported by a foundation similar to those used for the WTGs, or co-located on a foundation with a WTG. If the OSS is located on its own foundation, the total height of the substation will be 150 to 200 feet (45.7 to 61 m), measured from MSL to the top of the substation. If the substation is co-located with a WTG on a single foundation, the substation will be placed on the foundation such that the total maximum height of the WTG does not exceed the total height of other WTGs (as depicted on Figure 3.1-3).

Appendix G includes a conceptual design of the OSS, for both standalone and co-located foundation.

Figure 3.1-4. Offshore Substation

Conceptual three-dimensional rendering of the proposed offshore substation, note wind turbine generators in picture are conceptual, not scaled for height or spacing.

3.1.2.5 South Fork Wind Farm Operations and Maintenance Facility

The only ancillary facility that will be built as an integrated operational component of the SFWF is the onshore SFWF O&M facility where SFWF O&M staff can prepare and mobilize from this location for offshore maintenance activities, monitor the wind farm, and/or access storage space for spare parts and other equipment to support maintenance activities. The SFWF O&M facility will be located in a port in Montauk in East Hampton, New York or at Quonset Point in North Kingstown, Rhode Island, and will be utilized during the duration of the Project.

The SFWF O&M facility will include building(s) that provide office space (a maximum of up to approximately 1,000 square feet) equipment storage space (a maximum of up to approximately 6,600 square feet at Montauk and up to approximately 11,000 square feet at Quonset Point), a stationary crane for equipment transfer, up to three vessel berths for the crew transfer vessels (CTV), as well as accommodations for parking spaces, additional containers for equipment storage, and minor surface improvements.

Modifications at the Port of Montauk may also include reinforcement and/or rehabilitation of quayside(s), as well as both initial and maintenance dredging to support the CTVs. These modifications are not anticipated to be required at Quonset Point.

3.1.3 Construction

This section describes the construction process of the SFWF based on typical methods, vessels, and equipment.

Before construction begins, SFW will finalize contracts with vendors and fabrication and installation contractors. SFW will also finalize mobilization plans and arrangements at port facilities to support Project activities, including logistic support for fabrication, as needed.

It is assumed that certain Project components will be pre-fabricated prior to arrival at regional ports (e.g., blades and nacelles). Some fabrication and pre-assembly activities, particularly for the foundations, may occur at regional ports. Foundations and WTGs components may be staged and loaded at regional ports and transported to the SFWF. Onshore fabrication and manufacturing of the offshore components will take place in the years before and during offshore construction.

The general process for installation of the SFWF involves the installation of the foundations to the sea floor via pile driving, and preparation of the structures for the WTGs. Work vessels then supply and assemble all the WTG components and install them on the foundations. All installation activities will occur within the MWA (Figure 3.1-1; Location Plat included in Appendix F).

Although some activities may overlap, offshore construction for the SFWF is anticipated to be completed in the following general sequence, which is further described in subsequent sections:

- Mobilization of vessels
- Transportation of the foundations to the WTG installation site
- Installation of the foundations
- Installation of the OSS
- Installation of the Inter-array Cable
- Installation of the WTGs

The WTG commissioning phase begins when the first WTG is installed offshore.

3.1.3.1 Ports, Vessels and Vehicles, and Material Transportation

Port Facilities

During construction, several existing port facilities located in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, and/or Virginia may be temporarily utilized to support offshore construction, assembly and fabrication, crew transfer and logistics. Figure 3.1-7 and Table 3.1-5 provide additional information about the potential Project activities that may occur at selected ports. At this time no final determination has been made concerning the specific location(s) of these activities, which are limited in scope, temporary in nature, and could take place at various locations.

SFW expects that a number of upgrades or modifications at several ports throughout the northeast – including but not limited to those under consideration by SFW – will occur in the future to support the offshore wind industry. If and when the port owner or lessor makes any necessary upgrades or modifications, SFW may consider use of that port for the Project. The majority of ports that can support the Project’s needs for crew transfer, cargo logistics, and storage are not anticipated to require expansion of or modifications to existing infrastructure However, in the event that such locations undertake expansions or modifications, the port owner or lessor will be responsible for securing the necessary federal, state and local permits and overseeing the construction.

For example, port modifications may occur at the Port of Providence, which is being considered for use by SFW. Modifications at the Port of Providence may include erection of a temporary buildings for storage and offices (up to 40,000 ft^2 [3,720 m^2]), as well as localized reinforcement of terrestrial bearing capacity and changes to surface materials to support laydown and staging of Project components, (e.g., WTGs and foundations). SFW understands that none of these modifications at the Port of Providence involve expansion of the port infrastructure or would include in-water or onshore work requiring federal permits.

Table 3.1-5. Potential Project Port Facilities

Anticipated ports that may be utilized during construction, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

State / Province	Port	Town	Summary of Potential Project Activities	
			Fabrication, Assembly, Deployment, Decommissioning	Crew Transfer, Cargo Logistics and Storage
New York	Port of Montauk	Montauk		❍
	Shinnecock Fish Dock	Hampton Bays		❍
	Greenport Harbor	Greenport		❍
Rhode Island	Port of Providence	Providence	❍	
	Port of Davisville and Quonset Point, Quonset Development Corporation	North Kingstown	❍	❍
	Old Harbor and New Harbor	New Shoreham		❍
	Port of Galilee	Point Judith		❍
Massachusetts	New Bedford Marine Commerce Terminal	New Bedford	❍	❍
Connecticut	Port of New London	New London	❍	❍
New Jersey	Paulsboro Marine Terminal	Paulsboro	❍	
Maryland	Sparrows Point	Baltimore	❍	
Virginia	Port of Norfolk	Norfolk	❍	
Nova Scotia	Port of Sheet Harbour	Sheet Harbour	❍	

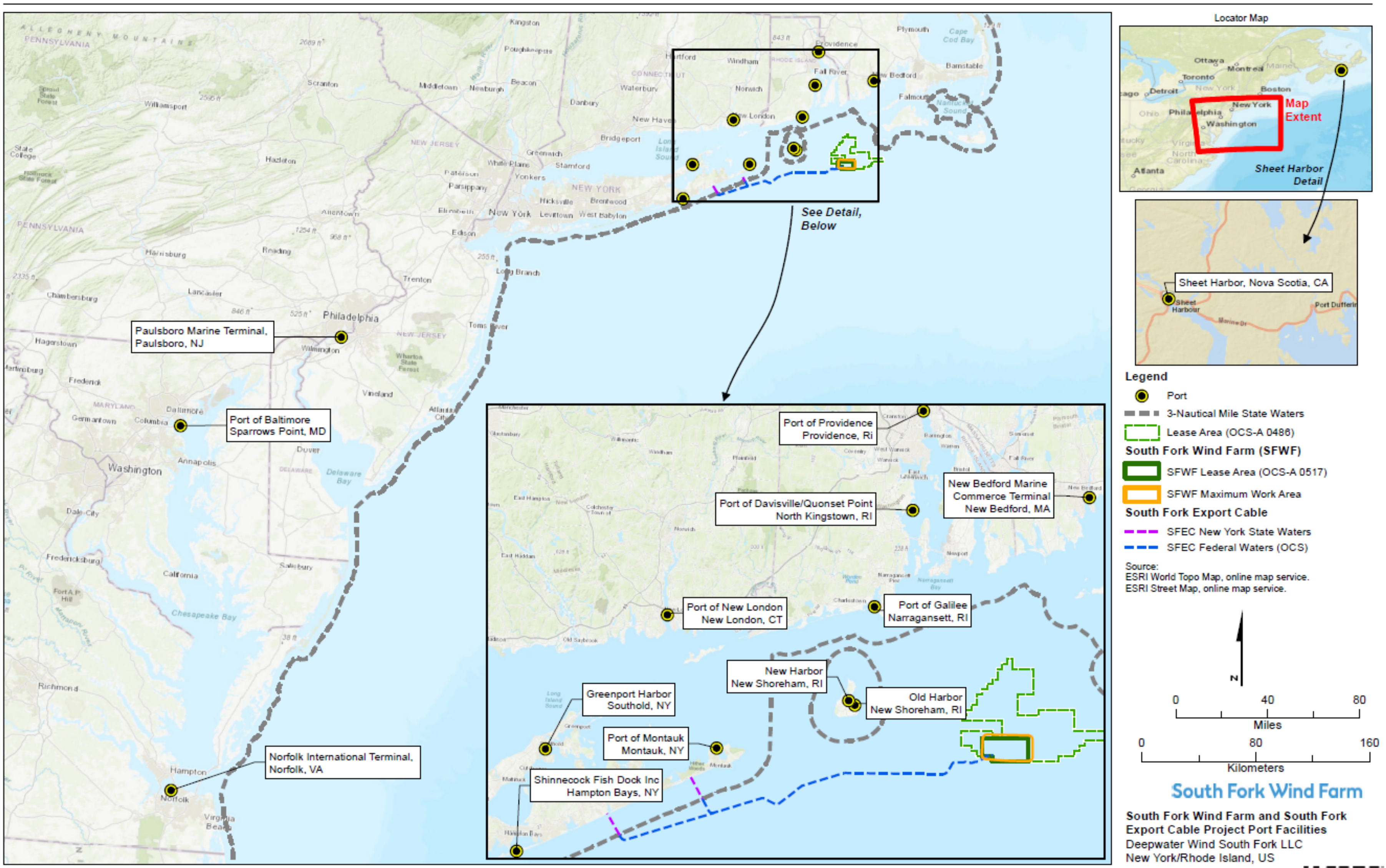

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Figure 3.1-5 Locations of Project Port Facilities

Anticipated ports that may be utilized during construction, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

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Vessels and Vehicles

All vessels associated with the Project (foreign and domestic) will comply with United States Coast Guard requirements. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability. The vessel types that are anticipated to support installation of the SFWF, as well as types of onshore vehicles that will be used at ports, are described in Table 3.1-6.

The large vessels anticipated to support most offshore installation activities will have accommodation units that provide board and lodging for crew, construction managers, inspectors, and other personnel (e.g., CVA). Occasional crew changes will be provided by crew transport vessels or when vessels return to port for provisioning or material transport.

Project vessels could employ a variety of anchoring systems, which include a range of size, weight, mooring systems, and penetration depth. Table 3.1-7 provides additional details about the maximum seabed disturbance for these systems.

Material Transportation

The WTGs and other components will be transported to the onshore staging facilities (as described in Table 3.1-5) prior to installation. During installation, transportation barges and material barges will transport components and equipment to the Lease Area. Vessels not transporting material from local ports may travel with components and equipment directly to the Lease Area from locations such as the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports. Before arriving at the SFWF, a local port call for inspections, crew transfers and bunkering can occur.

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Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC- Onshore
OFFSHORE VESSELS									
Heavy Lift Crane Vessel	Vessel for installation of foundations and substation (0 to 10 knots)	❍		☐					
Derrick Barge Crane Vessel	Vessel for installation of foundations and substation (0 to 10 knots)	❍		☐					
Jack-up Installation Vessel	Vessel for installation of foundations, WTG, and substation (0 to 10 knots)	❍		☐					
Jack-up Material Feeder Barge[a]	Vessel to transport materials to installation vessels (0 to 10 knots)	❍	❍	☐	☐	❍		☐	
Floating Material Barge	Barge transport materials to installation vessels (0 to 7 knots)	❍	❍	☐	☐	❍		☐	
Jack-up Crane Work Vessel	Vessel to complete misc. work (e.g., cable mattressing) (0 to 4 knots)	❍	❍	☐		❍		☐	
Floating Crane Work Vessel	Flat-topped materials transportation barge (0 to 4 knots)	❍	❍	☐		❍		☐	

Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC- Onshore
Towing Tug	Towing tug for transportation barge or cable seafloor preparation support (0 to 10 knots)	○	○	□	□	○	○	□	
Anchor Handling Tug	Towing tug for positioning anchors (0 to 11 knots)	○	○	□	□	○	○	□	
Rock Dumping/Fallpipe Vessel (FPV) [b]	Vessel used to place rock on seabed in vicinity of foundations (0 to 6.5 knots)	○							
Fuel Bunkering Vessel	Bunker vessel for refueling vessels offshore during installation (10 knots)	○	○	□	□	○	○	□	
Cable Laying Vessel	Vessel used for transporting and installing cable (12.4 knots during transit, up to 2 miles per day during installation)		○		□	○		□	
Crew Transport Vessel	For transport of crew and/or supplies to/from worksite (25 knots)	○	○	■	■	○		■	

Table 3.1-6. Project Vessels and Vehicles

Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC- Onshore
Support Vessel/Inflatable Boat	For transport of environmental observers (25 knots)	❍	❍	■	■	❍		■	
Cable Installation Equipment	Equipment for installing cable on seafloor		❍		□	❍		□	
ONSHORE VEHICLES									
Crane	For staging activities at ports and for installation and decommissioning of SFEC - Onshore	❍	❍	■		❍	❍	□	□
Front-end Loader		❍	❍	■		❍	❍	□	□
Heavy-duty Truck		❍	❍	□		❍	❍	□	□
Pickup Truck		❍		■			❍		□
Self-propelled modular transportation		❍		□			❍		□
Bulldozer		❍					❍		□
Excavator		❍					❍		□
Trencher		❍					❍		□
Dump Truck		❍					❍		□
Bucket Truck							❍		
Telescoping Forklift							❍		

Table 3.1-6. Project Vessels and Vehicles
Vessels, vehicles, and associated activities planned for use during installation, operations, and decommissioning of South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Vessel/Vehicle Activity (Average Speed Range of Vessel)	SFWF				SFEC			
		Installation and Decommissioning		Operations		Installation and Decommissioning		Operations	
		Monopile Foundations, WTG, OSS	Inter-Array Cable	Monopile Foundations, WTG, OSS	Inter-Array Cable	SFEC - Offshore	SFEC - Onshore	SFEC - Offshore	SFEC- Onshore
HDD Boring Machine	For installation of sea-to-shore transition						❍		■
Helicopter	For emergency transport	❍	❍	☐	☐	❍	❍	☐	☐

Key

❍ Installation

■ Operations - Planned Maintenance

☐ Operations - Unplanned Maintenance

Notes:

[a] A jack-up crane barge would be used for transportation of WTGs, but not for foundations or the OSS.

[b] A rock dumping or FPV would be used for placement of scour protection for monopile foundations, but not for installation of WTGs or the OSS.

Table 3.1-7. Seabed Disturbance from Vessels
Maximum seabed disturbance from activities during installation of the South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Maximum Area of Seabed Disturbance (total acres/ ha per foundation)	Maximum Area of Seabed Disturbance (ft²/ m² per activity)	Description of Bottom-Disturbing Activity and Maximum Seabed Disturbance	Maximum Depth of Penetration (feet [m])
Bottom-disturbing activity during Typical Installation of Foundations				
Derrick Barge Crane Vessel (anchor)	9.02 (3.7)	392,698 (36,482)	8-point 12-ton delta flipper anchor spread, used 2 times at each foundation, with disturbance of 196,349 ft²	15 (4.6)
Jack-up Installation Vessel (spud can)	0.62 (0.25)	27,000 (2,508)	Spud cans, up to 4 per vessel, used 4 times at each foundation, with disturbance of 6,750 ft²	9 (2.7)
Jack-up Material Feeder Barge (spud can) [a]	0.93 (0.38)	40,500 (3,763)	Spud cans, up to 4 per vessel, used 6 times at each foundation, with disturbance of 6,750 ft²	9 (2.7)
Floating Material Barge (anchor)	27.05 (11)	1,178,094 (109,449)	8-point 12-ton delta flipper anchor spread, used 6 times at each foundation, with disturbance of 196,349 ft²	15 (4.6)
Jack-up Crane Work Vessel (spud can)	0.15 (0.06)	6,750 (627)	Spud cans, up to 4 per vessel, used 1 time at each foundation, with disturbance of 6,750 ft²	9 (2.7)
Floating Crane Work Vessel (anchor)	13.52 (5.47)	589,047 (54,724)	Anchor only used if issue with dynamic positioning (DP) system; 8-point 12-ton delta flipper anchor spread, used 3 times at each foundation, with disturbance of 196,349 ft²	15 (4.6)
Bottom-disturbing activity only in emergency use or if issue with DP system				
Towing Tug			Anchor only used if issue with DP system, would be 12-ton delta flippers, with disturbance of 196,349 ft²	15 (4.6)
Anchor Handling Tug			Anchor only used if issue with DP system, would be 12-ton delta flippers, with disturbance of 196,349 ft²	15 (4.6)
Rock Dumping/Fallpipe Vessel [b]			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft²	15 (4.6)

Table 3.1-7. Seabed Disturbance from Vessels

Maximum seabed disturbance from activities during installation of the South Fork Wind Farm and South Fork Export Cable.

Vessel/Vehicle	Maximum Area of Seabed Disturbance (total acres/ ha per foundation)	Maximum Area of Seabed Disturbance (ft^2/ m^2 per activity)	Description of Bottom-Disturbing Activity and Maximum Seabed Disturbance	Maximum Depth of Penetration (feet [m])
Fuel Bunkering Vessel			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft2	15 (4.6)
Cable Laying Vessel			Anchor only used if issue with DP system, would be 12-ton delta flipper, with disturbance of 196,349 ft2	15 (4.6)
Heavy Lift Crane Vessel (DP)			2-point anchor for emergency use only if issue with DP system	15 (4.6)
Crew Transport Vessel			1-point anchor for stationing on site, 5-ton delta flipper	5 (1.5)
Support Vessel/Inflatable Boat			1-point anchor for stationing on site, 5-ton delta flipper	5 (1.5)

Notes:

[a] A jack-up crane barge would be used for transportation of WTGs, but not for foundations or the OSS.

[b] A rock dumping or FPV would be used for placement of scour protection for monopile foundations, but not for installation of WTGs or the OSS.

3.1.3.2 Foundation Installation

The general installation sequence includes the following steps:

1. Prepare sea floor, if necessary.
2. Install foundation, including pile driving.
3. Commission platform which includes installation of marking and lighting for Private Aid to Navigation required by the USCG.
4. Complete quality control checks and inspection in accordance with the FIR.

The installation process is described in further detail below. Table 3.1-8 summarizes various installation parameters for the pile driving and Appendix G includes conceptual drawings that depict the installation sequence.

Table 3.1-8. South Fork Wind Farm Parameters: Foundation Installation
Anticipated parameters for installation of foundations.

Foundation Installation Parameter	Design Specification
Pile hammer size (kilojoules)	4,000
Power pack capacity for pile hammer (kilowatts [kW])	6,000
Maximum penetration depth into seabed (feet [m])	164 (50)
Duration of pile driving (hours/foundation)	2-4 hours
Duration of installation (days/foundation)	2-4 days

To allow for site-specific micro-siting, each foundation will be installed within a 1,000-foot (152 m) diameter circle (as shown on Figure 3.1-1 and in the location plat in Appendix F).[5] Seafloor preparation associated with foundation installation, including boulder relocation and anchoring/mooring, will occur within a 1,312-foot (400 m) diameter circle from the location where the monopile will be installed. The seabed disturbance associated with the foundation installation is included in Tables 3.1-1 and 3.1-2.

Although the likelihood of munitions and explosives of concern / unexploded ordnance (MEC/UXO) encounter is very low, prior to seafloor preparation, cable routing, and micrositing of all assets, the Project will implement a MEC/UXO Risk Assessment with Risk Mitigation Strategy (RARMS) designed to evaluate and reduce risk in accordance with the As Low As Reasonably Practicable (ALARP) risk mitigation principle. The RARMS consists of a phased process beginning with a Desktop Study and Risk Assessment that identifies potential sources of MEC/UXO hazard based on charted MEC/UXO locations and historical activities, assesses the baseline (pre-mitigation) risk that MEC/UXO pose to the Project, and recommends a strategy to mitigate that risk to ALARP.

Avoidance is the preferred approach for MEC/UXO mitigation; however, it is anticipated that there may be instances where confirmed MEC/UXO avoidance is not possible due to layout restrictions, presence of archaeological resources, or other factors that preclude micrositing. In such situations, confirmed MEC/UXO may be removed through physical relocation to another suitable location on the seabed within the APE or previous designated disposal areas for wet storage using a "Lift and Shift" operation. Selection of a mitigation strategy will depend on the location, size, and condition of the confirmed MEC/UXO, and will be made in consultation with a MEC/UXO specialist and in coordination with the appropriate agencies. Safety measures such as

[5] In accordance with 30 CFR § 585.634(c)(6), micro-siting of foundations will occur within a 500-foot (152 m) radius around locations identified in the indicative layout scenario, which is equivalent to a 1,000-foot (305 m) diameter circle.

the use of guard vessels, enforcement of safety zones, and others will be identified in consultation with a UXO/MEC specialist and the appropriate agencies and implemented as directed.

During Project construction, once the ALARP standard has been achieved, the likelihood of MEC/UXO encounter is very low. SFW will work with BOEM to identify appropriate response actions, which may include developing an emergency response plan, conducting MEC/UXO-specific safety briefings, or retaining an on-call MEC/UXO consultant.

Prior to commencing installation activities, geophysical surveys may be conducted near each foundation location and the seabed will be checked for debris and levelness within a 200-foot (61-m) diameter circle from the location where the monopile will be installed. As necessary, significant debris, such as large boulders, will be moved outside this area (as described for the Inter-Array Cable in Section 3.1.3.3). Prior to monopile installation, a filter layer of engineered rock will be placed on the seabed by an FPV or rock-dumping vessel.

The foundations will be installed from a jack-up lift barge or derrick barge moored to the seabed or kept in position by the vessel's DP system. The hydraulic pile driving hammer and crane used for lifting foundations and piles will be located on the installation barge. Jack-up vessels use metal legs with spud cans attached to the bottom to lift the work vessel out of the water. Once the vessel has completed its task, the vessel lowers back down to the water and lifts the spud cans off the sea floor and moves to the next work location. If a derrick barge is used as the installation vessel, it will be anchored at the location of the foundation. Once the vessel has completed its task, the vessel lifts its anchors and moves to the next work location. Alternatively, the derrick barge uses a DP system to maintain position instead of anchors. Material barges will be used to transport the foundations to the installation site. Appendix G depicts a typical installation sequence, using a jack-up lift barge, and Tables 3.1-2 and 3.1-8 include relevant dimensional parameters.

Each monopile will be lifted from the material barge, placed onto the seabed, leveled, and made ready for pile driving. Each monopile will then be driven to its final penetration target depth using a hydraulic hammer. Once the monopile is installed to the target depth, a transition section will be bolted to the top of the monopile to complete the installation. A transition piece may include boat landing and access ladders. Alternatively, a "one-piece monopile" (also known as a "transition piece-less monopile") may be used, in which secondary steel components may be installed instead of a transition piece, potentially including an anode cage, internal and external platforms, and boat landing.

Assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances, each monopile will require approximately 2 to 4 days for installation. Duration of pile driving is anticipated to be approximately 2 to 4 hours per pile.

Monopiles may require scour protection because of the diameter of the foundation. Scour protection will consist of engineered rock that will be placed around the base of each monopile in a 225-foot (68 m) diameter circle using either an FPV or a stone dumping vessel. The specific parameters for the diameter, volume, and area of scour protection are depicted in Table 3.1-2. A scour analysis will be completed as part of the FDR to refine these assumptions.

3.1.3.3 Inter-Array Cable Installation

The general installation sequence for the Inter-array Cable includes the following steps:

1. Prepare sea floor.
2. Conduct cable installation trials.
3. Install cable.
4. Install secondary cable protection.

The installation process is described in further detail below.

Geophysical surveys may be conducted throughout installation, potentially including multibeam echosounder (MBES), side scan sonar, sub-bottom profiler or imager, cable tracking equipment, and/or visual surveys. As described in Section 3.1.3.2, the Project will implement a MEC/UXO RARMS.

Boulders may be relocated within sections of the corridor for the cable route. Boulder relocation will occur within 65 feet (20 m) on each side of the cable centerline. Boulder relocation will typically be completed by a towing tug, with a towed plow generally forming an extended "V" shaped configuration that forces boulders to the extremities of the plow and establishes a clear centerline for the cable installation equipment. Boulder relocation may require multiple passes. Where appropriate, a boulder grab tool deployed from a DP vessel may also be used to relocate isolated or individual boulders. The temporary seabed disturbance from boulder relocation is included in Tables 3.1-1 and 3.1-4.

Prior to boulder relocation, trials are anticipated to occur within the cable corridor to test the equipment is working properly and is appropriate for the seabed conditions. Each trial would include the deployment and towing of boulder clearing equipment and/or use of boulder grab tool along portions of the inter-array cable route, and each trial would be approximately 0.62 mile (1 km, 0.53 nm). It is anticipated that approximately 5 to 10 trials may be necessary in different areas. The trials may also include pre- and post-trial geophysical survey work potentially utilizing MBES, side-scan sonar, sub-bottom profiler or imager, cable tracking, and/or visual surveys. The temporary seabed disturbance from these trials is included in Table 3.1-4.

Prior to cable installation, trials may occur within the cable corridor to test that the installation equipment is working properly and is appropriate for the seabed conditions. Each trial includes operating the installation equipment within a portion of the corridor, offset from the centerline, and may also include installing a portion of cable. It is anticipated that approximately 5 to 10 trials may be necessary to test the various pieces of equipment. The trial cable would be recovered towards the end of the cable installation process. The trials may also include pre- and post-trial geophysical survey work, as described above. The temporary seabed disturbance from cable installation trials is included in Table 3.1-4.

In addition, a pre-lay grapnel run (PLGR) will be conducted. The purpose of the PLGR run is to remove possible obstructions and debris, such as abandoned fishing nets, wires and hawsers, from along the cable route.

The Inter-array Cable is expected to be buried using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, each of which is further described below. The burial method is dependent on suitable seabed conditions and sediments along the cable route.

The maximum temporary seabed disturbance from cable installation equipment is included in Tables 3.1-1 and 3.1-4.

- Mechanical Cutter: This technique involves either a cutting wheel or an excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor.
- Mechanical Plow: This technique involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share. Mechanical plowing is suited to a range of soil conditions except for very soft soils, hard soils and rock. Backfill of the trench is expected shortly after installation due to collapse of the trench walls and/or by natural infill.
- Jet-Plow: This technique involves the use of water jets to fluidize the soil temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor. Typical types of jet-plows

include towed jet sleds, tracked jet-trencher, or vertical injectors. Backfill of the trench is expected shortly after installation due to settlement of fluidized sediments and/or trench collapse. Immediately after installation a trench will likely be visible on the seabed as well as tracks/skids from the installation equipment; however, over time this will backfill to the original seabed level.

Cable lay and burial will be carried out until it reaches a distance of approximately 300 feet (91 m) from each foundation, where the cable will be laid out, cut, and a pulling head will be put on the cable end to allow the cable to be pulled into the foundation. The surface-laid cable will be post-buried, and secondary protection, such as rock bags, concrete mattresses, or rock berms may be required to stabilize the cable. Scour protection will be also be installed, either before or after the Inter-array Cable has been installed.

The most effective method of protecting a submarine cable from damage caused by external forces is to bury the cable under the seabed. The target burial depth of the cable is 4 to 6 feet (1.2 to 1.8 m). Remedial burial activities and/or secondary cable protection may occur to avoid risk of interaction with external hazards where sufficient burial depth cannot be achieved. Remedial burial may be conducted with a jet-plow or controlled flow excavator. A controlled flow excavator is a non-contact methodology with a jetting tool that draws in seawater from the sides and jets the water from a vertical down pipe at a specified pressure and volume. The down pipe is positioned over the cable alignment, enabling the stream of water to fluidize the sands around the cable, which allows the cable to settle into the trench under its own weight. Secondary cable protection may also be employed, such as articulated concrete mattresses, fronded mattresses, rock bags, or rock placement.

A cable monitoring and maintenance plan will be developed, and an as-built survey will be conducted, both of which will be reviewed by the CVA, to confirm the cable burial depth along the route and identify the need for any further remedial burial activities and/or secondary cable protection.

3.1.3.4 Wind Turbine Generator Installation

After installation of the foundation and the pull-in of the Inter-array Cable (i.e., feeding the cable into each foundation), the WTGs will either be transported from the onshore staging facility by barge to the offshore installation site adjacent to the installation jack-up lift barge, or some WTG components may be transported to the SFWF aboard the installation vessel. In some locations, vessels may use moorings in temporary staging areas adjacent to the installation site. If a U.S.-flagged jack-up lift vessel is available, the WTG components may be loaded directly onto this vessel at the staging port for offshore installation. The WTG installation process is depicted in Appendix G.

After transportation to the SFWF, the WTGs will be installed in accordance with the following general sequence (Figure 3.1-6).

1. The jack-up vessel will be located next to each foundation and will individually lift each WTG component in accordance with the final installation strategy that will be described in the FIR. The towers for the WTGs will be installed in sections with the lower tower section lifted first followed by the other tower sections. Alternatively, the complete tower could be installed in one piece.
2. The nacelle will be lifted and connected to the tower, followed by installation of each blade to the hub. Pending final engineering and vessel availability, some tower sections (potentially including the full tower), and the full rotor (potentially including the hub and three blades) might be pre-assembled onshore.
3. Once the components are installed, workers will finalize securing each WTG component.

Installation of each WTG will require up to 3 days to complete, assuming a 24-hour work window and no delays due to weather, sea conditions, or other circumstances.

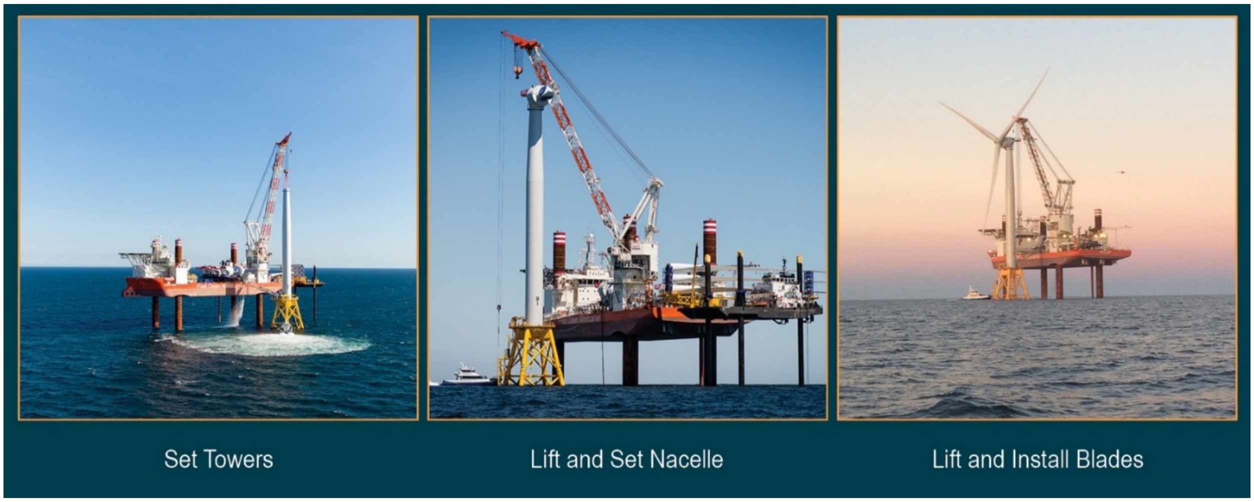

Figure 3.1-6. South Fork Wind Farm Wind Turbine Generator Installation
Photographs depicting the wind turbine generator installation sequence from the Block Island Wind Farm.

3.1.3.5 Offshore Substation Installation

The general installation process for the OSS will be very similar to the WTG installation process. The substation will be placed on the same foundation as a WTG or a similar foundation as the WTGs. The substation will be brought to the foundation on a transportation barge and lifted into place by a jack-up lift barge or a derrick barge.

3.1.4 Commissioning

During commissioning, a variety of electrical and mechanical work and quality testing will occur. Commissioning requires technicians to frequently travel to each WTG and the OSS. Technicians will be transported to and from the SFWF by a CTV.

A typical commissioning process includes the following steps:

- Onshore at the port: tower electrical and mechanical tests, checks, and quality controls to validate functionality of components installed in the tower and in the nacelle, and of the interface between components in tower and nacelle
- Offshore cold commissioning: electrical and mechanical tests, checks, and quality controls to validate mechanical and electrical integrity of the complete WTG prior to energizing
- Offshore hot commissioning: final electrical tests, checks, and quality controls to validate systems interactions, while the WTG is energized but not generating
- Reliability testing: operational test of each WTG in normal conditions, including electrical and mechanical tests, checks, and quality controls to validate reliability and systems interaction

3.1.5 Operations and Maintenance

SFW will be responsible for the O&M of the SFWF. The SFWF will operate in accordance with the approved COP, and other applicable approvals and permits. The SFWF will operate at maximum capacity while complying with all electric grid requirements from LIPA and New York Independent System Operator (NYISO). The SFWF will be monitored 24 hours a day, 365 days a year from a remote facility. Any issues that cannot be fixed remotely will be addressed locally by trained technicians.

The SFWF O&M Facility, which will be staffed by project technicians, will include storage for an appropriate number of spare parts.

3.1.5.1 Vessel and Vehicle Mobilization and Material Transportation

During operations, vessels for SFWF maintenance activities will typically be mobilized from one of the identified ports, as described in Table 3.1-5. The anticipated vessels and support vehicles that will be used during operations are described in Section 3.1.3.1 and Table 3.1-6.

In the case of unplanned maintenance, vessels may travel directly to the SFWF from locations that will be determined based on the type of maintenance that is required and vessel availability. These vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports.

3.1.5.2 Foundations

During operations, the primary activity related to foundations will be inspections and any resulting maintenance.

A foundation inspection program will be developed during the FDR phase so that nodes/critical components of the foundations are inspected within a 5-year timeframe. Underwater inspection will include visuals and eddy currents tests conducted by divers or remotely operated vehicles. Any observed damage or cracks would be analyzed further and repaired if required.

3.1.5.3 Wind Turbine Generators

Personnel conducting O&M activities will access the SFWF on an as-needed basis with no personnel living offshore. The WTGs are remotely monitored and controlled by the SCADA system. The SCADA system connects the WTGs to the OSS and the OSS to the SFEC - Interconnection Facility with fiber optic cables that will be embedded in the inter-array and export cables. Each WTG will have a wind speed and wind direction measuring device, such as a mechanical anemometer and windvane or other devices able to make such measurements. The SCADA system will provide a live feed of the measured wind speeds within the SFWF, as well as mechanical and electrical status of each WTG. The WTG activation/de-activation and output setpoints will normally be implemented through the fiber optic network that will be housed, in part, within the OSS and the SFEC - Interconnection Facility. This system will store real-time and historical data on performance and environmental conditions and provide a link to appropriate entities to monitor and control the SFWF.

The WTGs are equipped with safety devices to ensure safe operation during their lifetime. These safety devices may vary depending on the WTG selected and will be reviewed by the CVA during the FDR and the FIR phases. They may include, but are not limited to, vibration protection, over-speed protection, and aerodynamic and mechanical braking systems, as well as electrical protection devices.

The WTGs will be maintained in accordance with a dedicated service and maintenance plan, developed by the WTG vendor before the start of operations. It is anticipated that each WTG will require approximately 1 week of planned maintenance and approximately 1 week of unplanned maintenance per year. Planned maintenance will be scheduled during low-wind periods of the year. For the SFWF, this is expected to be during the summer. Unplanned maintenance will occur to address issues that cannot be resolved remotely.

For planned maintenance activities, personnel access will be provided using CTVs (Figure 3.1-7). Unscheduled maintenance, including major repairs, may require the use of jack-up or crane barges if repairs to equipment such as power transformers, reactors, or switchgear are necessary. Helicopters may be used for emergency transport, and/or limited maintenance activities. Temporary diesel generators, with secondary containment, may be used during repairs.

3.1.5.4 Inter-Array Cable

The Inter-array Cable has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated from damage because of outside influences, such as boat anchors. The armoring of the Inter-array Cable and the burial of the Inter-array Cable to target depth will minimize the risk of damage to the cable system. An O&M phase cable monitoring and maintenance plan will be developed by SFW as part of the FDR and reviewed by the CVA.

Figure 3.1-7. Crew Transfer Vessel
Photograph depicting an example CTV from the Block Island Wind Farm.

3.1.5.5 Offshore Substation

The OSS will be monitored and controlled remotely through the SCADA system. The OSS is equipped with devices to ensure safe operation. These safety devices may vary depending on the substation selected and will be reviewed by the CVA as part of the FDR and FIR. They may include, but are not limited to, smoke detection, arc flash and safety signage, and fire suppression. During emergency events in which the power connection may be lost, a utility generator will operate to keep essential systems functional. Unplanned maintenance, which can include major repairs to heavy components like the main transformer, may require the use of jack-up or crane barges. Helicopters may be used for emergency transport and/or limited maintenance activities.

3.1.6 Conceptual Decommissioning

SFW will decommission the SFWF in accordance with 30 CFR § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

The WTG components and OSS will be disconnected and likely be removed using a jack-up lift vessel or a derrick barge. A material barge will then likely transport the components to a recycling yard where the components will be disassembled and prepared for re-use and/or recycling for scrap metal and other materials. The foundations will be cut by an internal abrasive water jet cutting tool at 15 feet (4.6 m) below the seabed in accordance with 30 CFR § 585.910 and returned to shore for recycling in the same manner described for the WTG components and

OSS. The Inter-array Cables will be decommissioned in accordance with the approved decommissioning plan. The decommissioning application will include a plan to clear the area after the SFWF facilities have been decommissioned to ensure that no unauthorized debris remains on the seabed.

3.2 South Fork Export Cable

3.2.1 Project Location

The SFEC will be located offshore, in both federal waters and New York State territorial waters, and onshore in East Hampton, New York. As shown on Figure 1.1-2, the SFEC - Offshore extends westward through federal waters from the OSS, passes south of Block Island, and crosses into New York State territorial waters 3 nm (5.6 km, 3.5 m) offshore. SFW is considering two landing sites for the SFEC in East Hampton - Beach Lane and Hither Hills. As shown on Figure 1.1-3, the SFEC - Onshore extends from the landing site to the SFEC - Interconnection Facility in East Hampton.

Water depths, in the areas where the SFEC is proposed, range from 0 feet (0 m) in New York State waters to approximately 158 feet (48.2 m) in federal waters. The SFEC will have a target burial depth of 4 to 6 feet (1.2 to 1.8 m) in the seabed.

Construction staging for the SFEC - Offshore will be as described for the SFWF, using ports in New York, Rhode Island, Massachusetts, or Connecticut. Construction staging for the SFEC - Onshore will be located in East Hampton, New York.

3.2.2 South Fork Export Cable Facilities

The SFEC will be a 138 kV AC electric cable that will connect the SFWF to the existing mainland electric grid on Long Island.

Table 3.2-1 summarizes the approximate distances for the following segments of the SFEC:

- **SFEC - Offshore**: A submarine export cable (138 kV), buried beneath the seabed, including the SFEC - OCS and the SFEC - NYS:
  - **SFEC - OCS:** the submarine segment of the export cable, buried beneath the seabed, within federal waters on the OCS from the OSS to the boundary of New York State territorial waters.
  - **SFEC - NYS:** the submarine segment of the export cable, buried beneath the seabed, within state territorial waters, from the boundary of the OCS to a sea-to-shore transition vault located in the Town of East Hampton on Long Island, Suffolk County, New York. The SFEC - NYS includes the sea-to-shore transition.
- **SFEC - Onshore**: the terrestrial underground segment of the export cable (138 kV), buried beneath public roads and along the Long Island Railroad (LIRR) ROW, from the sea-to-shore transition to a new interconnection facility (SFEC - Interconnection Facility) where the SFEC will interconnect with the LIPA electric transmission and distribution system at the existing East Hampton substation in the town of East Hampton on Long Island, Suffolk County, New York.

Table 3.2-1. Summary of South Fork Export Cable Segments
Approximate distances for each segment of South Fork Export Cable.

SFEC Section	Beach Lane	Hither Hills
SFEC - Offshore	62 miles (99.9 km, 53.9 nm)	49.9 miles (80.4 km, 43.4 nm)
SFEC - OCS	58.3 miles (93.9 km, 50.7 nm)	46 miles (74.6 km, 40.0 nm)
SFEC - NYS [a]	3.7 miles (6.0 km, 3.2 nm)	3.5 miles (5.6 km, 3.1 nm)
SFEC - Onshore	4.1 miles (6.6 km)	11.5 miles (18.5 km)
TOTAL	66.1 miles (106.5 km)	61.4 miles (98.9 km)

Note:

[a] The SFEC - NYS includes the sea-to-shore transition, which includes approximately 860 feet (0.26 km, 0.1 nm) on land.

Each of the SFEC segments are described in the following sections, and where consistent, references are incorporated for information previously presented for the SFWF Inter-array Cable. The major characteristics that may vary within the Project Envelope are listed in Table 3.0-1. The temporary and permanent footprints for each component are summarized in Table 3.2-2. The tables in the following sections further describe parameters that may vary.

Table 3.2-2. Footprint of South Fork Export Cable Segments
Maximum temporary and permanent seabed footprint for components of South Fork Export Cable.

Project Component/Activity	Temporary	Permanent
SFEC - OCS submarine cable[a]	555.3 acres (224.7 ha)	7.0 acres (2.9 ha)
SFEC - OCS cable protection[b]	N/A	8.0acres (3.2 ha)
SFEC - NYS submarine cable[a]	18 acres (7.3 ha)	0.4 acres (0.17 ha)
SFEC - NYS cable protection[b]	N/A	0.2 acres (0.08 ha)
SFEC - NYS sediment excavation for sea-to-shore transition [c]	26,500 yd^3 (20,260 m^3)	N/A

Notes:

[a] Conservatively assumes the SFEC has a total permanent diameter of 12 inches (0.3 m), and that temporary seabed disturbance includes seafloor preparation.

[b] Conservatively assumes additional cable protection, consisting of concrete matting, fronded mattresses, rock bags, or rock placement (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to 5 percent of the SFEC - OCS (7.0 acres) and up to 2 percent of the SFEC - NYS (0.2 acres), and for seven locations (0.9 acres) where the SFEC - OCS will cross utility crossings, each of which may need up to 280 linear feet (85.3 m) of concrete matting.

[c] Conservatively assumes that excavation will occur, or a cofferdam, if utilized will enclose an area that is up to 185 feet long by 530 feet wide to a depth of up to 17 feet (56.4 m long by 161.5 m wide to a depth of up to 5.2 m). The footprint for excavation / cofferdam are intended to represent maximum design scenarios. The actual footprints of these acfivities are dependent on the final installation methodology and engineered design but are anticipated to be smaller than the footprints depicted.

m^3 = cubic meter

yd^3 = cubic yard

3.2.2.1 South Fork Export Cable - Offshore (SFEC - OCS and SFEC - NYS)

The SFEC - Offshore will be a buried submarine power cable, comprised of one segment of single three-core conductor and fiber optic cable for communication and control (Figure 3.2-1). The cable is the same in federal waters and New York State territorial waters. The SFEC will carry 138 kV 3-phase HVAC power, and will operate as a bi-directional conduit for power flow.

Figure 3.2-1. South Fork Export Cable Cross Section

Three-dimensional rendering of the typical design of the submarine cable.

The SFEC will be approximately 8 to 12 inches (20 to 30 cm) in diameter, including a continuous three-conductor and fiber optic bundle that will be encased in a water sealed jacket, which is wrapped in either a single or double-steel armor wire. The bundle will be wrapped in a polyester yarn which will likely exhibit bright black and yellow striping for identification and handling. The power conductors will be made of either copper or aluminum alloys with a cross sectional area of less than 1,000 (copper) or 1,500 (aluminum) square millimeters (1.55 [copper] or 2.32 [aluminum] square inches) and insulated with cross-linked polyethylene (XLPE). The export cable does not contain lubricants, liquids, or oils.

The SFEC - Offshore will have a target burial depth of 4 to 6 feet (1.2 to 1.8 m). Secondary cable protection may be applied to avoid risk of interaction with external hazards where sufficient burial depth cannot be achieved. The need for secondary cable protection in specific locations will be based on the the cable burial design documents (e.g., Cable Burial Risk Assessment) to be completed during the FDR/FIR. Based on the assumption that these cable burial design documents will be used to determine the need for secondary cable protection, it is estimated that a maximum of 5 percent of the SFEC – OCS (up to 2.9 linear miles [4.7 km, 2.5 nm], and up to 2 percent of the SFEC – NYS (up to 0.07 mile [0.11 km, 0.06 nm] will require secondary cable protection. The 5 percent estimate for the SFEC – OCS does not include (i) the protection needed at seven identified cable crossings or (ii) other areas where burial may not be permitted due to potential culturally or archeologically sensitive areas.

Appendix F includes a figure depicting areas of the SFEC - OCS most likely to require boulder relocation or secondary cable protection. Appendix G includes a typical cross-section of the export cable, a cross-section of the trench and burial depth for the cable, and a conceptual drawing of cable protection where burial depth may not be achieved. The Site Characterization Report (Appendix H1) includes additional information about the cable burial assessment.

The Project Envelope includes maximum parameters for the offshore segments of the export cable (Table 3.2-3).

Table 3.2-3. South Fork Export Cable Parameters: Outer Continental Shelf and New York State Export Cable

Anticipated parameters for the export cable.

Parameter	OCS	New York State
Cable diameter	8-12 inches (20 - 30.5 cm)	
Target burial depth [a]	4 - 6 feet (1.2 - 1.8 m)	
Maximum trench depth	10 feet (3 m)	
Maximum length of cable	58.3 miles (93.9 km, 50.7 nm)	3.7 miles (6 km, 3.2 nm)
Maximum Permanent Footprint		
Export cable [b]	7.0 acres (2.8 ha)	0.4 acres (0.17 ha)
Cable joints [c]	0.1 acres (.05 ha)	N/A
Secondary cable protection [d]	7.1 acres (2.8 ha) 305,974 ft^2 (28,426 m^2)	0.2 acres (0.08 ha) 7,351 ft^2 (683 m^2)
Cable protection for existing utility crossing [e]	0.9 acres (0.36 ha) 39,200 ft^2 (3642 m^2)	N/A
Total maximum permanent footprint	15.1 acres (6.1 ha)	0.6 acres (0.26 ha)
Temporary Seabed Disturbance (not including permanent footprint)		
Cable installation [f]	198.0 acres (80.1 ha)	18 acres (7.3 ha)
Cable installation trials [g]	9.3 acres (3.75 ha)	N/A
Boulder relocation [g]	357.3 acres (144.4 ha)	N/A
Cable joint installation [g]	4.9 acres (2 ha)	N/A
Total temporary seabed disturbance	555.3 acres (224.7 ha)	18 acres (7.29 ha)

Notes:

[a] Burial depth is measured from the seabed to the top of the cable.

[b] Conservatively assumes the SFEC – OCS has a length of 58.3 miles (93.9 km, 50.7 nm) and the SFEC – NYS has a length of 3.7 miles (6 km, 3.2 nm), and the cable diameter is 12 inches (0.3 m).

[c] Conservatively assumes up to 2 cable joints may be installed for the SFEC – OCS. Each joint has a length of 36 feet (11 m) and a diameter of 3 feet (0.9 m), requires cable protection for 88 feet (27 m), and requires additional cable on each side of the joint for a length of 1312 feet (400 m).

[d] Conservatively assumes secondary cable protection will be needed for up to 5 percent of the SFEC – OCS and up to 2 percent of the SFEC – NYS, where burial depth may be less than 4 feet (1.2 m). Cable protection will consist of concrete mattresses fronded mattresses, rock bags, or rock placement (conservatively assumed to be 8 feet [2.4 m] long by 20 feet [6.1 m] wide).

[e] Conservatively assumes secondary cable protection, consisting of concrete mattress (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to seven existing cable systems, each of which may need up to 5,600 ft^2 (520 m^2) of matting for 280 linear feet (85.3 m).

[f] Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of either i) 25 feet (7.5 m) for 49.6 miles (79.9 km, 43.1 nm) for the SFEC – OCS and up to 3.7 miles (6 km, 3.2 nm) for the SFEC – NYS or ii) 43 feet (13 m) for up to 9 miles (14 km, 7.5 nm) for the SFEC – OCS.

[g] Conservatively assumes additional temporary disturbance for other seafloor preparation and cable installation activities, including installation trials, boulder relocation, and cable joint(s). Up to five installation trials may occur, each of which has a temporary disturbance of 25 feet (7.5 m) wide and 3,280 feet (1,000 m) long. Boulder relocation may occur within 66 feet (20 m) of each side of the cable centerline and will include total disturbance of 131 feet (40 m) wide for up to 50 percent of the total length of the SFEC – OCS; the temporary seabed disturbance includes the width in addition to cable installation (32.5 m for 32.8 km and 27 m for 14 km). Placement of cable joint(s) may include use of controlled flow excavator for up to two joints, each of which has a temporary disturbance of 33 feet (10 m) wide and 3,280 feet (1,000 m) long.

3.2.2.2 South Fork Export Cable - Sea to Shore Transition

The sea-to-shore transition connects the SFEC - NYS to the SFEC - Onshore. The offshore and onshore cables will be spliced together so the cable can be routed to the SFEC - Interconnection Facility by an underground electrical duct bank. The sea-to-shore transition will include a new onshore transition vault, cable installed using HDD under the beach and intertidal water and may also include a temporary cofferdam located offshore beyond the intertidal zone. If conditions require a cofferdam, it will be installed using either sheet pile or gravity cell (as described in Section 3.2.3.4). Figure 3.2-2 provides a conceptual illustration of the sea-to-shore transition; while the illustration is based on a landing site at Beach Lane, the concept would be similar for a landing site at Hither Hills. Figure 3.2-3 shows an approximate aerial view of each landing site and Appendix G3 includes conceptual plans of the sea-to-shore transition for both Beach Lane and Hither Hills.

Beach Lane

The cable will be installed at least 30 feet (9.1 m) below the current profile of the beach.

A new underground transition vault will be placed within the roadway approximately 860 feet (262 m) onshore from the MHWL. The vault will be positioned along the northern side of Beach Lane with a manhole cover at the surface. Pedestrian and vehicle access will be maintained throughout installation.

A temporary cofferdam may be located offshore, approximately 1,750 feet (533 m) from the MHWL. The cofferdam will be sited at a location with approximately 25 to 40 feet (7.6 to 12.2 m) of water depth.

Hither Hills

The cable will be installed at least 30 feet (9.1 m) below the current profile of the beach.

A new underground transition vault will be placed within the pavement approximately 650 feet (198 m) onshore from the MHWL. The vault will be positioned within the northern parking lot adjacent to State Highway 27. Pedestrian and vehicle access will be maintained throughout installation.

A temporary cofferdam may be located approximately offshore, 1,900 feet (579 m) from the transition vault location in the Hither Hills parking lot. The cofferdam will be sited at a location with approximately 40 to 60 feet (12.2 to 18.3 m) of water depth.

Appendix G includes conceptual plan and profile drawings for the HDD installation work area, for the cofferdam installed by gravity cell or by sheet pile, and for the transition vault.

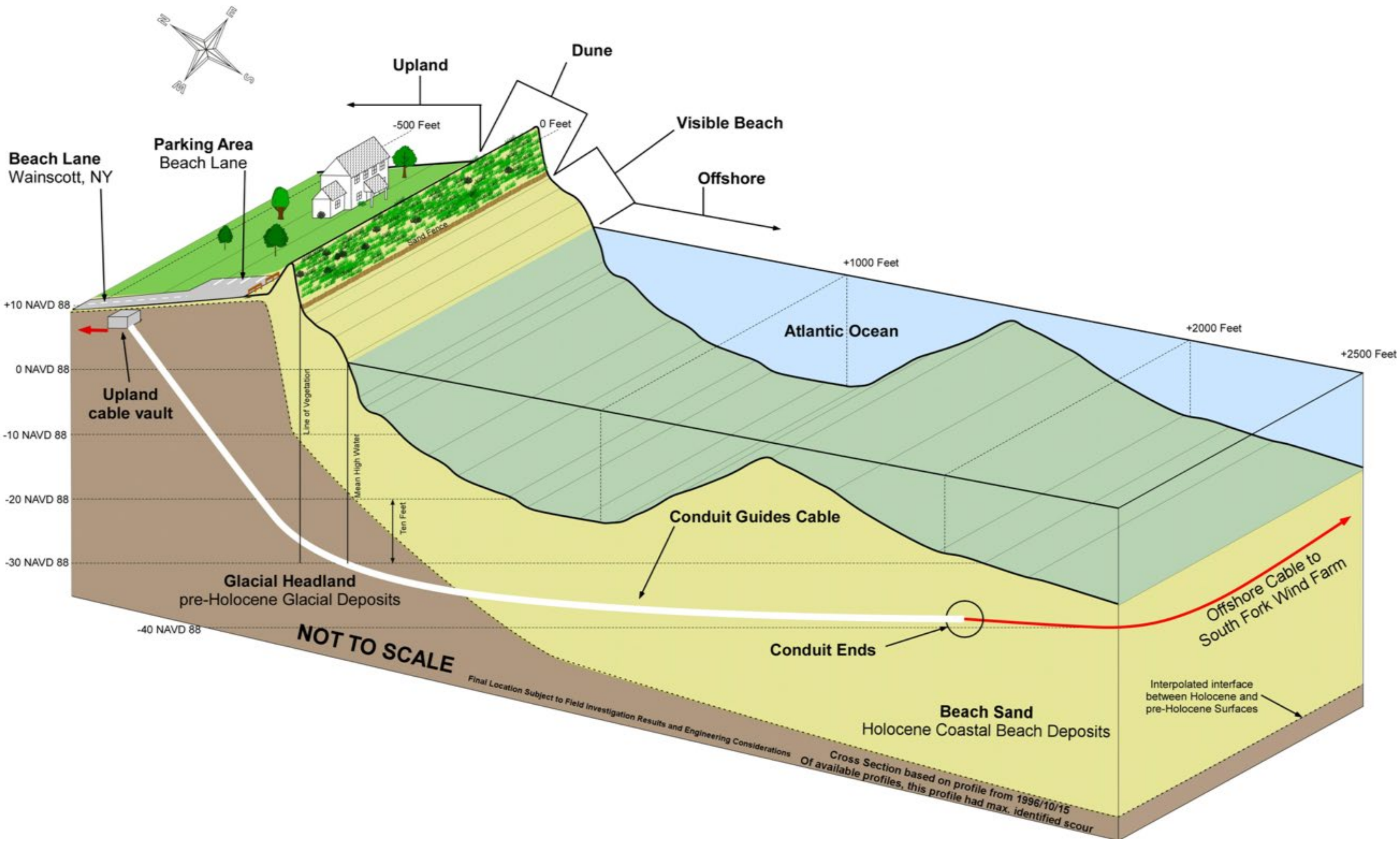

Figure 3.2-2. SFEC - Sea-to-Shore Transition Illustration

Illustration of sea-to-shore transition at the Beach Lane landing site.

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Source: Aerial image © 2018 Google.

Figure 3.2-3. South Fork Export Cable - Landing Sites

Aerial views (approximate) of the two landing site options at Beach Lane, East Hampton and Hither Hills, Montauk.

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3.2.2.3 South Fork Export Cable - Onshore

The SFEC - Onshore begins at the transition vault located onshore at the sea-to-shore transition and ends at the SFEC - Interconnection Facility (Figure 3.2-4). The SFEC - Onshore will be installed within a new underground duct bank. The SFEC - Onshore will be an underground power cable, comprised of three single core cables with a conductor of either copper or aluminum and two separate fiber optic cables, which will provide communication and control. Duct banks will be designed to accommodate up to two circuits. The SFEC - Onshore will carry 138 kV 3-phase HVAC power, and will operate as a bi-directional conduit for power flow.

Each conductor will be approximately 2 to 4 inches (3 to 10 cm) in diameter, including a single-core cable, with compact round, uncoated copper wires. The cable will be insulated with XLPE. The conductors will be sheathed by a semi-conductive insulation screen and wrapped in a high-density polyethylene (HDPE) jacket.

The duct bank will be located underground within public ROWs and alongside the tracks within the LIRR ROW. The SFEC - Onshore will not include any overhead lines. Most of the SFEC - Onshore that is located on public roads will be located within the existing paved section of the ROW. The specific configuration of the duct bank could vary along the route; the maximum width would be 36 inches (91 cm) and the maximum depth would be 40 inches (101 cm).

Appendix G includes a typical cross-section of the underground export cable, as well as typical cross-sections of the cable trench, duct bank, and manhole cable splice vaults.

3.2.2.4 South Fork Export Cable - Interconnection Facility

The SFEC - Interconnection Facility will be newly constructed to connect the SFEC with the existing 69 kV LIPA substation, located off Cove Hollow Road in the town of East Hampton, New York. The SFEC - Interconnection Facility will be located adjacent to the existing LIPA substation (Figure 3.2-2), on the same parcel in the town of East Hampton's Commercial Industrial zoning district.

The footprint of the SFEC - Interconnection Facility will be up to 230 by 336 feet (70.1 by 102.4 m), including the exterior wall, with a maximum equipment height of approximately 43 feet (13.1 m).

The configuration of the SFEC - Interconnection Facility and the interconnection to the East Hampton substation will be developed as part of the NYISO interconnection process and will include all the equipment necessary to safely connect the SFEC with the NYISO transmission system.

Appendix G includes conceptual plan and profile drawings for the interconnection facility.

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Source: Aerial image © 2018 Google. Annotation © 2018 CH2M HILL, Inc.

Figure 3.2-4. South Fork Export Cable - Interconnection Facility Lease Area

Location of South Fork Export Cable - Interconnection Facility adjacent to existing East Hampton Substation.

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3.2.3 Construction

This section describes the construction process of the SFEC based on typical methods, vessels, and equipment.

Before construction begins, SFW will finalize contracts with vendors (including fabrication and installation contractors), develop mobilization plans, and make arrangements at the port facilities to support Project activities, including fabrication, as needed.

3.2.3.1 Ports, Vessels and Vehicles, and Material Transportation

As described for the SFWF, multiple port locations may be utilized (Table 3.1-5, Figure 3.1-8).

The anticipated vessels and vehicles that will be used for construction of the SFEC are described in Table 3.1-6. Vessels that will not be transporting material from local ports may travel directly to the work sites from locations that will be determined prior to construction. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability. A cable lay vessel, similar to what may be used to install the SFEC- Offshore is shown in Figure 3.2-5.

Figure 3.2-5. Cable Lay Vessel
Photograph depicting an example cable lay vessel.

3.2.3.2 South Fork Export Cable - Outer Continental Shelf Waters

The general installation sequence for the export cable includes the following steps:

1. Prepare sea floor.
2. Prepare cable crossings.
3. Conduct cable installation trials.
4. Install cable, including cable joint(s).
5. Install secondary cable protection.

The installation of the SFEC – OCS will follow similar methods as those described in Section 3.1.3.3 for the Inter-array Cable of the SFWF, including geophysical surveys, MEX/UXO mitigation (if needed), PLGR, and boulder relocation. The associated temporary seabed disturbance is included in Table 3.2-3. Geophysical survey work could occur throughout installation, potentially including MBES, side-scan sonar, sub-bottom profiler or imager, cable tracking, and/or visual surveys.

In addition to the cable installation equipment described for the Inter-array Cable, the SFEC – OCS installation may also include use of a displacement plow which mechanically displaces materials from the trench so that the cable can be laid in the trench. The tool is commonly used to target challenging ground conditions (i.e., very hard soils and/or where subsurface boulder risk is high). In addition, the vessel used for cable burial may use a pull-ahead anchor deployed in front of the vessel to assist during cable burial operations.

Additional activities for the installation of the SFEC – OCS will occur and are described below.

Cable installation trials may occur within the cable corridor for the SFEC – OCS to test that the installation equipment is working properly and is appropriate for the seabed conditions. The trial will occur for a maximum length of up to 3,281 feet (1000 m) in up to five sections, at a depth similar to the target burial depth. Each trial includes operating the installation equipment within the corridor, offset from the centerline, and may also include installing a short section of cable. The trial cable would be recovered towards the end of the cable installation process. The trials may also include pre- and post-trial geophysical survey work potentially utilizing MBES, side scan sonar, sub-bottom profiler, or imager, cable tracking equipment, and/or visual surveys. The temporary seabed disturbance from cable installation trials is included in Table 3.2-3.

Due to the length of the SFEC – OCS, up to two offshore cable joints may be installed to splice two sections of the SFEC – OCS cable. The location of the joints will depend on cable installation and manufacturing and will be confirmed during the FDR/FIR and reviewed by the CVA. Prior to cable jointing, a section of the cable end may be temporarily placed on the seabed within the surveyed corridor and fitted with appropriate rigging to enable safe storage and recovery. The cable end will subsequently be recovered to the vessel, jointed to the second section of cable and then the joint and cable are lowered to the seabed and either placed within the trench or post-buried. A controlled flow excavator may be used at this location to either prepare the seabed for cable placement or complete post-burial activities for the cable joint. The seabed disturbance from installation of a cable joint is included in Table 3.2-2.

Cable lay and burial for SFEC – OCS, as described for the Inter-array Cable of the SFWF, will be carried out along the entire route until approximately 300 feet (92 m) of the OSS. Depending on the timing of the OSS installation, the export cable may be temporarily placed on the seabed in the vicinity of the OSS and fitted with appropriate rigging to enable safe storage and recovery. The cable will be temporarily placed for approximately one month and the position of the cable will be recorded. The cable will be attached to the OSS, in the same process as described for connecting the Inter-array Cable to WTG in Section 3.1.3.3.

Scour protection at the foundation for the OSS will also be installed, either before or after the SFEC – OCS has been installed. As described for the Inter-array Cable, the burial method is dependent on suitable seabed conditions and sediments along the SFEC route. Therefore, in areas where seabed conditions might not allow for cable burial, remedial burial may occur using a controlled flow excavator and/or other methods of cable protection may be employed, such as articulated concrete mattresses, fronded mattresses, rock bags, or rock placement.

SFEC – OCS will cross seven existing telecommunications cable systems, some of which are active and others that are inactive, on the seabed. SFW is consulting with these cable owners to implement a mutually agreeable crossing process (Appendix F). This process will be consistent with industry practice and will typically use articulated concrete mattresses. Inactive cable systems may be cut and cleared from the burial route for a short distance on each side. Any cut and cleared cables will typically have the exposed ends weighted with clump weights or short-section chain, in accordance with industry practice, so that the cable cannot be snagged by other seabed users, such as fishermen.

A cable monitoring and maintenance plan will be developed, and an as-built survey will be conducted, both of which will be reviewed by the CVA, to confirm the cable burial depth along the route and identify the need for remedial burial activities and/or secondary cable protection that may be needed.

3.2.3.3 South Fork Export Cable - New York State Territorial Waters

Installation of the SFEC - NYS will follow the same methods described above for the SFEC – OCS, except that cable joint installation is not expected to occur within New York State waters. No other cable systems (e.g., existing cables) along the proposed cable route have been identified within New York State waters.

3.2.3.4 South Fork Export Cable - Sea-to-Shore Transition

Installation of the SFEC - Offshore will start with HDD within the sea-to-shore transition. The installation process will be the same at Beach Lane or Hither Hills, although the specific locations of the transition vault and cofferdam will be different at each site.

The workspace for the HDD and drill entry point will be located at least 650 feet (198 m) onshore from the MHWL at both Beach Lane and Hither Hills. The HDD (as well as the conduit and the cable) will end at least 1,750 feet (533 m) offshore from the MHWL at both Beach Lane and Hither Hills and will be installed under the beach and intertidal zone.

The onshore workspace for the HDD will include a temporary sheetpile anchor wall to provide stability of the HDD rig during drilling activities. The temporary anchor wall is anticipated to be approximately 29.5 feet (9 m) in length and driven to a depth of approximately 19.7 feet (6 m). In addition to the anchor wall, the workspace may also require the installation of other temporary sheetpiles to aid in anchoring of the rig or to provide soil stabilization of the excavated area.

To support HDD activities, temporary casing pipes may be installed at both the HDD entry and exit locations. Several temporary posts will be installed to help support the casing pipe at the HDD exit location. Upon completion of the HDD operation, the posts and casing pipe will be removed from the seafloor.

Before HDD begins, a temporary cofferdam may be installed at the endpoint of the HDD, where the conduit exits from the seabed. Alternatively, the HDD might be installed without a cofferdam. The cofferdam, if installed, serves as containment for the drilling returns during the HDD installation and keeps the excavation free of debris and from silting back in. The cofferdam, if required, may be installed as either a sheet piled structure into the sea floor or a gravity cell structure placed on the sea floor using ballast weight. Installation of the cofferdam and drilling support will be conducted from an offshore work barge anchored near the cofferdam. A 5-point anchor barge may be employed at the cofferdam site to incorporate a second HDD drill spread in a push-pull drilling operation, which would facilitate removal of drill cuttings, insertion of HDPE conduit, and grouting. The location will be clearly marked to indicate to vessels that the cofferdam is present below the water surface, and SFW will coordinate navigational marking and publication of its location with United States Coast Guard.

- *Sheet Pile Installation*. If the cofferdam is installed using sheet pile, a vibratory hammer will be used to drive the sidewalls and endwalls into the seabed. Installation of a sheet pile cofferdam may take approximately up to 3 days. The sidewalls and endwalls will be driven to a depth of approximately 6 feet (1.8 m); sections of the shoreside endwall will be driven to a depth of up to 30 feet to facilitate the HDD entering underneath the endwall. After the sheet piles are installed, the inside of the cofferdam will be excavated to approximately 12 feet (3.7 m). This depth allows access to the HDD pilot hole for installation of the HDPE conduit. Up to 26,500 cubic yards (yd^3; 20,260 cubic meters [m^3]) of material will be excavated from the pilot hole and sidecast during installation to naturally disperse. The cofferdam walls will be cut off at a depth of 4 feet (1.2 m) above the sea floor. The piles will be removed using the vibratory hammer, after

HDD operations and conduit are installed. Metal sheeting will be removed, placed on the work barge, and hauled back to shore.

- *Gravity Cell Installation.* If the cofferdam is installed using a gravity cell, the cell will be lowered onto the seafloor by a crane that is on a work barge. The sidewalls and seaside wall and end wall will be multi skinned to accommodate a rock ballast fill that will stabilize the cofferdam on the seabed. The cofferdam may be of a multi-sectional design to allow transportation and assembly at the site. Assembled interior dimensions of the cofferdam will be similar to a sheet pile cofferdam with similar volumes of excavated material which is sidecast, allowing access to the HDD conduit by the cable trencher. Once the HDD is complete and the conduit installed, the ballast is lifted out of the cofferdam and the un-ballasted cofferdam lifted off the seabed, placed on the work barge, and hauled to back to shore.

For the construction of the HDD a drilling fluid of bentonite-water-based mud or another non-toxic drilling fluid will be used to cool the drill bit, maintain bore hole stability, and control fluid loss during operations. Drilling mud will be injected into the drill pipe onshore using pumps that are located within the HDD workspace. The mud will be jetted through a rotating drill bit attached at the end of the drill pipe. Jetting of the mud will cool the drill bit and suspend drill cuttings within the mud solution. Mud and cuttings will flow back to the surface in the gap between the drill pipe and bore hole, which will stabilize the bore hole. Once the mud flows back to the bore hole entry, it will be collected and reused.

The drill bit will enter the cofferdam under the cofferdam shoreside end wall; sufficient clearance will be allowed in the design to facilitate the pilot hole, drill head, and HDPE conduit. Once the pilot hole has exited in the cofferdam, the hole will be opened to a diameter of approximately 32 inches (81 cm) to install the conduit. When no cofferdam is used, a small construction vessel will monitor the completion of the HDD drilling. This vessel will ensure that no drilling mud will be released.

The conduit, consisting of a thick-walled HDPE pipe with a maximum diameter of 24 inches (61 cm), will be inserted through the entire length of the bore hole through which the submarine cable will be installed. The conduit may be assembled either adjacent to the HDD workspace or offsite. After completion of drilling, the conduit will be capped, either moved across the surface of the beach (if needed) or transported from offsite, and floated to the endpoint of the HDD. The HDD equipment will be used to pull the HDPE pipe through the drill hole to create a stable conduit for bringing the cable ashore.

After installation of the HDPE conduit, a transition vault will be installed onshore around the drill pit. A pull line will be placed inside the finished conduit to facilitate pulling the SFEC through the conduit. After the SFEC is pulled through the conduit, the submarine and fiber optic cables will be spliced to the SFEC - Onshore cable within the transition vault. The transition vault will be sealed, covered, and repaved with manhole covers at the surface.

The temporary cofferdam will be removed after installation of the SFEC - NYS has started. The remaining cofferdam walls will be removed, either by vibratory hammer (for sheet pile cofferdam) or by lifting (for gravity cell cofferdam). The excavated sediments placed in the immediate vicinity of the cofferdam will be allowed to disperse naturally. Cable protection may be placed at the HDD exit point (e.g., one cable mattress).[6]

The onshore work areas have been sized to accommodate an HDD rig, mud pumps, generators, a slurry plant, de-silter, backhoe, boom truck, crane, pickup truck, as well as areas for parking and other equipment and facilities necessary to support installation.

[6] A mattress placed at the HDD exit point is included within the 0.2 acres (0.08 ha) for cable protection along the SFEC – NYS.

Depending on site-specific conditions and other external factors, the HDD installation activities are expected to take 10 to 16 weeks, including equipment mobilization and breakdown. In residential areas, HDD activities will be limited to a typical 12-hour working window, with exceptions for extenuating circumstances and for two specific activities (conduit installation and cable pull-in) that require 24-hour operation for a short period of time. HDD activities will be completed outside the summer season, with active drilling expected to be completed before March 31.

3.2.3.5 South Fork Export Cable - Onshore

The construction for the SFEC - Onshore includes the following activities:

- Site preparation, including minimal vegetation clearing as needed
- Excavation for underground duct bank
- Duct bank installation
- SFEC - Onshore installation and splicing
- HDD, where appropriate, for crossing of infrastructure

The SFEC - Onshore will be installed in an underground duct bank consisting of concrete encased conduits, with cable vaults for installation and maintenance access.

The SFEC - Onshore will be installed within the ROW of the existing roadways or the ROW of the LIRR. Existing pavement, gravel, or dirt will be removed and a trench of up to 4 feet (1.2 m) wide and 8 feet (2.4 m) deep will be excavated. Once each portion of the trench is excavated, the conduit will be assembled and lowered into the trench and the area around the conduit will be filled with concrete. Once the conduit is installed, the trench will be backfilled with compacted soil. Initially, temporary pavement will be applied followed by full pavement of the affected lane or the road as appropriate.

The SFEC - Onshore will be installed following the installation of the duct bank and cable vaults. The SFEC - Onshore will be installed by pulling the cable from manhole to manhole. The SFEC - Onshore will be spliced in each manhole.

3.2.3.6 South Fork Export Cable - Interconnection Facility

The construction for the SFEC - Interconnection Facility includes the following activities:

- Site preparation, excavation, and grading
- Construction of foundations for the control building, transformer, reactors, and switchgear
- Construction of electrical grounding, duct banks, and underground conduits
- Installation of appropriate drainage systems and station service including electrical and water
- Installation of all aboveground structures including transformer, reactors, switchgear, cable systems, and lightning protection.

Any temporary staging areas required during construction, such as laydown areas, temporary equipment storage, and work offices will be located within or adjacent to the location identified on Figure 3.2-4.

3.2.4 Commissioning

Once the SFEC has been installed, SFW will commence commissioning to meet standards for grid interconnection reliability and provide a baseline of the cable characteristics including a baseline time domain reflectometer, and high potential test.

During these steps, commissioning testing will include:

- Visual and function tests of bonding and grounding system

- Continuity tests of conductor and armoring
- Resistance and capacitance tests for insulation and conductors
- Grounding measurements
- Time domain reflectometer for both optical (fiber) and electrical (power) to establish reference baseline performance metrics

3.2.5 Operations and Maintenance

SFW will be responsible for the operation of the SFEC. As described for the SFWF, the SFEC will be monitored 24 hours a day, 365 days a year from a remote facility. The SFEC is not expected to require planned maintenance; however, inspections and tests will be conducted regularly based on manufacturer-recommended schedules; regular monitoring and any repairs will be based on manufacturer-suggested methods. SFW will maintain at least 500 feet (152.4 m) of spare cable and underwater splices to facilitate mechanical cable repair that could become necessary through a fault or mechanical damage event.

Monitoring will include a periodic review of anomalies in cable charging current and power factor, as well as review of protection device operation records.

3.2.5.1 Vessel and Vehicle Mobilization and Material Transportation

As described for the SFWF, during operations, vessels for the SFEC - Offshore maintenance activities will typically be mobilized from one of the identified ports, as described in Table 3.1-5. Onshore personnel vehicles for the SFEC - Onshore maintenance activities will be mobilized from the O&M facility. The vessels and vehicles anticipated to be used during operations are described in Table 3.1-6.

In the case of unplanned maintenance, vessels may travel directly to the work sites from locations to be determined prior to operations. Some of these vessels may originate from the Gulf of Mexico, Atlantic Coast, Europe, or other worldwide ports, depending on charter agreements and vessel availability.

3.2.5.2 South Fork Export Cable - Offshore (OCS and NYS)

The SFEC - Offshore has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated because of damage from outside influences, such as boat anchors. Burial of the cable to the target burial depth will minimize the risk of damage to the cable system. An O&M-phase cable monitoring and maintenance plan will be developed by SFW, included in the FDR, and reviewed by the CVA. Mechanical inspections will include a cable burial assessment and debris field investigation of the SFEC. The mechanical inspection is planned to occur on a 5-year basis or following a storm event that may necessitate an unplanned inspection.

If mechanical damage to the SFEC - Offshore should occur, the cable will fault immediately. SFW will identify the location of the fault, and mobilize a repair barge, which would be equipped with water pumps, jetting devices, hoisting equipment, and other tools typically used in repairs of submarine cables. The cable would be exposed with hand-operated jet tools and cut in the middle of the damaged area. The cable would be raised to the repair barge where the damaged portion of the cable would be cut so that cable splicing can occur. The repaired cable would then be reburied to the appropriate depth by hand-operated jet tools.

3.2.5.3 South Fork Export Cable - Onshore

The SFEC - Onshore has no maintenance needs unless a fault or failure occurs. Cable failures are only anticipated because of damage from outside influences, such as unexpected digs from other parties. If repair is needed, spare cable and splice kits would be used to replace the affected area.

3.2.5.4 South Fork Export Cable - Interconnection Facility

The SFEC - Interconnection Facility will be monitored and controlled remotely through the SCADA system that is linked with fiber optic cables to the SFWF O&M facility. During emergencies in which the power connection may be lost, a utility generator will operate to keep essential systems functional.

Inspections and tests will be conducted regularly based on manufacturer-recommended schedules and repairs will be based on manufacturer-suggested methods.

3.2.6 Conceptual Decommissioning

SFW will decommission the SFEC in accordance with 30 CFR § 585.902 and 30 CFR §§ 585.905 through 585.912. The first step will be submission of a decommissioning application in accordance with 30 CFR § 585.905. Unless otherwise approved in the decommissioning plan, removal of facilities will be completed in accordance with the approved decommissioning plan and will follow the same relative sequence as construction but in reverse.

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Section 4 - Site Characterization and Assessment of Potential Impacts

The site characterization and assessment of potential impacts for the Project is structured in accordance with 30 CFR 585 and the BOEM guidelines on the information requirements for a COP for OCS renewable energy activities on a commercial lease, as required by 30 CFR 585.626(a) and (b). The approach also considers the additional detailed information and certifications, as specified under 30 CFR 585.627, which support BOEM's compliance with NEPA regulations and other applicable laws and regulations.

The approach to site characterization and impact assessment involves the following steps, as illustrated on Figure 4.0-1.

- Identification and Analysis of Impact-producing Factors - Project activities and infrastructure, as described in Section 3, that could impact resources were identified as impact-producing factors (IPFs). Where Project specifications are not available because final design has not been completed, the Project design envelope was considered to include the range of possible impact-producing activities.[7] A summary of Project activities, by phase, are compared to the IPFs considered in this impact assessment as a matrix and shown in Table 4.0-1. The extent of potential impact, resulting from IPFs, was identified and described for each IPF in Section 4.1.
- Characterization of Affected Environment – The environmental setting of the Project, including the footprint of the SFWF and the SFEC within federal and state waters of New York, and within the town of East Hampton, New York, is described for physical, biological, socioeconomic, cultural, and visual resources that have the potential to be impacted by Project activities. The affected environment for each resource includes a regional overview of the resource followed by characterization of the resource relative to the SFWF and the SFEC. The affected environment for each resource is described separately for the SFWF, SFEC - OCS, SFEC - NYS, and SFEC - Onshore.
- Impact Assessment – The impact assessment used in this document approximately follows an assessment of significance as discussed in 40 CFR 1508.27. The impact assessment for the SFWF and SFEC involves the evaluation of potential overlap of the IPF, in time and space, on the affected environment for each resource, during each Project phase, as shown in Table 4.0-1. The type and degree of potential impacts from proposed Project activities varies based on the characteristics of the resource (e.g., presence/absence, conservation status, abundance) and the IPF that may affect each resource. Potential impacts are discussed separately for the SFWF and SFEC.

  Potential impacts are characterized as direct or indirect and whether they result from construction, O&M, and/or decommissioning of the Project. Anticipated impacts are characterized as short-term or long-term and by intensity, as negligible, minor, moderate, or major. The following impact levels are used to provide consistency in the assessment of potential impacts:

  - **Direct or Indirect**: Direct effects are those occurring at the same place and time as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity.
  - **Short-term or Long-term Impacts**: Short- or long-term impacts do not refer to any defined period. In general, short-term impacts are those that occur only for a limited period or only during the time required for construction activities. Impacts that are short-lived, such

[7] SWF has provided supplemental information about the O&M Facility locations – including a characterization of the affected environment and impact assessment – in Appendices BB1 to BB3.

as noise from routine maintenance work during operations, may also be short-term if the activity is short in duration and the impact is restricted to a short, defined period. Long-term impacts are those that are likely to occur on a recurring or permanent basis or impacts from which a resource does not recover quickly. In general, direct impacts associated with construction and decommissioning are considered short-term because they will occur within the no more than 2-year construction phase. Indirect impacts are determined to be either short-term or long-term depending on if resource recovery may take several years. Impacts associated with O&M are considered long-term because they occur over the 25-to-30-year life of the Project.

- **Negligible, Minor, Moderate, or Major Impacts:** Negligible, minor, moderate, or major impacts are relative terms used to characterize the magnitude of an impact.
  - Negligible impacts are generally those impacts that, if perceptible, would not be measurable.
  - Minor impacts are those impacts that, if adverse, would be perceptible but, in context, avoidable with proper mitigation; and, if impacts are measurable, the affected system would be expected to recover completely without mitigation once the impact is eliminated.
  - Moderate impacts are those that, if adverse, would be measurable but would not threaten the viability of the affected system and would be expected to absorb the change or impact if proper mitigation or remedial action is implemented.
  - Major impacts are those impacts that, if adverse, would be measurable but not within the capacity of the affected system to absorb the change, and without major mitigation, could be severe and long lasting.

- Proposed Environmental Protection Measures – For each resource, if measures are proposed to avoid or minimize potential impacts, the impact evaluation included consideration of these environmental protection measures.

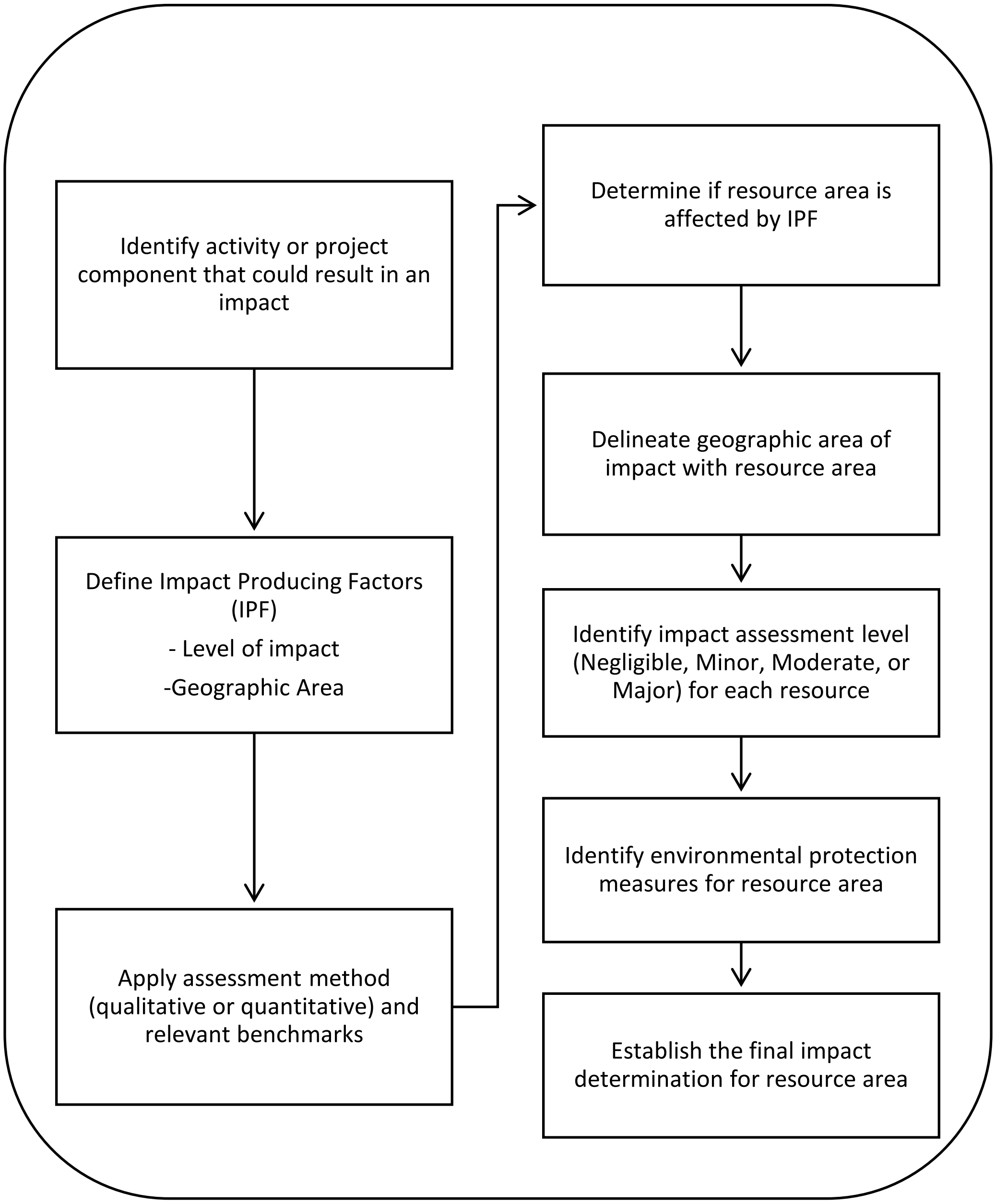

Figure 4.0-1. Illustration of Steps Involved in the Proposed Impact Assessment

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Table 4.0-1. Anticipated Project Activities and Possible Impact-producing Factors during Construction, Operations & Maintenance, and Decommissioning of the South Fork Wind Farm and South Fork Export Cable

SFWF and SFEC Activities	Seafloor/ Land Disturbance	Sediment Suspension/ Deposition	Noise	Electro-magnetic Field	Discharges / Releases	Trash Debris	Traffic	Air Emissions	Visible Structures	Lighting
CONSTRUCTION										
Equipment and Material Transportation										
Vessels	●	●	●		●	●	●	●		●
Port-side Support Activities										
Cranes and heavy equipment	●		●				●	●		
Vehicles	●		●				●	●		
SFWF WTG Installation										
Vessels and heavy equipment	●	●	●		●	●	●	●		●
Seafloor preparation	●	●								
Pile driving (Monopile)	●	●	●							
Placement of scour protection	●	●			●					
SFWF Inter-Array Cable Installation										
Vessels (dynamically positioned / other)	●	●	●		●	●	●	●		●
Seafloor preparation	●	●								
Cable installation equipment	●	●								
SFEC Installation										
Vessels (dynamically positioned and other)	●	●	●		●	●	●	●		●
Seafloor preparation	●	●								
Cable installation equipment	●	●								
SFEC Sea-to-Shore Transition										
Vessels and heavy equipment	●	●	●		●	●	●	●		●
Sheet pile driving (Vibratory hammer)	●	●	●							
Cofferdam excavation	●	●	●		●					
HDD			●		●	●				
Transition vault excavation	●		●							

Table 4.0-1. Anticipated Project Activities and Possible Impact-producing Factors during Construction, Operations & Maintenance, and Decommissioning of the South Fork Wind Farm and South Fork Export Cable

SFWF and SFEC Activities	Seafloor/ Land Disturbance	Sediment Suspension/ Deposition	Noise	Electro-magnetic Field	Discharges / Releases	Trash Debris	Traffic	Air Emissions	Visible Structures	Lighting
Construction vehicles	●		●				●	●		
SFEC Onshore										
Site preparation (clearing, grading)	●		●		●	●		●		
Trenching	●		●		●	●		●		
Vehicles	●		●				●	●		
SFEC - Interconnection Facility										
Site preparation (clearing, grading)	●		●		●	●		●		
Substation construction	●		●		●	●		●	●	
Vehicles	●		●				●	●		
OPERATIONS AND MAINTENANCE										
Material and Personnel Transportation										
Vessels	●	●	●		●	●	●	●		●
Aircraft			●					●		
Vehicles	●		●				●	●		
SFWF WTG Operation			●		●				●	●
SFWF Inter-Array Cable Operation				●						
SFEC Offshore Cable Operation				●						
SFEC Onshore Cable Operation				●						
SFEC Substation Operation			●		●				●	●
DECOMMISSIONING										
Vessels	●	●	●		●	●	●	●		●
SFWF Foundation Removal (Monopile)	●	●	●		●	●				
SFWF WTG Disassembly			●			●				
SFEC Offshore Cable Removal	●	●	●		●	●	●	●		
SFEC Onshore Cable (Abandonment)	●	●								
SFEC Substation (Repurposed or demolished)	●	●							●	●

4.1 Summary of Impact-producing Factors

The IPFs identified for the SFWF and SFEC, based on the construction, O&M, and decommissioning activities described in Section 3, are listed below. In this section, each IPF is characterized qualitatively and quantitatively (when possible) in accordance with the scope of each phase and activity. As presented in Table 4.1-1, the IPFs that have been evaluated and result in impacts that are negligible or greater are cross-referenced to each corresponding resource and COP section number.

- Seafloor and Land Disturbance
- Sediment Suspension and Deposition
- Noise
- Electromagnetic Fields (EMF)
- Discharges and Releases
- Trash and Debris
- Traffic
- Air Emissions
- Visible Structures
- Lighting

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Table 4.1-1. Summary of the Evaluation of Impact-producing Factors associated with the South Fork Wind Farm and South Fork Export Cable and Affected Physical, Biological, Cultural and Socioeconomic Resources

	Physical Resources				Biological Resources							Cultural Resources				Socioeconomic Resources								
Impact-producing Factor	Air Quality	Water Quality & Water Resources	Geological Resources	Physical Oceanography & Meteorology	Coastal Habitat	Benthic & Shellfish Resources	Finfish & Essential Fish Habitat	Marine Mammals	Sea Turtles	Avian Species	Bat Species	Above-ground Historic Properties	Marine Archaeological Resources	Terrestrial Archaeological Resources	Visual Resources	Population, Economy, & Employment	Housing & Property Values	Public Services	Recreation & Tourism	Commercial & Recreational Fishing	Commercial Shipping	Coastal Land Use & Infrastructure	Other Marine Uses	Environmental Justice
Impact Evaluation Section Number	*4.2.1.2*	*4.2.2.2*	*4.2.3.2*	*4.2.4.2*	*4.3.1.2*	*4.3.2.2*	*4.3.3.2*	*4.3.4.2*	*4.3.5.2*	*4.3.6.2*	*4.3.7.2*	*4.4.1.2*	*4.4.2.2*	*4.4.3.2*	*4.5.2*	*4.6.1.2*	*4.6.2.2*	*4.6.3.2*	*4.6.4.2*	*4.6.5.2*	*4.6.6.2*	*4.6.7.2*	*4.6.8.2*	*4.6.9.2*
Seafloor and Land Disturbance		•	•	•	•	•	•	•	•	•	•		•	•					•	•		•		
Sediment Suspension and Deposition		•	•	•	•	•	•	•	•	•			•							•				
Noise						•	•	•	•	•	•	•				•	•		•	•				•
Electromagnetic Field						•	•	•	•											•				
Discharges and Releases		•			•	•	•	•	•	•									•	•		•		
Trash and Debris		•			•	•	•	•	•	•									•	•		•		
Traffic						•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•
Air Emissions	•																							
Visible Structures				•				•	•	•	•	•		•	•	•	•		•	•	•	•	•	•
Lighting						•	•	•		•	•	•			•		•		•		•	•	•	

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4.1.1 Seafloor/Land Disturbance

The Project activities with the potential to adversely affect the seafloor and land during construction include installation of foundations for up to 15 WTGs and one OSS, the installation of the Inter-array Cable, submarine export cable, and terrestrial export cable, and the construction of the interconnection facility. During O&M, disturbance to the seafloor and land could result from the presence of infrastructure and temporarily anchored maintenance vessels. Over the life of the Project, the placement of foundations and scour protection will alter the seabed and associated habitat by replacing the existing seabed and habitat with hard structures that create a reefing effect that results in colonization by assemblages of both sessile and mobile animals. Decommissioning activities will have similar impacts to the seafloor and land as construction.

SFWF and SFEC activities that could result in potential impacts by seafloor and land disturbances were presented in Table 4.0-1 and are further described below. Resources potentially impacted by seafloor and land disturbance are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

4.1.1.1 South Fork Wind Farm

During construction of the SFWF, seafloor disturbance will be associated with several of the following activities:

- Seafloor preparation, including clearing and/or leveling of the seafloor, such as boulder relocation where necessary, prior to foundation and cable installation
- Pile driving for the monopile foundation for WTG and/or OSS
- Placement of rock scour protection at the base of each foundation
- PLGR, submarine cable trenching, or burial for the SFWF Inter-array Cable
- Anchoring of vessels and equipment during construction (including the use of spuds)

SFWF design parameters were discussed in Section 3.1.2. The extent of anticipated seabed disturbance during the construction and O&M phase for the monopile foundation is presented in Table 3.1-1 and repeated here in Table 4.1-2. As noted above, seafloor disturbance impacts will likely occur during O&M by the presence of the bottom-founded infrastructure and maintenance vessels temporarily anchored at the WTGs. Impacts on physical, biological, cultural, and socioeconomic resources from seafloor and land disturbances are evaluated in the sections identified in Table 4.1-1.

Table 4.1-2. SFWF: Summary of Seafloor Disturbance
Maximum temporary and permanent seabed footprint for components of the SFWF

Project Component/Activity	Construction (Temporary)	Operation (Permanent)
Monopile Foundation [a]	14.8 acres (6 ha)	14.6 acres (5.9 ha)
Foundation cable protection [a]	N/A	7.5 acres (4.2 ha)
Vessel anchoring/mooring [c]	820.8 acres (332 ha)	N/A
Inter-array Cable [b]	340 acres (137.6 ha)	2.5 acres (1.0 ha)
Inter-array Cable protection [b]	N/A	10.2 acres (4.1 ha)

Notes:

[a] Conservatively assumes up to 16 foundations will be installed, including 15 foundations for WTGs and 1 foundation for the OSS. Permanent footprint also includes scour protection for 16 foundations and secondary cable protection for 16 foundations. Temporary disturbance includes seafloor preparation.

Table 4.1-2. SFWF: Summary of Seafloor Disturbance
Maximum temporary and permanent seabed footprint for components of the SFWF

Project Component/Activity	Construction (Temporary)	Operation (Permanent)

[b] Conservatively assumes the Inter-array Cable has a maximum length of 21.4 miles (34.4 km, 18.5 nm) and a diameter of 12 inches (0.3 m). Permanent footprint also includes secondary cable protection. Temporary disturbance includes seafloor preparation.

[c] Conservatively assumes that, during typical installation, three vessels will use anchors and that three vessels will use spud cans, and all six vessels will visit each of the 16 foundations.

ha = hectare(s)

Seafloor Preparation

Preparation of the seafloor for the SFWF foundations and Inter-array Cable will generally involve a levelness check and the removal of boulders, debris, and other obstructions for the foundation installation area. The PLGR will be completed to clear the Inter-array Cable route of possible obstructions and debris, such as abandoned fishing nets, wires, and hawsers. Seafloor preparation is temporary, direct disturbance to the seafloor prior to construction and installation activities that will occur in the same area with a similar extent of disturbance.

Foundation Installation

Pile driving will be used to install the monopile foundations to support the WTGs and OSS. Pile driving will disturb the seafloor at the point of pile penetration and the immediately adjacent area. During operations and maintenance, foundations will provide habitat that may be different from the existing seabed and that extends the entire water column. Similar bottom disturbance impacts will occur during decommissioning.

Monopile foundation systems involve driving a single, large-diameter, steel monopile into the seafloor to support each WTG or OSS. A monopile foundation is approximately 36 feet (11 m) in diameter and has a footprint of 1,025 ft^2 (95 m^2). When considering the area of installed scour protection around the base of the monopile, the estimated seabed disturbance from each installed monopile foundation will be 39,765 ft^2 (3,694 m^2) (see Table 3.1-2).

Inter-Array Submarine Cable

Disturbance to the seafloor from Inter-array Cable installation results from PLGRs, trenching for cable burial, and travel of the cable-laying equipment. The Inter-array Cable is expected to be installed using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow. Additionally, boulders may be relocated within sections of the corridor for the cable route. Boulder relocation may occur within 66 feet (20 m) on each side of the centerline where necessary (see Section 3.1.2.3 for more detail). The Inter-array Cable will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m) in the seabed. Where the Inter-array cable emerges from the trench and is attached to the foundation, cable protection (e.g., engineered concrete mattresses) may be placed on the seabed near the WTG foundation. In addition, it is anticipated that a maximum of 10 percent of the Inter-array Cable (2.1 miles [3.4 km, 1.9 nm]) may not achieve the target burial depth if hard substrate or other unforeseen obstacles are encountered. Secondary cable protection systems may be placed in those areas.

The design envelope parameters for the SFWF Inter-array Cable were defined in Table 3.1-4. Seafloor disturbance from Inter-array Cable installation is narrowly confined to the cable trench, the track width of the cable-laying equipment, and area of cable protection. The total estimated temporary seabed disturbance from Inter-array Cable installation, including seafloor preparation, is 340 acres (137.6 ha). The total estimated permanent footprint of the Inter-array Cable, including secondary cable protection and cable protection at the approach to the foundations, is 20.2 acres (9.3 ha).

The depth of disturbance will be limited to the cross-section of the trench cut for cable laying. Some sediment transport is expected outside of the cable trench due to currents and is dependent on the sediment grain-size, composition, and forces imposed on the sediment column necessary to achieve desired cable burial depths. However, suspended sediments from the trench will likely settle back into the trench or in areas immediately adjacent to the trench. The potential effects on sediment resuspension and deposition are discussed in the following section.

Vessel Anchoring

Anchoring results in a range of shallow seafloor disturbances from the penetration of spuds or anchors, dragging of anchors and from the "sweeping" of anchor chains. The extent and severity of seafloor disturbances from vessel anchoring are influenced by several factors including spud/anchor size and configuration, wave and current conditions, vessel drag distances and the physical and biological characteristics of the seafloor where anchoring occurs. Post-construction seafloor surveys of the Block Island Wind Farm documented the variability of the residual impacts of construction activities in the context of benthic habitat types and the mobile or stable nature of the seafloor. Dynamic, mobile, and sandy seafloor types were observed to recover more quickly than stable seafloor types consisting of cobble and gravel (INSPIRE, 2017).

Temporary anchoring of vessels within the SFWF will occur during construction, O&M, and decommissioning for durations varying according to work activity as detailed in Section 3.1.3.1. Anticipated seabed disturbances from Project vessels were presented in Table 3.1-7. All vessel anchoring associated with the SFWF will occur within the maximum work area (MWA) (Figure 3.1-1) encompassing the WTGs and Inter-array Cable. During construction, jack-up or heavy lift barges, equipped with up to four spud cans per vessel for positioning, will be used for WTG installation. Other vessels, including tugs, material barges and CTVs may be occasionally anchored using single or multiple anchors. Throughout Inter-array Cable installation, less frequent anchoring by the dynamically positioned vessel (DPV) for cable-laying is anticipated. During O&M, anchoring will be limited to vessels required to be onsite for an extended duration. Typically, CTVs are not expected to anchor when visiting the SFWF. During decommissioning, seafloor disturbances from anchoring will be similar to those expected during construction.

4.1.1.2 South Fork Export Cable

During construction of the SFEC, seafloor and land disturbance activities will be similar to those previously identified for the SFWF Inter-array Cable in addition to the following:

- Installation of the sea-to-shore transition consisting of a new onshore transition vault and HDD of the cable under the beach and intertidal water areas, which may also include a temporary cofferdam.
- Construction of the new interconnection facility, on land adjacent to the existing LIPA substation in East Hampton, New York
- Trenching and installation of the onshore segment of the export cable

Section 3.2 provides a discussion of the SFEC and Table 3.2-2 presents a summary of the design parameters for the SFEC – OCS, SFEC – NYS, and SFEC – Onshore. Estimated areas of seabed disturbance during construction of the SFEC are summarized in Table 4.1-3. Sea floor and land disturbance associated with decommissioning activities are expected to be similar to those associated with construction.

Table 4.1-3. Seafloor Disturbance
Maximum temporary and permanent seabed footprint for components of the SFEC

Project Component/Activity	Temporary	Permanent
SFEC – OCS submarine cable [a]	555.3 acres (224.7 ha)	7.0 acres (2.9 ha)
SFEC – OCS cable protection [b]	N/A	8.0 acres (3.2 ha)
SFEC – NYS submarine cable [a]	18 acres (7.3 ha)	0.4 acres (0.17 ha)
SFEC – NYS cable protection [b]	N/A	0.2 acres (0.08 ha)
SFEC – NYS sediment excavation for for sea-to-shore transition [c]	26,500 yd^3 (20,260 m^3)	N/A

Notes:

[a] Conservatively assumes the SFEC has a total permanent diameter of 12 inches (0.3 m), and that temporary seabed disturbance includes seafloor preparation.

[b] Conservatively assumes additional cable protection, consisting of concrete matting or fronded mattresses, rock bags or rock placement (conservatively assumed to be 8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to 5 percent of the SFEC - OCS (7.0 acres) and up to 2 percent of the SFEC - NYS (0.2 acres, and for seven locations (0.6 acres) where the SFEC - OCS will cross utility crossings, each of which may need up to 280 linear feet (85.3 m) of cable protection.

[c] Conservatively assumes that excavation will occur, or a cofferdam, if utilized will enclose an area that is up to 185 feet long by 530 feet wide to a depth of up to 17 feet (56.4 m long by 161.5 m wide to a depth of up to 5.2 m). The footprint for excavation / cofferdam are intended to represent maximum design scenarios. The actual footprints of these acfivtiies are depending on the final installation methodology and engineered design but are anticipated to be smaller than the footprints depicted.

m^3 = cubic meter
yd^3 = cubic yard

Seafloor Preparation

Site preparation of the seafloor along the SFEC – OCS and SFEC – NYS will be similar to the activities described for the SFWF Inter-array Cable in Section 3.1.3.3.

SFEC Sea-to-Shore Transition

SFEC-Offshore installation will begin at the offshore sea-to-shore transition point, which may include installation of a temporary cofferdam. If installed, the cofferdam will be fabricated of sheet pile or a pre-cast, multi-sectional gravity cell, as explained in Section 3.2.3.4. It will be located at least 1,750 feet (533 m) offshore from the mean high-water line (MHWL) at the landing site in approximately 25 to 60 feet (7 to 18 m) of water depending on the landing site (see Figure 3.2-2). The cofferdam, if installed, will occupy approximately 2.2 acres (0.89 ha) of seafloor. The area within the cofferdam or gravity cell may require the removal of sediment to facilitate the completion of the HDD process and pull back of conduit and cable. Cable protection may be placed at the HDD exit point (e.g., one cable mattress).[8]

No disturbance to the seafloor is expected between the offshore cofferdam location and the shore because the cable will be installed via HDD.

SFEC - OCS and SFEC - NYS Installation

The installation of the submarine export cable will follow similar methods described in Section 3.1.3.3 for the SFWF Inter-array Cable, except that no boulder relocation, installation trials, or cable joint installation are expected to occur in New York State waters. Disturbance to the seafloor is characterized by the parameters provided in Table 4.1-4. Within the SFEC trench

[8] A mattress placed at the HDD exit point is included within the 0.2 acres (0.08 ha) for cable protection along the SFEC – NYS.

footprint, the seafloor sediments will be fluidized and/or moved by the cable installation equipment. Once the cable is laid into the trench, the suspended sediment is expected to settle back into the trench. Except for approximately 15.1 acres (6.1 ha) for the SFEC-OCS and 0.6 acres (0.26 ha) for the SFEC-NYS of permanent impact to the seafloor caused by the presence of the cable, cable joints, secondary cable protection, and cable protection for existing utility crossing, the direct impact of trenching/cable installation is temporary. Estimated temporary seabed disturbance for the SFEC-OCS is 555.3 acres (224.7 ha) and for the SFEC-NYS is 18 acres (7.29 ha). The installation of each offshore joint is expected to take 7 to 10 days and, if controlled flow excavation occurs, it would take an additional 48 to 72 hours to complete.

Table 4.1-4. SFEC Parameters: OCS and NYS Export Cable
Anticipated parameters for the export cable

Parameter	OCS	New York State
Cable diameter	8-12 inches (20 - 30.5 cm)	
Target burial depth[a]	4 - 6 feet (1.2 - 1.8 m)	
Maximum trench depth	10 feet (3 m)	
Maximum length of cable	58.3 miles (93.9 km, 50.7 nm)	3.7 miles (6 km, 3.2 nm)
Maximum Permanent Footprint		
Export cable[b]	7.0 acres (2.8 ha)	0.4 acres (0.17 ha)
Cable joints[c]	0.1 acres (.05 ha)	N/A
Secondary cable protection[d]	7.1 acres (2.8 ha) 305,974 ft^2 (28,426 m^2)	0.2 acres (0.08 ha) 7,351 ft^2 (683 m^2)
Cable protection for existing utility crossing[e]	0.9 acres (0.23 ha) 39,200 ft^2 (3642 m^2)	N/A
Total maximum permanent footprint	15.1 acres (6.1 ha)	0.6 acres (0.26 ha)
Temporary Seabed Disturbance (not including permanent footprint)		
Cable installation[f]	198.0 acres (80.1 ha)	18 acres (7.3 ha)
Cable installation trials[g]	9.3 acres (3.75 ha)	N/A
Boulder relocation[g]	357.3 acres (144.4 ha)	N/A
Cable joint installation[g]	4.9 acres (2 ha)	N/A
Total temporary seabed disturbance	555.3 acres (224.7 ha)	18 acres (7.29 ha)

Notes:

[a] Burial depth is measured from the seabed to the top of the cable.

[b] Conservatively assumes the SFEC - OCS has a length of 58.3 miles (93.9 km, 50.7 nm) and the SFEC - NYS has a length of 3.7 miles (6.0 km, 3.2 nm), and the cable diameter is 12 inches (0.3 m).

[c] Conservatively assumes up to two cable joints may be installed for the SFEC – OCS. Each joint has a length of 36 feet (11 m) and a diameter of 3 feet (0.9 m), requires cable protection for 88 feet (27 m), and requires additional cable on each side of the joint for a length of 1312 feet (400 m).

[d] Conservatively assumes secondary cable protection will be needed for up to 5 percent of the SFEC – OCS and up to 2 percent of the SFEC – NYS, where burial depth may be less than 4 feet (1.2 m). Cable protection will consist of concrete mattresses, fronded mattresses, rock bags, or rock placement (conservatively assumed to be 8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]).

Table 4.1-4. SFEC Parameters: OCS and NYS Export Cable
Anticipated parameters for the export cable

Parameter	OCS	New York State

[e] Conservatively assumes secondary cable protection, consisting of concrete mattress (8 feet long by 20 feet wide [2.4 m long by 6.1 m wide]), for up to seven existing cable systems, each of which may need up to 5,600 ft^2 (520 m^2) of matting for 280 linear feet (85.3 m).

[f] Conservatively assumes that temporary seabed disturbance will include installation equipment with a maximum temporary disturbance of either i) 25 feet (7.5 m) for 49.6 miles (79.9 km, 43.1 nm) for the SFEC – OCS and up to 3.7 miles (6.0 km, 3.2 nm) for the SFEC – NYS or ii) 43 feet (13 m) for up to 9 miles (14 km, 7.5 nm) for the SFEC – OCS.

[g] Conservatively assumes additional temporary disturbance for other seafloor preparation and cable installation activities, including installation trials, boulder relocation, and cable joint(s). Up to five installation trials may occur, each of which has a temporary disturbance of 25 feet (7.5 m) wide and 3,280 feet (1,000 m) long. Boulder relocation may occur within 66 feet (20 m) of each side of the cable centerline and will include total disturbance of 131 feet (40 m) wide for up to 50 percent of the total length of the SFEC – OCS; the temporary seabed disturbance includes the width in addition to cable installation (32.5 m for 32.8 km and 27 m for 14 km). Placement of cable joint(s) may include use of controlled flow excavator for up to two joints, each of which has a temporary disturbance of 33 feet (10 m) wide and 3,280 feet (1,000 m) long.

Some sediment transport is expected outside of the cable trench and is dependent on the sediment grain-size, composition, and forces imposed on the sediment column necessary to achieve desired cable burial depths. However, suspended sediments from the trench will likely settle back into the trench or in areas immediately adjacent to the trench. The potential effects on sediment resuspension and deposition are discussed in the following section.

Vessel Anchoring

Seafloor disturbance from temporary vessel anchors during SFEC installation may occur at the sea-to-shore transition during cofferdam construction location and intermittently along the SFEC cable corridor, if the DP cable-laying vessel or other support vessels must anchor. Short-term, localized seafloor disturbance will occur from vessels anchoring during SFEC installation. During O&M, anchoring will be limited to infrequent or emergency trips by maintenance vessels along the submarine export cable route. During decommissioning, seafloor disturbance associated with anchoring will generally be similar to that described for construction.

SFEC – Onshore Construction

Land disturbance will result from site clearance, excavation and filling associated with the construction of the onshore sea-to-shore transition, installation of the onshore cable, and construction of the interconnection facility. The construction sequence of these various activities was presented in Sections 3.2.2.2 and 3.2.2.3. Land disturbance will be localized to the immediate construction areas and limited to the duration of cable installation activities. Construction of the upland transition vault and HDD operations will temporarily impact previously disturbed areas at the seaward end of Beach Lane or parking lot of the Hither Hills State Park.

The onshore cable will be installed underground in a duct bank between the onshore transition vault and Interconnection facility. The duct bank will be located underground within public ROWs and alongside the tracks within the LIRR ROW. Multiple SFEC routes are under consideration and will result in the cable being installed in previously disturbed upland areas, avoiding sensitive resources, and upon completion, no appreciable change in land cover or imperviousness is expected. Excavation, grading and fill along the roadways and existing ROWs (for example, LIRR) may require cutting or trimming of vegetation and removal of large rocks from the construction work area to facilitate safe construction.

The SFEC – Interconnection Facility will occupy a 2.4-acre (0.97 ha) wooded parcel in a residential and commercial area in East Hampton. The footprint of the SFEC – Interconnection Facility will be up to 230 by 360 feet (70.1 m by 109.7 m), including the exterior wall, with a maximum equipment height of approximately 43 feet (13.1 m). Tree clearing, except for a vegetative buffer around the substation, as well as excavation, grading, and filling, will be conducted on the lease parcel to house the interconnection facility. The wooded area will be converted to an industrial use with expected changes to onsite drainage patterns that will be addressed during the environmental management and construction planning phase of the Project.

All earth disturbances from onshore construction activities will be conducted in compliance with the New York SPDES General Permit for Stormwater Discharges associated with Construction Activities and an approved Stormwater Pollution Prevention Plan (SWPPP).

4.1.2 Sediment Suspension and Deposition

Sediment suspension and deposition are naturally occurring processes in a highly dynamic oceanographic environment. On the continental shelf, tidal circulation and storm waves play important roles in the transport of sediment. Meteorological and oceanographic conditions within the SFWF and SFEC are discussed in Section 4.2.4. However, these processes are altered in areas of disturbance where construction activities occur, or infrastructure is placed where it previously was not. Suspension of sediments into the water column, which is measured as turbidity, resulting from SFWF and SFEC construction, O&M, and decommissioning activities, may adversely impact water quality and marine life. Once in suspension in the water column, sediments are transported by currents, eventually settling back onto the seafloor, resulting in deposition. Deposition may adversely impact marine life by smothering or altering benthic habitats. The placement of infrastructure on the seafloor may change the local hydrodynamics of the area, causing the movement of surrounding sediment and potential undermining of foundations and submarine cables.

Changes to turbidity and deposition from Project activities depend on the nature of the activity, characteristics of the seafloor (stable or mobile), physical sediment characteristics, and hydrodynamics in the area of disturbance. SFWF and SFEC activities that could lead to sediment suspension and deposition are described below. The physical, biological, cultural, and socioeconomic resources impacted from sediment suspension and deposition are identified in Table 4.1-1.

4.1.2.1 South Fork Wind Farm

Construction

Sediment suspension and deposition resulting from bottom-disturbing construction and decommissioning activities are expected to be localized and short-term. Temporary sediment suspension and deposition within the SFWF will result from the following activities:

- Seafloor preparation, including boulder relocation
- Pile driving installation of monopile foundations
- Burial of the Inter-array Cable
- Vessel anchoring

Decommissioning activities involving the removal of installed Project components will also result in sediment suspension and deposition, similar to construction, if similar vessels, equipment, and methods are used. Once constructed, the SFWF will result in localized changes to seafloor topography and bottom currents because of the presence of foundations and scour protection. The seafloor overlaying the buried Inter-array Cable is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns are expected.

Seafloor Preparation and Foundation Placement

Sediment suspension and deposition will be caused by bottom-disturbing activities during installation of the monopile foundation. The effect of these activities is expected to be localized to the activity and short-term. Any physical disturbances from seafloor clearing or leveling, boulder relocation, placement of scour protection, vessel anchoring, or pile driving will cause small plumes of finer sediments to mobilize up into the water column where limited transport is anticipated. When the activity stops, the sediment suspension will abate, and sediment is expected to settle out onto the seafloor.

SFWF Inter-Array Cable Installation

The installation (or removal) of the Inter-array Cable is the activity expected to result in the greatest amount of sediment suspension and deposition in the SFWF area. The mechanical and/or hydrostatic forces of the cable-laying process will result in temporary increases in sediment suspension and cause deposition in the vicinity of the Inter-array Cable corridors.

RPS performed hydrodynamic and sediment dispersion modeling to assess potential environmental impacts from cable installation by the jet plow,[9] one of three potential types of equipment for cable installation and assumed would produce the maximum amount of suspended sediments. The complete Hydrodynamic and Sediment Transport Modeling Results are provided as Appendix I.

The modeling for the SFWF Inter-array Cable assumed one pass of the cable-laying equipment between two WTGs within 1 day as a representative case. Model scenarios considered two seasonal tidal conditions to construct representative cases. It estimated the seabed footprint of sediment resuspension from jet plow trenching as approximately 3 feet (0.9 m) (trench surface width).The model assumed a total volume of the trench between the two WTGs of 3,063 cubic yards (yd^3; 2,342 cubic meters [m^3]). Most of this material was assumed to remain undisturbed at the seabed since the jet plow does not directly excavate sediment from the trench. For modeling, it was assumed that the equipment would operate at a constant (sedimentation) production rate of 160 yd^3/hour (122 m^3/hour) (based on an advance rate of 220 feet/hour [67 m/hour]). The jet plow was assumed to have a nominal power of 1,600 kW and would circulate 1,674 yd^3 (1,400 m^3) of seawater per hour. The key results of the modeling relating to sedimentation and deposition from the SFWF Inter-array Cable installation using a jet plow (Appendix I) are as follows:

- The maximum predicted total suspended solids (TSS) concentration from the Inter-array Cable burial activities is 100 milligrams per liter (mg/L).
- Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) from the source and TSS concentrations are predicted to return to ambient levels (<10 mg/L) within 0.3 hours from the conclusion of trenching.
- The maximum predicted deposition thickness is estimated to be 0.4 inch (10 mm) and limited to within 26 feet (8 m) of the burial route, covering an estimated cumulative area of 0.1 acre (0.04 ha).

Modeling results suggest that project-related sedimentation and deposition using a jet plow will not extend beyond the SFWF MWA and remain in federal waters. Water quality impacts will be short-term and relatively localized. Low amounts of sediment deposition will occur near the cable-laying activity.

Operations and Maintenance

During SFWF O&M, sediment suspension and deposition around the WTG foundations will be altered due to the localized changes in seafloor topography and hydrodynamics. The sediment around the WTG foundations will experience scour and backfilling subject to wave and current action with localized increases in turbidity. Potential adverse impacts from these processes will be mitigated by installing scour protection for the monopile foundation. Scour protection is

[9] Appendix I describes a "jet plow." For consistency, Section 4 uses the term "jet plow" when discussing the results described in this Appendix. Both terms describe a method of submarine cable installation equipment that primarily use water jets to fluidize soil, temporarily opening a channel to enable the cable to be lowered under its own weight or be pushed to the bottom of the trench via a cable depressor.

discussed in more detail in Section 3.1.3.2, and the impact parameters for scour protection are presented in Table 3.1-2.

4.1.2.2 South Fork Export Cable

Section 3.2.3 presented a description of the sequence of cable installation activities. Installation of the SFEC by cable installation equipment, cofferdam installation, and vessel anchoring will result in sediment suspension and changes in depositional patterns along the proposed cable corridor. Decommissioning of the SFEC or removal of the submarine cable, would result in similar temporary impacts to construction phase impacts. Where the SFEC target burial depth is achieved, the seafloor is expected to return to pre-construction conditions over time and no long-term changes to sediment mobility and depositional patterns would be expected during O&M, apart from areas where armoring is required. In the rare instance that the SFEC must be visually inspected or repaired during O&M, excavation in and around the SFEC would result in short-term, localized sediment suspension and deposition.

Construction

SFEC – OCS and SFEC – NYS Cable Installation

Installation of the SFEC between the sea-to-shore transition to the OSS will be conducted using a DP cable-laying vessel and one of three potential types of cable installation equipment as described for the SFWF Inter-array Cable. The potential for sedimentation and deposition from this activity is similar to that explained for the SFWF Inter-array Cable. However, the length and location of the SFEC is different than the Inter-array Cable. Sediment transport modeling was conducted to assess potential environmental impacts from cable installation by the jet plow, one of three potential types of equipment for cable installation.

As further detailed in Appendix I, sediment transport analysis for the SFEC included simulation of the cable installation between the sea-to-shore transition at Beach Lane and the SFWF OSS (61 miles [98.3 km]) assuming a jet plow. The model assumed a total volume of the SFEC trench of 214,943.4 yd^3 (164,366 m^3). Most of this material was assumed to remain undisturbed at the seabed since the jet plow does not directly excavate sediment from the trench. For modeling, it was assumed that the equipment would operate at a constant [sedimentation] production rate of 160 yd^3/hour (122 m^3/hour) (based on an advance rate of 220 feet/hour (67 m/hour). The jet plow was assumed to have a nominal power of 1,600 kW and would circulate 1674 yd^3 (1,400 m^3) of seawater per hour. The key results of the modeling relating to sedimentation and deposition from the SFEC installation using a hydraulic jet plow (Appendix I) are as follows:

- The sediment plume that arises during trenching is transient, and generally oscillates with the tide.
- In New York State waters, the plume is oriented in a northeast/southwest configuration, reflecting the tidal current patterns near Long Island, which are aligned with the nearshore topography. As the trencher moves into deeper waters, past Montauk, the plume assumes more of a north/south orientation.
- The highest TSS concentrations are predicted to occur in locations (Figure 26, Appendix I) where the jet plow equipment passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route) but concentrations above 30 mg/L otherwise remain within approximately 100 m of the source during the simulation. The cross-section view presented in Figure 37, Appendix I (bottom) suggests that peak TSS concentrations will remain near the seabed, and plumes above 10 mg/L are not predicted to extent vertically beyond 9.8 feet (3 m) of the source at any time during the simulation.
- Sedimentation (Figures 38 through 44, Appendix I) is limited to the area immediately adjacent to the burial route (typically within 328 feet [100 m]) and the pattern of deposition appears more uniform when compared with the TSS concentrations in the water column.

- The maximum predicted TSS concentration during the SFEC - NYS segment of the simulation is 578 mg/L. TSS concentrations at or above 100 mg/L are predicted to extend a maximum of 120 m from the source and TSS concentrations are predicted to remain elevated above ambient levels (greater than 10 mg/L) for 1.3 hours after the trencher passes into federal waters. Sediment deposition does not reach the level of 0.39 inch (1.0 cm) within New York State waters (that is, maximum predicted deposition thickness resulting from the SFEC - NYS is 0.39 inch [9.9 mm]).
- For the portion of the installation in federal waters (SFEC-OCS) the maximum predicted TSS concentration is 1,347 mg/L. TSS concentrations at or above 100 mg/L are predicted to extend a maximum of 1,115 feet (340 m) from the source and TSS concentrations are predicted to remain elevated above ambient levels (greater than 10 mg/L) for 1.4 hours after the conclusion of trenching. The maximum predicted deposition thickness is 0.45 inch (11.4 mm). Sedimentation at or above 0.39 inch (1.0 cm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.74 ha) of the seabed.

SFEC – Onshore Installation

Excavation, grading, filling, and construction vehicle movements associated with HDD operations, cable trenching, duct installation, laydown and staging, and interconnection facility construction during construction of the SFEC – Onshore increases the potential for soil erosion and sedimentation of local waterways by stormwater.

SFEC construction activities causing earth disturbance and the potential for soil erosion and sedimentation will be further addressed by the New York Public Service Commission's (NYPSC's) Article VII Certification and associated Environmental Management and Construction Plan (EM&CP, Construction Plan) detailing site-specific construction activities and the environmental best management practices (BMPs) to be implemented, which will be filed prior to construction. The SFEC will also be constructed in accordance with an approved SWPPP and the conditions of the SPDES General Permit for Stormwater Discharges from Construction Activity.

Operations and Maintenance

Sediment suspension and deposition may result from armoring placed over the SFEC – OCS and SFEC – NYS where target burial is not achieved or where crossing of existing telecommunications cables requires armoring. The introduction of rock or engineered concrete mattresses to areas of the seafloor can cause local disruptions to circulation, currents, and natural sediment transport patterns. Under normal circumstances these segments of the SFEC are expected to remain covered as accretion of sediment covers the cable and the armoring. In nonroutine situations, these segments may be uncovered, and re-burial might be required.

4.1.3 Noise

Noise is defined as unwanted sound, be it underwater or in-air (or airborne). Sound becomes an adverse impact when it interferes with the normal habits or activities of fish, wildlife or people. Recognition or perception of sound as noise, however is very subjective and circumstantial based on the receptor's experience as well as the characteristics of sound (DOI-MMS, 2007). The reception or perception of sound depends on many factors including the sound source (power level), frequency, distance between source and reception (sound pressure level [SPL]), receptor's hearing capability and physiology, and a suite of environmental factors including media (air, water, sediment), temperature, barriers, and other sounds. In this section, sources of noise from Project activities are identified and discussed as potential IPFs.

Noises generated by the SFWF and SFEC will transmit through the water and/or air. Underwater noises are those noises that transmit through the water column as the result of working engines or machines below the surface of the water (for example, vessel propeller or thruster) or noise transmitted through an underwater structure as waves of energy that propagate sound throughout the water column (for example, spinning WTG, impact or vibratory pile driving). In-air noises refer to those noises that are generated above the surface of the water and transmit through the atmosphere. For some activities, both in-air and underwater noises will be generated. During impact or vibratory pile driving, the pile driving hammer impacts the top of the steel pile generating sound waves through the air above the water and down through the water column. Noise-emitting activity and equipment abovedeck on work vessels can also generate sound both above and below the water in a similar way.

SFWF and SFEC activities that are expected to generate noise are presented in Table 4.0-1. The primary sources of noise associated with the SFWF and SFEC will occur during construction. Decommissioning may result in similar noise generation if it involves the removal of Project components with comparable equipment and methods as construction. Operational noises will result from the operation of the WTG (SFWF) and the interconnection facility (SFEC) with occasional vessel and vehicle noise produced from routine maintenance activities. Most of the construction noises will be underwater: vessel noise, including DPV thrusters; impact pile driving; vibratory hammer pile driving; and cable installation equipment. However, general construction, including HDD operations and port activity, as well as pile driving will generate in-air noise.

Three studies were conducted to evaluate project-related noise in support of this COP. Appendix J contains the three acoustic assessments: 1) Evaluation of Potential In-air Noise Impacts for the SFWF and SFEC; 2) Underwater Acoustic Modeling of Construction Noise; and 3) SFWF and SFEC Onshore Sound Study. Summary-level information from the results of these studies is included in this discussion of noise as an IPF. Also, the results of the acoustics assessments provide the basis for the evaluations of potential impacts on biological and socioeconomic resources in the affected environment presented in Sections 4.3 and 4.6.

4.1.3.1 South Fork Wind Farm

Underwater and in-air sound will be generated during SFWF construction and decommissioning by pile-driving, power equipment used to install the WTGs (for example, cranes, compressors) and Inter-array Cable, and the movement of vessels, including DPVs. Construction vehicles and equipment will generate noise at ports used for construction staging. Possible O&M noises will result from the rotors of operational turbines, vessels, and infrequently from O&M activities onshore. The different sound-generating activities are further described and assessed below.

Vessel Noise

Ship traffic is widely recognized as the leading contributor of noise to the ocean environment and varies depending on several factors related to vessel size, load, draft, propeller size, and mission or activity (DOI-MMS, 2007). Vessel noise is the also seen as the main contributor to ambient ocean noise in the low-frequency (LF) band that is audible by marine life (NRC, 2003; Hildebrand, 2009). A large portion of the noise from vessel traffic comes from engines and propeller cavitation, and those noises predominately occupy the LF spectral bands (Richardson et al., 1995). In the open water, vessel traffic can influence ambient background noise at distances of thousands of kilometers; however, the effects of vessel traffic noise in shelf and coastal waters are variable due to sound reflection, refraction, and absorption by the bathymetric and geological characteristics of the area.

During SFWF construction and decommissioning, the operation of vessels will transmit sound through both water and air. The vessels will be used to ferry workers and transport materials to offshore construction sites, lay Inter-array Cable, and provide work platforms for construction. Underwater vessel noise will result from turning propellers or DP thrusters; engine and other vessel noises being projected though vessel hulls; and the interactions of waves with the vessel's hull. Construction vessel noises are expected to be produced within the SFWF during installation and assembly of foundations, WTGs, OSS, and Inter-array Cable. Otherwise, noise from vessel movements will occur primarily at the beginning or end of each construction day, between Project ports, and whenever vessels move to or from the construction site transporting crews or equipment. During SFWF O&M, vessel noise will result from routine trips to the wind farm or in cases of emergency. Vessel noise during decommissioning is expected to be similar to construction vessel noise if the SFWF is removed using comparable vessels, equipment, and methods. Apart from the DPVs used to install the Inter-array Cable, project-related construction, O&M, and decommissioning vessels are not expected to contribute significantly to the underwater or in-air noise from regular vessel traffic present in the waters in and around the SFWF and the port areas to be utilized by the Project.

The underwater noise from the cavitation on the propeller blades of the DPV thrusters is considered the dominant IPF of all the project-related vessel noises. DPV thrusters are known to generate significant underwater noise with continuous source levels ranging from 150 to 180 decibels (dB) referenced to (re) 1 micropascal (μPa) at 1 m (BOEM, 2013; Matthews, 2012). The predictive noise modeling conducted by JASCO Applied Sciences (JASCO) demonstrates representative sound propagation from DPVs completing cable-laying activities for the SFWF Inter-array Cable and the SFEC (Appendix J). The DPV thrusters generate nonimpulsive sound with the distance to unweighted SPLs (L_p) from the DP ranged from 164 feet (50 m) to the 166 dB isopleth, to greater than 8.7 miles (14 km) to the 120 dB isopleth. The implications of DP thruster propagation in terms of impacts to finfish, marine mammals, and sea turtles are discussed in Sections 4.3.3, 4.3.4, and 4.3.5, respectively, and Appendix P1.

Inter-Array Cable Installation Sound

Installation of the SFWF Inter-array Cable may involve using a jet plow. The jet plow is expected to generate sound underwater as it progresses along the seafloor but not above the water's surface. The sound is predominantly from the high-pressure water jetted into the seafloor from the jet plow to create a trench for the cable to lay into. This underwater hydraulic sound is expected to be masked by DPV thrusters that will be operating at the same time. Therefore, the jet plow is not considered a source of a noise IPF. Other cable installation equipment that may be used for the Inter-array Cable is not expected to generate noticeable levels of underwater noise.

Aircraft Noise

Helicopters may be used for emergency transport and/or maintenance activities between the SFWF and onshore landing locations and will not generate a noise IPF. As discussed in Appendix J, sound levels from helicopters flying back and forth to the SFWF are not expected to last for extended periods of time at points other than existing helipads or to reach levels of potential impact to wildlife or people.

General Construction Noise – Ports and other Onshore Facilities

During construction of the SFWF, heavy equipment, vehicles, and power tools will be used to support fabrication, installation, and maintenance activities. It is expected that most, if not all, of these activities will occur at existing ports in Connecticut, Massachusetts, New York and/or Rhode Island where there will be other ongoing industrial activities, independent of the SFWF. Construction sounds specifically related to SFWF activities at existing port facilities are expected to be similar to operational sounds associated with routine activities at these existing ports and therefore, are not considered a noise IPF.

Pile Driving Noise

In-air and underwater noise will result from the use of impact pile drivers to install the SFWF monopile foundations. Pile driving sound levels vary with pile size (diameter and wall thickness), subsurface/ geotechnical characteristics, hammer energy and type of pile driver. Pile driving sounds propagate both above and below the sea surface although sound transmission is different in water than in air making it difficult to compare airborne and underwater sound levels.

Impact pile-drivers typically utilize a weight (sometimes referred to as a piston or hammer) to impact the top of a pile to force it into the seafloor. The repetitive hammer blows drive the pile into the seafloor, similar to hammering a nail into a piece of wood. Piles are driven until the desired resistance is achieved (typically measured in blow counts per foot or inch) or the pile fails to advance (known as refusal). The primary sources of noise associated with impact driving are the impact of the hammer on the pile/drive cap and the noise radiated from the pile.

In-Air Noise from Pile driving

Driving of monopiles will generate in-air impulse sounds as the hammer strikes the pile. This sound source will only last as long as the duration of pile driving and take place exclusively offshore within the SFWF work area. In-air noise is expected to reach 94 A-weighted decibels (dBA) at 50 feet from the source to 60 dBA at 2,400 feet from the source (Appendix J2). No pile driving noise from the SFWF is expected to reach the shore.

Underwater Noise from Pile driving

Underwater noise from pile driving is considered an important IPF because of its potential impacts on marine life such as marine mammals, sea turtles, and certain finfish. To define underwater impulsive sounds from pile driving, an acoustic modeling study was completed by JASCO and is presented in Appendix J1. JASCO used its acoustic propagation model, Full Waveform Range-dependent Acoustic Model (FWRAM) to predict the propagation of underwater sound. The sound propagation modeling incorporates site-specific environmental data that describes the bathymetry, sound speed in the water column, and seabed geoacoustics in the SFWF. Two locations were selected within the SFWF to model representative sound fields associated with potential monopile foundation pile driving. SFW also supplied the following information for the model: pile-driving equipment, pile specifications, pile-driving schedules, soft start procedures, and noise attenuation technologies.

Modeling estimated the distances of impulse sound propagation to certain acoustic thresholds as published by federal and state agencies for finfish, marine mammals, and sea turtles. These distances are used to define this particular IPF, so the impact evaluations could be completed. These evaluations are presented in Sections 4.3.3, 4.3.4, and 4.3.5, and Appendix P1.

4.1.3.2 South Fork Export Cable

The potential for noise to be generated during construction or decommissioning of the SFEC is the result of vessel use, including the DPV for cable installation; aircraft use; sheet pile cofferdam installation by vibratory hammer; installation of the SFEC – Onshore; and construction of the SFEC - Interconnection Facility. During SFEC O&M, there will be no underwater noise. Only the OSS is expected to generate in-air sound.

Vessel Noise

Vessel noise, both underwater and in-air, during construction, O&M, and decommissioning of the SFEC is expected to be similar to the vessel noise described for the SFWF above. As is expected to be the case with the installation of the SFWF Inter-array Cable, the DPV thrusters will be the dominant underwater sound source during SFEC construction and decommissioning. Unlike the installation of the SFWF Inter-array Cable that will occur within the offshore SFWF work area, DPV operations performing SFEC installation will occur over approximately 50 to 60 miles (80.5 to 96.6 km) from the SFWF to the sea-to-shore transition point just off the shore (approximately 2,100 feet [640 m]) of Long Island.

Submarine Cable Installation Sound

As described for the installation of the SFWF Inter-array Cable, SFEC cable installation is not expected to generate impact-producing sound beyond that described above for the DPV thruster.

Aircraft Noise

Aircraft noise from nonroutine helicopter use is expected to generally be the same as discussed for SFWF above.

General Construction Noise – Ports and other Onshore Facilities

During the construction of the SFEC, vehicle, vessel, and equipment sounds associated with staging and support activities at existing ports are similar to those described for the SFWF above.

Offshore Cofferdam Installation

As described in Section 3.2.3.4, a temporary cofferdam may be located approximately 1,700 feet (518 m) offshore from the MHWL at the potential landing site (Beach Lane or Hither Hills) to facilitate cable pull-in at the sea-to-shore transition. The cofferdam will be sited at a location with approximately 25 to 60 feet (7 to 18 m) of water depth. The cofferdam will be installed using either sheet pile or gravity cell.

If the temporary cofferdam is constructed of steel sheet pile, vibratory hammer pile driving will be used for installation and removal. Vibratory hammering, which is a nonimpulsive (or continuous) sound source, differs from the impact hammering, which is an impulsive sound source, in several ways. The propagation characteristics of the vibratory hammering differ from the impact hammering because the location is close to shore and the duration of the installation is estimated to be short (roughly 12 to 24 hours). The threshold criteria for vibratory hammering also differs from the impact hammering being used for SFWF foundation installation.

The distance from shore and the likelihood the sound will be masked by ambient sounds or other construction noises diminish the circumstances that people will be exposed to disturbing noise. The in-air noise evaluation in Appendix J2 estimated cofferdam installation noise levels at 62 dBA at the shoreline, which is within both applicable state and local noise standards.[10]

Underwater continuous or nonimpulsive sound from cofferdam installation is expected to propagate over considerable distances and is a concern with respect to potential noise-related impacts on marine life. JASCO included vibratory hammer sound predictions in its underwater acoustic modeling study presented in Appendix J1. Modeling estimated the distances of nonimpulsive sound propagation to certain acoustic thresholds as published by federal and state agencies for finfish, marine mammals, and sea turtles. These evaluations are presented in Sections 4.3.3, 4.3.4, and 4.3.5, respectively, and Appendix P1.

SFEC - Onshore Installation Noise

Construction activities would introduce temporary noise sources associated with the different phases of SFEC - Onshore installation. The following summarizes the different phases of construction:

- An HDD rig, mud pump, crane, generator, backhoe, and other HDD installation activities are expected to take approximately 10 to 16 weeks and HDD activities would be completed outside the summer season. Construction at the sea-to-shore transition site would also include site preparation and excavation for the vault, including an excavator, crane, and sheetpile driver. The onshore workspace for the HDD will include a temporary sheetpile anchor wall to provide stability of the HDD rig while conducting drilling activities. The temporary anchor wall is anticipated to be approximately 29.5 feet (9 m) in length and driven to a depth of 19.7 feet (6 m). In addition to the anchor wall, the workspace may also require the installation of other temporary sheetpiles to aid in anchoring of the rig or to provide soil stabilization of the excavated area.
- The SFEC – Onshore cable route begins at the sea-to-shore transition vault and would run to the SFEC – Interconnection Facility at Cove Hollow Road. A duct bank would be located underground along public road ROWs and the LIRR ROW and would not include any overhead lines before arriving at the SFEC – Interconnection Facility. Wherever possible, the SFEC - Onshore route would be located within the existing paved section of the road ROW. Underground cable construction typically includes concrete saws, jackhammers, or hoe

[10] *See* Section 3 – Regulatory Context of the SFEC Sound Study (VHB 2018) in Appendix J for applicable noise standards.

rams to remove existing pavement and small backhoes, trenchers, and dump trucks to install the cable and replace the paved surface. SFEC - Onshore cable installation is expected to take approximately 12 to 15 months and would occur during daytime hours.

- Construction of the SFEC – Interconnection Facility would take approximately 12 to 18 months and would occur during daytime hours. Substation construction would include the following activities:
  - Site preparation, excavation, and grading (this is typically the loudest phase of substation construction)
  - Construction of foundations for the control building, transformer, reactors, and switchgear
  - Construction of electrical grounding, duct banks, and underground conduits
  - Installation of appropriate drainage systems and station service including electrical and water
  - Installation of all above ground structures including transformer, switchgear, and cable systems

VHB (2020) modeled construction noise for the SFEC - Onshore components listed above using standard methods for energy and transmission line projects in a manner that is consistent with federal guidelines (Appendix J3). The construction noise model accounts for the types of construction equipment, the number of each type of equipment, the amount of time they typically operate during a work period (usage factor), and the distance between receptor locations and the equipment. For typical daytime construction activities, construction noise is evaluated according to the 8-hour energy-average L_{eq}(8h). For construction activities that may occur continuously, such as HDD, construction noise is evaluated according to the 24-hour energy-average L_{eq}(24h).

Noise emissions of construction equipment is based on reference data from the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) and other project-specific equipment specifications. RCNM includes a database of sound emissions for commonly used construction equipment such as dump trucks, backhoes, concrete saws, air compressors, and portable generators.

For stationary construction, including site preparation for HDD operations and construction at the SFEC – Interconnection Facility, Cadna-A has been used to predict sound at nearby receptor locations. The model includes specific locations of the equipment, heights of the construction noise sources, terrain, and location and height of intervening objects such as sound walls surrounding the HDD site. The model provides construction sound level contours from the sites. For construction of the SFEC - Onshore, which moves linearly along public road ROWs and the LIRR ROW, the FHWA RCNM model is used to predict construction noise levels. The model provides sound level versus distance results (Table 4.1-5).

Table 4.1-5. Construction Equipment Noise Emissions

Construction Activity	Construction Equipment	Sound Level (dBA)	Utilization Factor
SFEC - Onshore Construction in Roadway or Railway	Dump Truck[a]	76 dBA at 50 feet	40%
	Backhoe[a]	78 dBA at 50 feet	40%
	Jackhammer, Hoe Ram, or Concrete Saw [a]	90 dBA at 50 feet	20%
	Generator (75 kW)[b]	56 dBA at 50 feet	40%

Table 4.1-5. Construction Equipment Noise Emissions

Construction Activity	Construction Equipment	Sound Level (dBA)	Utilization Factor
SFEC – Interconnection Facility Construction	Crane[a]	76 dBA at 50 feet	10%
	Backhoe[a]	78 dBA at 50 feet	40%
	Dump Truck[a]	76 dBA at 50 feet	40%
HDD Onshore Site Preparation	Impact Pile Driver[a]	101 dBA at 50 feet	20%
	Excavator[a]	81 at 50 feet	40%
	Crane[a]	76 at 50 feet	10%
HDD Onshore Entry / Exit Site	HDD Rig[c]	70 dBA Sound Power	100%
	Mud pump[d]	67 dBA Sound Power	50%
	Crane[a]	76 dBA at 50 feet	10%
	Generator (75 kW)[b]	56 dBA at 50 feet	40%
	Backhoe[a]	78 dBA at 50 feet	40%

Sources:

[a] RCNM, 2011.
[b] Whisper Watt Ultra Silent 75 kW Generator.
[c] Vermeer, Caterpillar
[d] eNoise Control Case Study (Sound Power Level, 98 dBA).

SFEC – Interconnection Facility Noise

Operation of the SFEC – Interconnection Facility would introduce new sources of noise (Appendix J includes site-specific noise-modeling). The SFEC – Interconnection Facility is assumed to include: One main power and one dynamic volt-amperes-reactive (DVAR) transformer rated for 650 kV Basic Insulation Level (BIL) and 108 mega-volt-amperes (MVA); two oil-cooled reactors rated for 35 mega-volt-amperes-reactive (MVAr); and, one control house with exterior HVAC equipment. Based on the results of the modeling:

- Sound from the SFEC – Interconnection Facility is modelled to be 37 dBA at the closest receptor property line location. At all other receptor locations, sound from the SFEC – Interconnection Facility would be 35 dBA or lower.
- Nighttime ambient sound measures near the substation site indicate that existing ambient nighttime sound levels range from 37.3 to 42.2 dBA (L_{eq}). Sound from the SFEC – Interconnection Facility is modelled to be below existing nighttime ambient sound levels at all receptor locations. The greatest increase in future noise would be 2.6 dBA at the closet receptor property line location. At all other receptor locations, future sound levels would increase 2 dB or less. Future increases in sound of less than 3 dBA is typically below the threshold of perception.

For additional data on the measured ambient sound levels and predictive operational sounds from the SFEC – Interconnection Facility, please see Tables 10 and 11 in Appendix J3.

4.1.4 Electromagnetic Field

4.1.4.1 SFWF Inter-Array Cable and SFEC

Operations

EMF are physical fields produced by electrically charged objects. Like all wiring and equipment connected to the electrical system, the electric and magnetic fields (EMF) surrounding cables such as the SFWF inter-array and the SFEC, will oscillate with a frequency of 60 Hertz (Hz). The magnetic field results from the flow of electricity along the cable and the magnetic flux density is reported in units of milligauss (mG), where 1 Gauss (G) = 1,000 mG. The magnetic field will be strongest at the surface of the cable and will decrease rapidly with distance from the cables. An electric field is created by the voltage applied to the conductors within the cable, but this electric field is totally shielded from the marine environment by grounded metallic sheaths and steel armoring around the cable. However, the oscillating nature of the 60-Hz magnetic field will induce a weak electric field around the cable that, similar to the magnetic field, will vary in strength based on the flow of electricity along the cable. The electric field is measured in units of millivolts/meter (mV/m).

Two assessments of electric and magnetic fields were conducted in support of the Project by Exponent. Appendix K contains the offshore and onshore EMF assessments that examined the potential for EMF generation from the SFWF Inter-array Cable and the SFEC offshore segments and SFEC – Onshore, respectively. The modeling of magnetic field and induced electric fields at the Project site was used in the analysis of the available scientific literature on the sensitivity of marine species to EMF. Resources potentially impacted by SFWF and SFEC EMF are identified in Table 4.1-1, and further described in Sections 4.3 through 4.6. The key findings from the offshore and onshore EMF reports (Exponent, 2018a, b) are provided as follows:

- Offshore, modeling results under winter normal conductor (WNC) conditions confirm that the maximum magnetic fields at 3.3 feet (1 m) above the seabed are below 200 mG everywhere along the offshore portion of the Project.
- Calculated magnetic-field levels for offshore are further found to be below reported thresholds for effects on the behavior of magnetosensitive fish and calculated induced electric-field levels are found to be below reported detection thresholds of local electrosensitive fish.
- Onshore, the proposed cables were modeled for line loadings equal to the WNC ratings as well as the maximum assumed output of the SFWF turbines. Modeling results under WNC conditions show that the maximum magnetic field ±50 feet from the duct bank centerline in all portions of the route are below 200 mG for the proposed configurations of the transmission lines.
- The electric field from the underground and submarine transmission cables is blocked by the cable armoring as well as the earth and therefore will not be a direct source of any electric field outside the cables.

4.1.5 Discharges and Releases

Discharges and releases of liquids and solid waste to the ocean or land pose a threat to water quality and risks to marine life from exposure, ingestion, or entanglement. Routine or accidental (non-routine) fuel spills, wastewater discharges and solid waste releases associated with SFWF and SFEC activities are possible but considered unlikely during normal construction, O&M, and decommissioning activities. Appendix F includes additional information about the potential discharges and potential methods of treatment.

4.1.5.1 South Fork Wind Farm

Construction and Decommissioning

Routine Discharges and Disposal

The greatest volume of vessel traffic and overall project-related activity will occur during the construction phase (of both the SFWF and SFEC). Routine discharges of wastewater (e.g., gray water or black water) or liquids (e.g., ballast, bilge, deck drainage, stormwater) outside of state waters may occur from vessels, WTGs, or the OSS during construction and decommissioning; however, those discharges and releases are anticipated to have negligible impacts because all vessel waste will be offloaded, stored, and disposed of in accordance with all applicable local, state, and federal regulations, such as the EPA and USCG requirements for discharges and releases to surface waters. In addition, compliance with applicable project-specific management practices and requirements will minimize the potential for adversely impacting water quality and marine life.

In accordance with the Oil Pollution Act of 1990 (OPA-90) and the MARPOL 73/78 international treaty, owners and operators of certain vessels are required to prepare Vessel Response Plans (VRP) approved by the USCG. In addition, the USCG regulates the at-sea discharges of vessel-generated waste under the authority of the Act to Prevent Pollution from Ships. All Project vessels will be required to comply with the applicable USCG pollution prevention requirements. Additionally, all vessels less than 79 feet (24.1 m) will comply with the Small Vessel General Permit issued by EPA on September 10, 2014 for compliance with National Pollutant Discharge Elimination System (NPDES) permitting.

Accidental or Non-Routine Spills or Releases

During construction and decommissioning, there is increased probability of spills and accidental releases of fuels, lubricants, and hydraulic fluids. BMPs for fueling and power equipment servicing greatly minimizes the potential for spills and accidental releases and will be incorporated into the SFWF and SFEC Oil Spill Response Plan (OSRP; Appendix D). Accidental releases are minimized by containment and clean-up measures detailed in the OSRP.

During all SFWF phases, certain hazardous materials necessary to support the installation of the WTGs will be transported to and from the SFWF and ports, including the SFWF O&M facility. The transport of this material may result in the accidental discharges of small volumes of hazardous materials, such as oil, solvents, or electrical fluids. The OSS will have transformers that contain large reservoirs of electrical insulating oil (such as mineral oil), as well as smaller amounts of additional fluids, such as diesel fuel and lubricating oil. Per the information requirements outlined in 30 CFR 585.626, a list of solid and liquid wastes generated, including disposal methods and locations, as well as federally regulated chemical products, is found in Appendix F. SFWF and SFEC activities that could result in potential discharges and releases are presented in Table 4.0-1, and are further described below. Resources potentially impacted by discharges and releases are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

Operations and Maintenance

The WTGs will be designed to contain any potential leakage of fluids, thereby preventing the discharge of fluids into the ocean. During WTG maintenance, small leaks could occur during servicing of hydraulic units or gearboxes. During WTG operation, small accidental leaks could occur because of broken hoses, pipes, or fasteners. Any accidental leaks within the WTGs are expected to be contained within the hub and main bed frame or tower. During O&M, the only discharges to the sea that are anticipated are those associated with vessels performing maintenance. BMPs for fueling and power equipment servicing greatly minimize the potential for spills and accidental releases. Accidental releases are minimized by containment and clean-up measures detailed in the OSRP (Appendix D).

4.1.5.2 South Fork Export Cable

Discharges and releases of liquids and solid waste to the ocean or land from SFEC construction, O&M, and decommissioning is similar to those described for the SFWF. The SFEC is a solid dielectric cable and is not liquid filled so there is no risk of cable rupture and release. Vessels used during SFEC construction or decommissioning will also comply with applicable local, state, and federal regulations and project-specific plans and procedures. The potential for discharges and releases from SFEC - Onshore construction will be governed by New York State regulations and the Project's Construction Plan. O&M of the SFEC – Interconnection Facility represents low potential for discharges and releases during routine O&M.

The sea-to-shore transition, which includes an HDD of the cable under the beach and intertidal water areas, will require the use of HDD drilling fluid, which typically consists of a water and bentonite mud mixture or another non-toxic drilling fluid. Bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. While the mixture is not considered toxic, if released, SFW will implement BMPs during construction to minimize potential release for a frac-out of the drilling fluid associated with HDD activities.

4.1.6 Trash and Debris

Solid wastes and construction debris will be generated predominantly during construction and decommissioning of the SFWF and SFEC. Per the information requirements outlined in 30 CFR 585.626, a list of solid and liquid wastes generated, including disposal methods and locations is presented in Appendix F. The discharge or disposal of solid debris into offshore waters from OCS structures and vessels is prohibited by BOEM (30 CFR 250.300) and the USCG (MARPOL, Annex V, Pub. L. 100−220 [101 Stat. 1458]). The SFWF and SFEC activities that could result in the generation of trash and debris are presented in Table 4.0-1 and are further described below. Resources potentially affected by discharges and releases are identified are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6.

Construction and Decommissioning

It is anticipated that comprehensive measures, in accordance with applicable federal, state, and local laws, will be implemented prior to and during SFWF and SFEC construction to avoid, minimize, and mitigate impacts related to trash and debris disposal. Offshore, trash and debris will be contained on vessels and offloaded at port/construction staging areas. Material that has been shredded and can pass through a 25-millimeter (mm) mesh screen may be disposed according to 33 CFR 151.51-77. All other trash and debris returned to shore will be disposed of or recycled at licensed waste management and/or recycling facilities. Disposal of any solid waste or debris in the water will be prohibited. Good housekeeping practices will be implemented to minimize trash and debris in the SFWF and SFEC work areas, offshore, and onshore.

Operations and Maintenance

During O&M of the SFWF and SFEC, the generation of trash and debris is likely to be limited. The overall quantity of trash and debris is likely to be small because most maintenance activities are unlikely to produce much of this type of material. The nominal amounts of trash and debris generated by maintenance activities will be managed in accordance with federal, state, and local laws and not disposed of at sea or on land.

4.1.7 Traffic (Vessels, Vehicles, and Aircraft)

Anticipated traffic related to the SFWF and SFEC will include water vessels, onshore vehicles, and helicopters. An overview of anticipated vessel usage is provided in Table 3.1-6. SFWF and SFEC activities that could result in potential impacts by traffic (vessels, vehicles, and aircraft) are presented in Table 4.0-1 and are further described below. Impacts to physical, biological, cultural, and socioeconomic resources from project-related traffic are evaluated in the sections identified in Table 4.1-1. The impacts of traffic on marine navigation are evaluated in Section 4.6.6, Commercial Shipping; Section 4.6.8, Other Marine Uses; and Appendix X, Navigational Safety Risk Assessment.

4.1.7.1 South Fork Wind Farm

Marine Vessel Traffic

A temporary increase in vessel traffic will occur during construction of the SFWF. Vessel traffic will occur at the SFWF and along routes between the SFWF and the ports used to support Project construction, O&M, and decommissioning. Timing of vessel traffic will be clarified once final construction schedules are issued and approved. The amount of time vessels will transit back and forth to the SFWF and how long they will remain on station is greatly dependent on final design factors, weather, sea conditions, and other natural factors. The larger installation vessels, like the floating/jack-up crane barge and DP cable-laying vessel, will generally travel to and out of the construction area at the beginning and end of the SFWF construction and not on a regular basis. Tugs and barges transporting construction equipment and materials will make more frequent trips while smaller support vessels carrying supplies and crew may travel to the SFWF daily. However, construction crews responsible for assembling the WTGs will hotel onboard installation vessels at sea thus, limiting the number of crew vessel transits expected during SFWF installation.

During SFWF O&M, vessel traffic will be limited to routine maintenance visits and nonroutine maintenance, as needed. Limited crew and supply runs using smaller support vessels will be required. Marine vessel traffic impacts during SFWF O&M will be based on the moderate size of the maintenance vessel and the number of vessel trips. Impacts are more fully evaluated in the navigation assessment in Section 4.6.6, Commercial Shipping, Section 4.6.8, Other Marine Uses, and Appendix X, Navigational Safety Risk Assessment.

Vehicular Traffic

Vehicular traffic during SFWF construction will include truck and automobile traffic over existing roads and highways to support various activities on land and at sea. The majority of vehicular traffic will be within and around the potential ports identified to support SFWF construction. It is expected that the greater proportion of SFWF components will be transported by sea; however, some components and equipment will arrive by land at varying frequencies throughout the construction period. Project-related deliveries will result in loading and unloading traffic as well as vehicle movements to complete assembly, fabrication, and staging of SFWF components and equipment. Vehicular traffic volumes and frequencies associated with the SFWF are not expected to have a measurable impact on traffic in and around the selected port facilities.

Aircraft Traffic

Anticipated aircraft traffic includes only helicopter trips to and from the SFWF during construction, O&M, and decommissioning for emergency transport or limited maintenance transport of crew and/or supplies. A winch deck for emergency evacuation is proposed as part of the OSS platform. Based on the very low anticipated frequency of aircraft traffic, the impact of air traffic is expected to be minimal for both the SFWF and SFEC during construction, O&M, and decommissioning.

4.1.7.2 South Fork Export Cable

Marine Vessel Traffic

Construction of the SFEC will require various vessel types including a DP cable-laying vessel, tugs, barges, and work and transport vessels. Cable installation will begin at the offshore site of the sea-to-shore transition point and proceed to the SFWF OSS. A comparable level of vessel activity is expected during decommissioning. During O&M, very limited vessel usage is expected for survey vessels and small maintenance vessels tasked with investigating any reported problems.

Vehicular Traffic

During SFEC installation, the transport of materials, personnel, and equipment in and out of the ports where staging, assembly, and fabrication take place will result in temporary increases in traffic along nearby roadways. During SFEC – Onshore installation, construction vehicles, including site worker vehicles, will result in temporary (mostly daytime) increases in traffic within the relatively dense, residential areas of East Hampton, New York. Vehicular traffic attributed to the SFEC will occur over a relatively short period and include heavy equipment (for example, excavators, dump trucks, and paving equipment) for onshore cable installation and interconnection facility construction.

Onshore construction activities will abide by local construction ordinances and occur primarily during normal daylight hours except for certain activities associated with cable installation at the landing sites. The increase in any construction traffic in East Hampton, New York would be comparable to typical roadway or utility construction work. New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.

During O&M, vehicle traffic will be limited to the anticipated use of a pickup truck making routine visits to the SFEC - Interconnection Facility and occasional operational emergency visits. These limited additional trips are not expected to contribute to local traffic in any way.

Aircraft Traffic

Similar to anticipated aircraft traffic from the SFWF, helicopter usage associated with the SFEC would be primarily during the construction or decommissioning phase and during emergencies.

4.1.8 Air Emissions

Air emissions associated with construction, O&M, and decommissioning of the SFWF and SFEC depend on many factors, such as location, scope, type, and capacity of equipment; and schedule. Primary emission sources associated with the SFWF and SFEC will be from engine exhaust of marine vessel traffic, heavy equipment, and onshore vehicles during construction (Table 3.1-6). In general, most criteria pollutant emissions will be from internal combustion engines burning diesel fuel and will include primarily nitrogen oxides (NO_x) and carbon monoxide (CO), lesser amounts of volatile organic compounds (VOCs) and particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}) – mostly in the form of particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), and negligible amounts of sulfur oxides (SO_x). Project air emissions are subject to the regulations summarized in Section 4.2.1.

SFWF and SFEC activities that could result in air emissions are presented in Table 4.0-1 and are further described below. Resources potentially impacted by air emissions are identified in Table 4.1-1, and further described in Section 4.2.1. In addition, an inventory of project-related air emissions is provided as Appendix L.

4.1.8.1 South Fork Wind Farm

SFWF construction, O&M, and decommissioning activities will rely on combustion engines to transport crew, equipment, and materials. These project-related emission sources will be located offshore and onshore during all Project phases. Primary SFWF emissions sources include the vessels and vehicles included in Table 3.1-6. In addition, general and specialized construction equipment, utilized offshore on vessels and work platforms and onshore at regional ports, have the potential to emit pollutants during SFWF construction. These emission sources are included in the emissions inventory found in Appendix L.

SFWF construction vessels will transit between onshore support/staging facilities at ports located in Connecticut, Massachusetts, New York, and Rhode Island and the SFWF work area. Most of these vessels and onboard construction equipment will utilize diesel engines burning low sulfur fuel while some larger construction vessels may use bunker fuel. SFWF O&M activities will likely consist of small vessels transiting to and from the SFWF to service the WTGs or the OSS over the 25 year operational life of the SFWF. The estimated duration of usage for vessels is also provided in Appendix L.

4.1.8.2 South Fork Export Cable

Primary SFEC emissions sources include the vessels and vehicles included in Table 3.1-6 and further assessed in Appendix L. The SFEC – OCS and SFEC – NYS will mainly involve the DP cable-laying vessel and support vessels. The remainder of the vessels will be similar to, but fewer than, the vessels used during SFWF construction. Also, like the SFWF, construction staging and laydown for offshore construction will occur at port facilities in Connecticut, Massachusetts, New York, Rhode Island, New Jersey, Maryland, and/or Virginia.

Construction of the SFEC - Onshore will include an increase in construction equipment and vehicles, that are expected to emit (or have the potential to emit) air pollutants. Construction activities that will utilize primarily diesel-powered equipment include HDD operations, trenching/duct bank construction, and cable pulling and termination. In addition, a localized increase in fugitive dust may result during onshore construction activities. Any fugitive dust generated during construction of the SFEC - Onshore will be managed in accordance with the Project's Construction Plan.

4.1.9 Visible Structures

The SFWF and SFEC components that will be permanently visible and occupy space underwater, above water and on land have the potential to impact resources. Vessels, vehicles, and equipment used during SFWF and SFEC construction will be visible for a limited time and only from certain locations on the OCS, Long Island, and the ports to be used during construction. The temporary nature of these source during construction have such a negligible anticipated impact on resources that they are not considered further in this discussion. Once the Project is constructed, the visible structures will be the WTGs and the OSS.

SFWF and SFEC activities resulting in visible structures are presented in Table 4.0-1 and are further described below. Resources potentially impacted by visible structures are identified in Table 4.1-1, and further described in Sections 4.2 through 4.6. Impacts to visual resources and viewsheds are summarized in Section 4.5, Visual Resources and analyzed in Appendix U, Visual Resource Assessment, SFEC Onshore Substation, and Appendix V, Visual Impact Assessment - SFWF.

4.1.9.1 South Fork Wind Farm

During the O&M phase, the WTGs will occupy space in the ocean and above the water's surface. The WTG specifications, as they define the current SFWF design envelope, are discussed in Section 3.1.2.2.

The WTGs and OSS will be visible from points on land and water and the degree of visibility is dependent on a range of physical factors including elevation, weather conditions, sea state, and visual obstructions. Visual quality and significance of impact depends on the existing visual landscape and viewer groups, as discussed in Section 4.5 and associated appendices. Upon decommissioning, the WTGs and OSS will no longer be visible as they will be dissembled and removed from the area. The evaluation of potential impacts is the subject of Appendix V, Visual Impact Assessment, SFWF.

4.1.9.2 South Fork Export Cable

Visual infrastructure associated with the SFEC is limited to the SFEC - Interconnection Facility. Construction activity will result in some visible site disturbance, such as tree clearing, earth moving, and facility installation, all of which could temporarily alter the visual character of the landscape. Following construction activities, temporarily disturbed areas around the periphery of the substation expansion will be seeded (and stabilized, if necessary) to reestablish vegetative cover in these areas. The potential visibility of the SFEC - Interconnection Facility is evaluated in Appendix U, Visual Resource Assessment Report, SFEC Onshore Substation.

Once constructed, the SFEC – Interconnection Facility may be viewed from a few areas within approximately 0.25 mile (450.6 m) of the proposed site. Much of the SFEC – Interconnection Facility will be screened from view from most nearby areas by dense, mature vegetation that ranges in height between approximately 50 and 70 feet (15 to 21 m). Where visible, it is expected that views of the SFEC – Interconnection Facility will be limited to the uppermost portions of the proposed lightning masts (the tallest structures in the proposed station). Where the SFEC – Interconnection Facility is visible from greater distances, the lightning masts, even if visible, will be difficult to distinguish on the horizon because of their narrow profile and gray color.

4.1.10 Lighting

The impacts of lighting depend on the lighting source and factors that can affect light transmission, both in air and water. In air, the transmission of light can be affected by atmospheric moisture levels, cloud cover, and type and orientation of lights. In water, turbidity levels and waves can affect transmission distance and intensity. SFWF and SFEC activities that could result in potential impacts by lighting are presented in Table 4.0-1 and are further described below. Resources potentially impacted by lighting are identified in Table 4.1-1 and further described in Sections 4.2 through 4.6.

4.1.10.1 South Fork Wind Farm

In general, lights will be required on offshore platforms and structures, vessels, and construction equipment during construction, O&M, and decommissioning of the SFWF. There will be a temporary increase in the amount of lighting during construction and decommissioning due to the presence of work vessels. While Federal Aviation Administration (FAA) navigation lighting and marking recommendations apply to structures that are up to 12 nm (22 km) offshore, structures located in the SFWF are outside of 12 nm (22 km), and are therefore under the jurisdiction of BOEM. During operations, offshore structures will require lighting that conforms to BOEM guidelines (BOEM, 2019) and USCG requirements (USCG, 2020).

Control, lighting, marking, and safety systems will be installed on each WTG; the specific systems will be reviewed by the selected Certified Verification Agent and provided in the FDR.

Offshore turbines must be visible not only to pilots in the air, but also mariners navigating on water. In daylight, offshore wind turbines do not require lighting if the tower and components are painted white. The FAA and USCG consider white-colored turbines to be the most effective early warning technique for both pilots and mariners (Patterson, 2005). Marine Navigation Lighting (MNL) is regulated by the USCG through Federal Regulation 33 CFR 67 [63]. Structures must be fitted with lights for nighttime periods. No daytime lighting is required. Appendix X considers conceptual lighting that may be recommended by BOEM, based on BOEM guidelines (BOEM, 2019).

USCG-approved navigation lighting is required for all vessels during construction, O&M, and decommissioning. All vessels operating between dusk and dawn are required to turn on navigation lights. During night time construction, temporary work lighting will illuminate work areas on vessel decks or service platforms of adjacent WTGs or OSS platform. In addition, cable laying may occur 24 hours a day during certain periods, and these vessels will be illuminated at night for safe operation.

As discussed above, vessel and equipment lighting used during construction, O&M, and decommissioning will be temporary as vessels travel between the shore and SFWF and conduct maintenance activities at SFWF. Impacts of navigational and aviation lighting on WTGs during O&M are considered long-term but highly dependent on properties of the light. Upon decommissioning, all lighting will be removed.

4.1.10.2 South Fork Export Cable

During SFEC construction and decommissioning, lighting also will be necessary for illuminating the onshore work staging areas, at the ports, and on the vessels. Many of the onshore areas used for staging will be part of an industrial port where artificial lighting already exists. The SFEC –

Interconnection Facility lighting will be designed to the minimum standard necessary for substation safety and security per utility operational requirements, as well as state and local regulations.

4.2 Physical Resources

4.2.1 Air Quality

Specific requirements for submittal of air emissions information within this COP are provided in 30 CFR 585.659, which directs COP submittals to follow the regulations in 40 CFR 55 – *Outer Continental Shelf Air Regulations*. BOEM's COP guidelines mirror these regulations, requiring that a copy of the air emissions analysis prepared for the OCS air permit application be provided in the COP. SFW completed a Project-specific emissions inventory by estimating Project-related air emissions as the basis for an air permit application to the EPA in accordance with 40 CFR 55.6. This emissions inventory includes both potential emissions regulated and not regulated by the *Outer Continental Shelf Air Regulations*, as explained in this section, and is provided as Appendix L.

Under the authority of the Clean Air Act (CAA), EPA regulates air quality on the OCS, including emissions from the construction, operation, and decommissioning of the SFWF and SFEC. Section 328 (a)(4)(c) of the CAA defines an OCS source to include any equipment, activity, or facility that emits, or has the potential to emit, any air pollutant; is regulated or authorized under the OCS Lands Act; and is located on the OCS or in or on waters above the OCS. This definition includes vessels when they are permanently or temporarily attached to the seabed (40 CFR 55.2). For the OCS air permit application, SFW inventoried anticipated emissions from vessels associated with the Project while operating at the SFWF, along the SFEC route, or within 25 miles (40.2 km) of the activity. OCS activities located within 25 miles (40.2 km) of the seaward boundary of a state are subject to the same requirements as those applicable to the corresponding onshore area (COA) and to general conformity. Worst-case emission estimates were made for this analysis, which takes into the account the worst-case emissions for both OCS and conformity. It is anticipated that the actual emissions will be less than or equal to the worst-case emission estimates included herein.

In addition to the information specifically provided to support the OCS air permit, all estimated air emissions are included in the COP to allow for BOEM's assessments to fulfill its NEPA and CAA obligations. Under NEPA, BOEM will assess Project-related impacts to air resources. Under the CAA, BOEM is obligated to make a general conformity determination based on 40 CFR 51, Subpart W and Part 93, Subpart B, entitled "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." The General Conformity Rule applies to all federal actions except highway and transit programs. Title I, Section 176(c)(1) of the CAA defines conformity as the upholding of "an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards." Therefore, BOEM's approval of the COP, and associated air pollutant emissions, should not cause or contribute to new violations of NAAQS; increase the frequency or severity of any existing violation of the NAAQS; or delay timely attainment of the NAAQS or interim emission reductions.

This section defines the affected environment as it relates to air resources and potential emissions from the SFWF and SFEC. It also summarizes the potential emissions from the three phases of the Project and presents them categorically according to the expected CAA review (OCS Air Permit versus [vs.] General Conformity). The methodology and detailed results of the Project's air emissions inventory are found in Appendix L.

4.2.1.1 Affected Environment

Regional Overview

Air quality in the RI-MA WEA is described in the revised environmental assessment completed as part of BOEM's NEPA review for the RI-MA WEA and summarized here (BOEM, 2013). Vessels are the predominant emission source in the region, as traffic transits to and from the many Northeastern commercial ports. Southerly winds through the region have the potential to transport these emissions onshore. Conversely, air quality in the SFWF and SFEC is also influenced by onshore sources, as pollutants may be carried to the SFWF and SFEC by westerly winds. In comparison to existing emission sources regularly transiting the region, an incremental increase in vessel traffic and related emissions will result from Project construction, O&M, and decommissioning but the volumes of these pollutants are expected to be low (BOEM, 2013). The effect of emissions from vessel traffic associated with potential use of the Port of Sheet Harbour (Nova Scotia, Canada) would yield a similar conclusion as those vessel emissions would be subject to similar wind patterns.

The CAA requires the EPA to establish NAAQS to protect public health and welfare. The NAAQS are based on total concentrations of pollutants in the ambient air (i.e., outdoor air that is accessible to the public (40 CFR 50.1(e)). The EPA developed these ambient air quality standards for six common pollutants, known as criteria pollutants, for which ambient air quality standards exist: CO; lead; nitrogen dioxide (NO_2); ozone (O_3); particulate matter (PM); and sulfur dioxide (SO_2). PM is a mixture of solid particles and liquid droplets found in the air and includes particles of varying sizes and is categorized as PM_{10} and $PM_{2.5}$ (EPA, 2016a).

The NAAQS comprise both primary and secondary standards. The primary standards protect the health of particularly vulnerable populations, such as asthmatics, children, and the elderly. Secondary standards are based on protecting the welfare of the public against negative impacts, such as decreases in visibility and damage to crops, animals, vegetation, and buildings (EPA, 2016b). The NAAQS for each of the criteria pollutants are presented in Table 4.2-1.

Table 4.2-1. Criteria Pollutants and National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Standard	
CO	Primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead	Primary and Secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
NO_2	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and Secondary	1 year	53 ppb	Annual mean
O_3	Primary and Secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
$PM_{2.5}$	Primary	1 year	12.0 µg/m^3	Annual mean, averaged over 3 years
	Secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years
PM_{10}	Primary and Secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	Primary and Secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
SO_2	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: 40 CFR 50

Table 4.2-1. Criteria Pollutants and National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Standard

Note:

Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m³).

The CAA contains timeframes and milestones for states to meet and maintain NAAQS for criteria pollutants. Areas that do not meet the NAAQS based on an evaluation of available air quality data are designated as nonattainment areas (NAAs). The EPA reviews the NAAQS every 5 years and may update the standards based on new scientific information and establish new monitoring requirements. Each state is required to monitor the ambient air to determine whether it meets each standard. If monitoring shows that the air quality does not meet a standard, the state must develop and implement pollution control strategies to attain that standard. Once air quality meets a standard, a state must develop a plan to maintain that standard while accounting for future economic and emissions growth (MassDEP, 2016).

In addition to the criteria pollutants discussed, air pollutants can be categorized as toxic or hazardous air pollutants (HAPs) or greenhouse gasses (GHGs). There are no ambient air quality standards for HAPs or GHG; however, emissions are regulated through national manufacturing standards and permit requirements. HAPs, also known as toxic air pollutants or air toxics, are those pollutants known or suspected to cause cancer or other serious health impacts, such as reproductive impacts or birth defects, or adverse environmental impacts (EPA, 2017). Examples of HAPs include benzene (which is found in gasoline); dioxin; asbestos; toluene; and metals, such as cadmium, mercury, chromium, and lead compounds.

GHGs are gases that trap heat in the atmosphere and include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gasses. The largest source of GHG emissions from human activities in the United States is from burning fossil fuels (mostly coal and natural gas) for electricity, heat, and transportation (EPA, 2018a).

The scope of the affected environment for the assessment of potential Project-related emissions and impacts to ambient air quality encompass offshore areas and those states and counties where Project activities may occur. As described in Section 3.1.3.1, Project activities may use several regional, existing port facilities from Port of Montauk (Suffolk County, New York) to New Bedford Marine Commerce Terminal (Bristol County, Massachusetts), and several other ports in Connecticut, Rhode Island, New Jersey, Maryland and Virginia. It is possible that limited vessel travel may occur to and from the port of Sheet Harbour (Nova Scotia, Canada), but it is not anticipated that the vessel route will traverse any state/county waters. Therefore, for the purposes of this discussion, it is assumed that Project-related air emissions could occur near or within one or more of the following counties, depending on the ports used by the SFWF and SFEC:

- New London, New Haven, Middlesex and Fairfield Counties, Connecticut
- Barnstable, Bristol, Dukes, and Nantucket Counties, Massachusetts
- Nassau and Suffolk Counties, New York
- Washington, Newport, Kent, Providence, and Bristol Counties, Rhode Island
- New Castle, Kent, and Sussex Counties, Delaware
- Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Monmouth, Ocean, and Salem Counties New Jersey
- Berks, Bucks, Chester, Delaware, Lancaster, Lehigh, Montgomery, Northampton, Philadelphia, and York Counties, Pennsylvania

- Anne Arundel, Baltimore, Baltimore City, Calvert, Carroll, Caroline, Cecil, Charles, Dorchester, Frederick, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Somerset, St Mary's, Talbot, Wicomico, and Worcester Counties Maryland

Accomack, Charles City, Chesapeake, Essex, Franklin, Gloucester, Hampton, Isle of Wight, James City, King and Queen, King William, Lancaster, Middlesex, New Kent, Newport News, Norfolk, Northampton, Northumberland, Poquoson, Richmond, Suffolk, Sussex, Surry, Virginia Beach, Westmoreland, Williamsburg, and York Counties, VirginiaThe CT DEEP, Bureau of Air Management, Ambient Air Monitoring Group monitors air quality to protect public health and the environment. CT DEEP's ambient air monitoring network monitors for ozone, $PM_{2.5}$, NO_2, SO_2, CO, and lead, as well as VOCs, aldehydes, polycyclic aromatic hydrocarbons (PAHs), mercury, and dioxin. According to EPA, the New York-Northern New Jersey-Long Island Area and the Greater Connecticut areas are currently designated as moderate nonattainment for the 2008 ozone (8-hour) NAAQS (EPA, 2018b). The current trend is improvement for ozone standard attainment designations for New York Metro and the Greater Connecticut Area areas (CT DEEP, 2017).

Massachusetts Department of Environmental Protection (MassDEP) is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. MassDEP's Air Assessment Branch operates a network of 24 air monitoring stations that measure ambient concentrations of criteria pollutants, noncriteria pollutants (HAPs and others), and meteorological data (MassDEP, 2017). The most recent MassDEP monitoring data report (for the year 2016) shows that Massachusetts is in attainment with all the NAAQS criteria pollutant standards.[11] Trends for criteria pollutants and some HAPs have generally been downward in Massachusetts over the last several decades. MassDEP regulations establish a nonattainment new source review (NNSR) preconstruction review program for new major sources or major modifications in an NAA. NOx and VOCs are nonattainment pollutants in Massachusetts because the state is in an ozone transport region and as such designated as a serious ozone non-attainment area. Major source thresholds are 50 tons per year (tpy) NOx or 50 tpy VOCs.

The NYSDEC Division of Air Resources is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. NYSDEC operates a network of 50 air monitoring stations that measure ambient concentrations of criteria pollutants, HAPs (at 12 monitoring stations), and meteorological data (NYSDEC, 2017a). Long Island is considered Region 1, which has four monitoring stations. The most recent NYSDEC monitoring data report (2015) shows that New York State is in attainment with all the NAAQS criteria pollutant standards, except for ozone, which is designated as moderate nonattainment (EPA, 2018c). Trends for HAPs have generally been downward in New York over the last 10 years (NYSDEC, 2017b). The New York City Metropolitan area, including Long Island is designated as a severe ozone non-attainment area.

The New York State Energy Research and Development Authority (NYSERDA) *New York State Greenhouse Gas Inventory: 1990 to 2014* is based on EPA protocols and methodologies and includes an estimate of current GHG emissions produced within New York State from 1990 to 2014. Emissions of GHGs gradually increased from 1990, peaked in 2005, and then began to decline since. In 2014, emissions were approximately 8 percent lower than in 1990. This reduction stands in contrast to the 7 percent national increase in total GHG emissions over the same period. Energy-related emissions were 13 percent lower in 2014 relative to 1990 levels (NYSERDA, 2017).

[11] Massachusetts was previously designated as nonattainment for the 1979 1-hour ozone standard (0.12 ppm) and 1997 8-hour ozone standard (0.08 ppm). Through a combination of state and regional controls, Massachusetts' air quality attained the 1997 standards by the 2009 attainment deadline. In 2008, EPA lowered the 8-hour ozone standard to 0.075 ppm. In April 2012, EPA designated Dukes County as nonattainment (marginal classification) for the 2008 ozone standards and designated the remainder of Massachusetts as unclassifiable/attainment. Based on the most recent monitoring data, Dukes County attained the 2008 ozone standard by the 2015 attainment deadline (MassDEP, 2016).

The RI DEM, in conjunction with the Rhode Island Department of Health, operates a network of eight air monitoring stations throughout the state that measure ambient concentrations of criteria pollutants; toxic air pollutants (or HAPs); and ozone precursors, which are substances that react in the atmosphere to form ground-level ozone (RI DEM, 2016). The most recent RI DEM monitoring data report shows that Rhode Island is in attainment with all the NAAQS criteria pollutant standards. Emissions of GHG in Rhode Island have been estimated at 11.3 million metric tons of carbon dioxide equivalent (CO_2e) in 2015 (EC4, 2016). This is on target to meet the 2020 limit of 11.23 million metric tons of CO_2e in accordance with the 2014 Resilient Rhode Island Act, which outlines programs and policies the state could undertake to meet its commitment to reduce annual GHG emissions to at least 10 percent less than 1990 levels by 2020, and up to 80 percent less than 1990 levels by 2050 (EC4, 2016).

Delaware Department of Natural Resources and Environmental Control, or DNREC, is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants in Delaware. The Delaware air quality monitoring network includes permanent monitoring stations in all three counties and one mobile monitoring station used for special studies. Eight of the permanent monitoring stations measure multiple pollutants. Three measure only particulate matter. The Annual Air Quality Reports cover Delaware's air quality status and trends for criteria pollutants and some substances that do not have standard criteria, such as air toxics. They include information on sources of air pollution and inventory data related to the compounds responsible for forming ozone and PM2.5 pollution. And there is information on emission controls, air monitoring, air inventories, climate change, and more. According to EPA, the Philadelphia-Wilmington-Atlantic City Area and the Sussex County areas are currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS and the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

New Jersey Department of Environmental Protection (NJDEP) operates 30 air quality monitoring states across the state. These stations monitor all six criteria air pollutants. NJDEP's data has shown downward trends in concentrations of criterial air pollutants over the past few decades. NJ is getting close to meeting the ozone NAAQS and is now in compliance with PM2.5 NAAQS and has been in compliance with the NOx, SO2, CO and lead NAAQS. According to EPA, the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS, the New York-Northern New Jersey-Long Island, NY-NJ-CT area is currently designated as serious nonattainment for the 2008 ozone (8-hour) NAAQS and the New York-Northern New Jersey-Long Island, NY-NJ-CT areas are currently designated as moderate nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

The Pennsylvania Department of Environmental Protection (DEP) Quality Assurance and Data Assessment Section collects and validates ambient air quality data and analyzes monitored data and conducts comparison studies for reporting results. According to EPA, the Allegheny, Indiana, Beaver, and Warren counties are currently designated as nonattainment for the 2010 sulfur dioxide, the Lower Beaver Valley, Lyons, and North Reading areas of PA are currently designated as nonattainment for 2008 lead (EPA, 2020).

Maryland Department of the Environment is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. In an effort to keep Maryland citizens informed about the region's air quality, the Ambient Air Monitoring Program publishes monthly air quality reports for the following forecast regions: Baltimore, Eastern Shore, Washington DC, and Western Maryland. These reports provide basic statistics regarding the two major pollutants in Maryland: ground-level ozone and fine particles. According to EPA, part of the Anne Arundel County and Baltimore County area is currently designated as nonattainment for the 2010 sulfur dioxide NAAQS, the Philadelphia-Wilmington-Atlantic City Area is currently designated as marginal nonattainment for the 2008 ozone (8-hour) NAAQS, the Baltimore areas are currently designated as moderate nonattainment for the 2008 ozone (8-hour) NAAQS and the Philadelphia-Wilmington-Atlantic City Area, Washington DC-MD, VA area, and Baltimore MD areas are currently designated as marginal nonattainment for the 2015 ozone (8-hour) NAAQS (EPA, 2020).

The Virginia Department of Environmental Quality (DEQ) air monitoring program is a combined effort of the Air Quality Monitoring Office (AQM), six regional offices, the Alexandria Transportation and Environmental Services, the National Park Service, and the US Department of Agriculture Forest Service. The air monitoring sites measure the ambient air for the criteria pollutants and other air pollutants of special interest. Some additional sampling is conducted for volatile organic compounds, also known as the 'ozone precursors.' According to EPA, Washington DC-MD-VA area is currently designated as marginal nonattainment for the 2015 ozone (8-hour) (EPA, 2020).

Permitting Applicability

SFW will submit a notice of intent and then an OCS air permit application to EPA as required by the OCS Regulations in 40 CFR 55.6. For the OCS air permit application, annual construction and O&M air emissions will be compared with new source review (NSR) permitting thresholds to determine the type of permitting needed. Decommissioning emissions, likely to occur 25 years in the future, would be the subject of another permit application.

There are two types of major source permitting, depending upon the attainment status of the pollutant of concern with the NAAQS: Prevention of Significant Deterioration (PSD) program for attainment pollutants and NNSR for nonattainment pollutants. If the Project emissions are less than the major source thresholds, then only minor NSR applies to the project (EPA, 2018e). As stated, EPA sets NAAQS standards for six criteria air pollutants: O_3, CO, PM, SO_2, lead, and NO_2. Every area of the United States has been designated by EPA in one of three attainment classifications based on the status of the air quality in the area:

- Attainment – Air quality is equal to or better than the level of the NAAQS.
- Nonattainment – Air quality is worse than the level of the NAAQS.
- Unclassified – There are no air quality data for the area; the area is treated as attainment.

The PSD permitting program includes the following:

- Installation of the Best Available Control Technology – Emission limitation based on the maximum degree of emission control, considering environmental, energy, and economic impacts
- An air quality analysis consisting of an air dispersion model
- Additional impacts analysis to assess impacts on air, and ground and water pollution on soils, vegetation, and visibility
- Public involvement, including a required public review and comment period

The NNSR Program includes the following:

- Installation of the Lowest Achievable Emission Rate – Emission rate that represents the most stringent emission limit in a state implementation plan (SIP) or implemented in practice for a similar source, which is technically feasible for the project
- Purchasing of Emission Offsets – To avoid or offset increases in emissions, emissions from proposed projects are balanced by equivalent or greater reductions from existing sources
- Public involvement, including a required public review and comment period

A minor NSR program includes the following, which is implemented by the states:

- Sources must comply with emission controls or limits specified by the state.
- The program must not interfere with attainment of maintenance of the NAAQS or the control strategies of the SIP.

General Conformity

The General Conformity Rule per 40 CFR 93 Subpart B and 40 CFR 51 Subpart W prescribes that federal actions comply with the NAAQS. To meet this CAA requirement, a federal agency must demonstrate that every action it undertakes, approves, permits, or supports will conform to the appropriate SIP. That is, it will not interfere with the states' plans to attain and maintain compliance with the NAAQS.

BOEM will conduct the conformity analysis for the SFWF and SFEC based on the construction, O&M, and decommissioning emissions provided in this COP. The General Conformity emissions will not include emissions that are already accounted for in the OCS air permit. General Conformity emissions will only include direct and indirect emissions outside the 25- mile (40.2-km) OCS air region. A Conformity Determination is only required for emissions that exceed the *de minimus* thresholds. A list of the codified *de minimus* thresholds are included in Table 4.2-2.

Table 4.2-2. Clean Air Act Conformity *de minimus* Emission Thresholds

Emission	tpy
40 CFR 93.153(b)(1) – For purposes of paragraph (b) of this section the following rates apply in NAAs:	
Ozone (VOCs or NOx):	
Serious NAAs	50
Severe NAAs	25
Extreme NAAs	10
Other ozone NAAs outside an ozone transport region	100
Other ozone NAAs inside an ozone transport region:	
VOC	50
NOx	100
CO: All maintenance areas	100
SO_2 or NO_2: All NAAs	100
PM_{10}:	
Moderate NAAs	100
Serious NAAs	70
$PM_{2.5}$ (direct emissions, SO_2, NOx, VOC, and ammonia):	
Moderate NAAs	100
Serious NAAs	70
Lead: All NAAs	25
40 CFR 93.153(b)(2) – For purposes of paragraph (b) of thisf section the following rates apply in maintenance areas:	
Ozone (NOx), SO_2, or NO_2: All maintenance areas	100
Ozone (VOCs):	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100

Table 4.2-2. Clean Air Act Conformity *de minimus* Emission Thresholds

Emission	tpy
CO: All maintenance areas	100
PM_{10}: All maintenance areas	100
$PM_{2.5}$ (direct emissions, SO_2, NOx, VOC, and ammonia)	100
All maintenance areas	100
Lead: All maintenance areas	25

Source: EPA, 2018d.

South Fork Wind Farm

The discussion of air quality within the SFWF applies to the offshore area where the WTGs are located and the port areas that vessels will use in support of the Project. Ambient air quality data are not available for the offshore SFWF area because there are no air monitoring stations. However, the discussion of regional air quality, as previously presented, effectively characterizes the affected environment for air resources associated with the SFWF.

South Fork Export Cable

SFEC - OCS

The discussion of air quality along the SFEC – OCS applies to the offshore area where the SFEC will be installed in federal waters from the SFWF OSS to where the SFEC crosses into New York State jurisdictional waters. Air quality data are not available for the offshore OCS waters portion of the SFEC. However, the discussion of regional air quality, as previously presented, effectively characterizes the affected environment for air resources associated with the SFEC - OCS.

SFEC - NYS and SFEC - Onshore

The discussion of air quality along the SFEC – NYS applies to the nearshore area where the SFEC traverses New York State waters, including the offshore sea-to-shore transition. The SFEC - Onshore applies to the onshore area from the upland end of the sea-to-shore transition to the SFEC - Interconnection Facility. Air quality data are not available specifically for New York State waters; however, the NYSDEC Division of Air Resources is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants in the state. Two NYSDEC air quality monitoring stations are in relatively proximity to the SFEC in Holtsville and Riverhead, New York. New York State is in attainment with all the NAAQS criteria pollutant standards, except for ozone (EPA, 2018c), which is designated as moderate nonattainment (EPA, 2017). Trends for HAPs have generally been downward in New York over the last 10 years (NYSDEC, 2017b).

4.2.1.2 Potential Impacts

A summary of the IPFs that could result in air quality impacts is illustrated on Figure 4.2-1. IPFs that will not impact air quality are depicted with slashes through the circle. For the IPFs that could impact air but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. The IPFs with potential for minor to major impacts to air quality are evaluated in this section. The primary causes of potential air quality impacts from the SFWF and SFEC include emissions from vessels, vehicles, helicopters, and stationary engines. These sources were introduced in Table 3.1-6 and further categorized in the emissions inventory presented in Appendix L.

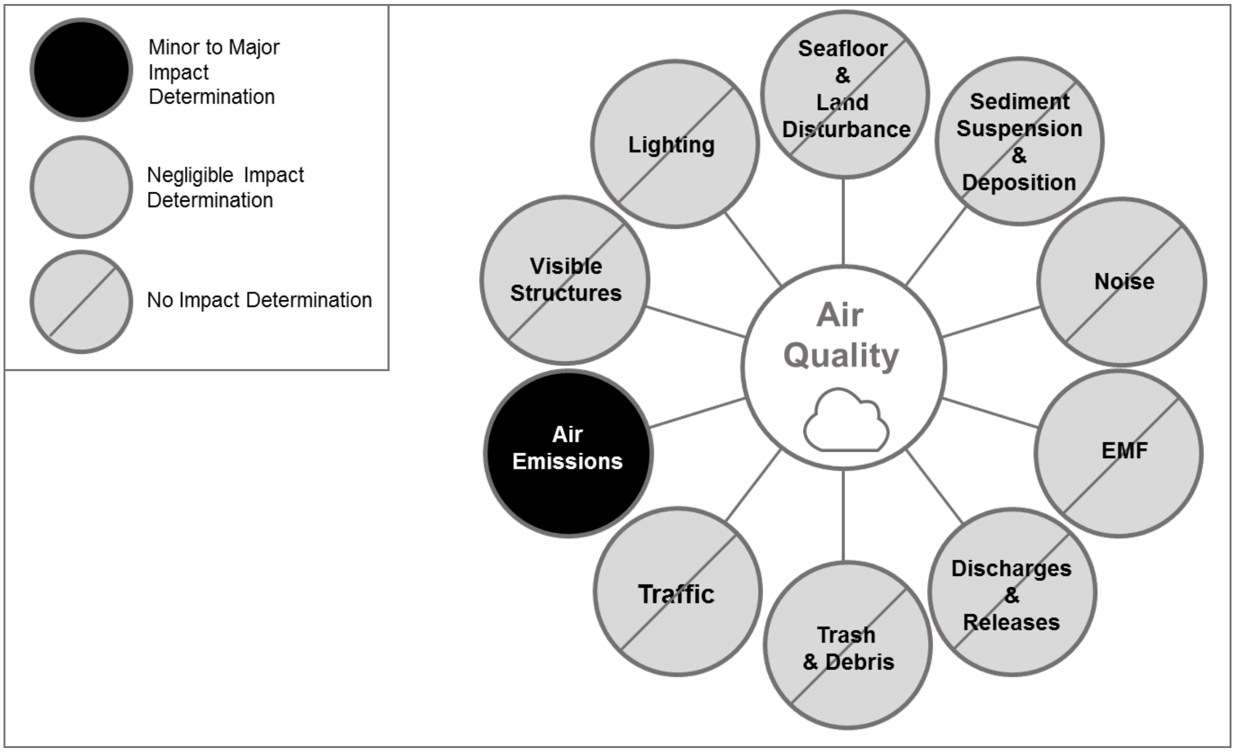

Figure 4.2-1. IPFs on Air Quality

Illustration of potential impacts to air quality resulting from SFWF and SFEC activities

Project-related aircraft, vessel, vehicle, and equipment usage will generate emissions offshore and onshore, predominantly during the anticipated one-to-twoyear construction phase. However, a one-year construction period was used to estimate worst case emissions. During the 25-year estimated O&M phase, the SFWF and SFEC will generate few emissions from infrequent use of emergency generators, equipment engines, vessels, and vehicles. O&M activities will produce relatively little emissions compared to those produced during construction. Emissions from decommissioning are estimated to be an order of magnitude less than construction emissions – though similar construction activities will be conducted to decommission Project components; the activity will be of a much shorter duration. However, decommissioning activities would occur 25 years in the future when combustion energy and pollution control technologies will be different, so it is speculative to predict emissions.

Appendix L contains the complete emissions inventory, including underlying assumptions for engine type and rating, engine use (hours), number of trips, trip destinations, and emission factors. For this COP and its related environmental review, total estimated emissions are analyzed for the SFWF and SFEC and by the three phases of the Project. This analysis provides a comparison of potential emissions from the construction of SFWF, which will predominantly occur within the lease area during foundation installation, WTG assembly, and Inter-array Cable laying. Potential emissions from the SFEC will occur as the cable laying vessel and other support vessels follow the proposed corridor from the sea-to-shore transition at Long Island to the SFWF.

Estimated emissions also are presented as annual emissions, OCS permit emissions, and conformity emissions. Appendix L provides a detailed explanation and regulatory context for these categories, but they are also summarized as follows. Total emissions include all combustion sources anticipated for Project-related usage offshore and onshore. OCS permit emissions include emissions from OCS sources, vessels meeting the definition of *OCS Source* (40 CFR 55.2), and vessels traveling to and from the SFWF when within 25 miles (40.2 km) of the SFWF's center (the 25-mile [40.2-km] centroid or the OCS centroid). General Conformity air emissions include emissions outside the 25- mile (40.2-km) centroid and within 25 nautical miles (46.3 km) of a state's seaward boundary. Conformity emissions are apportioned to the state where the emissions will occur based on the assumptions for project vessel trips between the SFWF and ports, as well as the SFEC landfall location. Emission estimates for construction and decommissioning phases are presented for a monopile WTG foundation. Emissions are presented by the pollutants identified in the BOEM *Wind Tool* and associated technical guidance (ERG, 2017).

Construction

For estimating worst case emissions, seven ports were chosen from the entire list of possible ports that may be used for the project, included in Table 3.1-5. Six ports were used for estimating worse case construction and decommissioning emissions and one port in New York was used for estimating worse case O&M emissions.

For estimating worst case total construction emissions, it was assumed that all construction and decommissioning activities could occur from one single port in each of the states (Massachusetts, Rhode Island, Connecticut, New Jersey, Maryland and Virginia), except New York. These ports, which were the likely port choices for each state are the New Bedford Marine Commerce Terminal in the City of New Bedford, MA, Port of Providence, Providence, RI, Port of New London, New London, CT, Paulsboro Marine Terminal, Paulsboro, NJ, Port of Baltimore, Sparrows Point, MD and Norfolk International Terminal, Norfolk, VA. Shinnecock Fish Dock Port in Hampton Bays, NY was chosen from among the New York ports for worst-case O&M emissions because that would result in greater emissions in New York than the other choices of Greenport and Montauk.

Although it is possible that some vessel travel may occur to and from the port of Sheet Harbour (Nova Scotia, Canada), this alternative scenario would reduce the amount of vessel traffic within U.S. waters, and therefore reduce the emissions that would occur within U.S. waters. Consequently, this scenario was not evaluated.

Using this approach provides a very conservative estimate of emissions in each state, as the total on-land, and emissions within 25 miles of the state's seaward boundary (exclusive of OCS permit emissions) are attributed to each state in each stand-alone scenario. This methodology results in a maximum, or worse-case modeled impact for each of the potential ports and would also allow worst-case conformity assessment because a maximum emission total would be provided to BOEM for each of the onshore states. Thus, using those seven port locations, all potential impacts for both the OCS permit and conformity can be conservatively estimated.

Estimated air emissions from the proposed construction activities for the SFWF and SFEC are summarized in Table 4.2-3 by port location. As shown in the table, construction conformity emissions vary by port location, OCS air emissions do not vary by port location. In addition, SFEC installation results in estimated emissions within the same range of estimated emissions expected for SFWF installation.

Table 4.2-3. Estimated Emissions from Construction for the South Fork Wind Farm and South Fork Export Cable by Port

Project	CO_2	CH_4	N_2O	Black Carbon	CO	NOX	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Port of New Bedford, MA											
SFWF	18,453	0.1	0.9	6.8	46.2	286.3	9.5	9.1	3.2	0.0011	7.8
SFEC	25,359	0.1	0.7	5.1	90.0	302.1	10.3	10.0	21.9	0.0009	29.2
Port of Providence, RI											
SFWF	20,065	0.1	0.9	7.5	50.8	313.2	10.4	10.0	3.5	0.0012	8.5
SFEC	25,599	0.1	0.7	5.2	90.8	305.6	10.4	10.1	21.9	0.0009	29.3

Table 4.2-3. Estimated Emissions from Construction for the South Fork Wind Farm and South Fork Export Cable by Port

Project	CO_2	CH_4	N_2O	Black Carbon	CO	NOX	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Port of New London, CT											
SFWF	21,446	0.1	1.0	7.8	56.2	331.0	11.0	10.6	4.5	0.0013	9.8
SFEC	25,633	0.1	0.7	5.2	90.8	305.8	10.4	10.1	21.9	0.0009	29.3
Paulsboro Marine Terminal, NJ											
SFWF	53,690	0.3	2.6	21.4	145.3	875.4	29.3	28.1	9.6	0.0032	24.0
SFEC	30,614	0.1	0.9	7.1	107.2	379.4	12.9	12.6	22.2	0.0013	30.7
Sparrows Point, MD											
SFWF	76,821	0.5	3.7	30.8	211.9	1,256.8	42.2	40.4	14.5	0.0045	35.4
SFEC	33,893	0.1	1.1	8.3	118.0	427.6	14.6	14.2	22.3	0.0015	31.6
Port of Norfolk, VA											
SFWF	60,351	0.4	2.9	24.2	164.0	986.8	33.1	31.7	10.8	0.0036	27.1
SFEC	31,608	0.1	1.0	7.5	110.5	394.0	13.4	13.1	22.2	0.0014	31.0

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Total, annualized OCS, and annualized Conformity emissions for the entire Project (i.e., SFWF and SFEC combined) by port location are presented in Table 4.2-4, assuming the installation of a monopile foundation. Appendix L breaks down construction emissions on an annual basis for OCS permitting purposes.

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO_2	CH_4	N_2O	Black Carbon	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Port of New Bedford, MA											
Total Construction Emissions (tons)	43,811	0.2	1.5	11.9	136.2	588.3	19.7	19.1	25.1	0.0021	37.0
Worst-case OCS Emissions (SFWF)	28,959	0.2	1.4	10.9	66.9	442.3	14.8	14.3	2.8	0.0019	9.5
Worst-case Conformity Emissions - Massschusetts	3,767	0.0	0.2	1.3	12.3	57.0	1.9	1.8	1.3	0.0002	2.4
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
Port of Providence, RI											

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO_2	CH_4	N_2O	Black Carbon	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Total Construction Emissions (tons)	45,664	0.2	1.6	12.7	141.6	618.8	20.8	20.1	25.4	0.0022	37.8
Worst-case OCS Emissions (SFWF)	29,075	0.2	1.4	11.0	67.2	444.2	14.9	14.4	2.8	0.0019	9.6
Worst-case Conformity Emissions - Rhode Island	5,405	0.0	0.2	2.0	17.0	84.0	2.8	2.7	1.6	0.0003	3.1
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
Port of New London, CT											
Total Construction Emissions (tons)	47,079	0.2	1.6	13.0	147.1	636.8	21.4	20.7	26.4	0.0022	39.1
Worst-case OCS Emissions (SFWF)	31,385	0.2	1.5	11.8	72.8	477.6	16.0	15.4	3.2	0.0020	10.5
Worst-case Conformity Emissions - Rhode Island	4,036	0.0	0.2	1.4	13.1	61.4	2.1	2.0	1.4	0.0002	2.5
Worst-case Conformity Emissions - Connecticut	2,844	0.0	0.1	0.9	9.7	41.8	1.4	1.4	1.2	0.0001	2.0
Worst-case Conformity Emissions - New York	19,732	0.0	0.4	3.0	76.8	218.6	7.4	7.3	21.5	0.0005	27.6
Paulsboro Marine Terminal, NJ											
Total Construction Emissions (tons)	84,304	0.5	3.5	28.5	252.5	1,254.8	42.2	40.7	31.8	0.0045	54.7
Worst-case OCS Emissions (SFWF)	33,772	0.2	1.6	12.9	80.7	521.5	17.5	16.9	3.6	0.0022	11.7
Worst-case Conformity Emissions -New Jersey	26,358	0.2	1.3	10.6	77.2	428.8	14.5	13.9	5.1	0.0015	12.3
Worst-case Conformity Emissions - New York	27,192	0.1	0.7	6.0	98.2	341.4	11.6	11.2	22.8	0.0010	30.9
Emissions in Other Water beyond 25 NM	9,704	0.1	0.5	4.0	27.9	159.7	5.4	5.2	1.6	0.0006	4.3
Sparrows Point, MD											
Total Construction Emissions (tons)	110,714	0.6	4.8	39.1	329.9	1,684.4	56.8	54.6	36.9	0.0060	67.0
Worst-case OCS Emissions (SFWF)	31,878	0.2	1.5	12.1	75.2	490.3	16.5	15.9	3.3	0.0021	10.8
Worst-case Conformity Emissions - Maryland	18,405	0.1	0.9	7.3	54.4	297.9	10.1	9.6	3.8	0.0011	8.8

Table 4.2-4. Estimated Total, OCS, and Conformity Emissions (tons) for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

Emission Type	CO_2	CH_4	N_2O	Black Carbon	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Worst-case Conformity Emissions - Virginia	20,247	0.1	1.0	8.1	59.6	328.2	11.1	10.6	4.1	0.0012	9.6
Worst-case Conformity Emissions - New York	22,820	0.1	0.5	4.3	85.7	269.4	9.1	8.9	22.1	0.0007	29.0
Emissions in Other Water beyond 25 NM	28,191	0.2	1.4	11.5	81.0	464.0	15.7	15.0	4.7	0.0017	12.3
Port of Norfolk, VA											
Total Construction Emissions (tons)	91,958	0.5	3.9	31.6	274.5	1,380.7	46.5	44.7	33.1	0.0049	58.1
Worst-case OCS Emissions (SFWF)	31,852	0.2	1.5	12.1	75.2	489.9	16.4	15.8	3.3	0.0021	10.8
Worst-case Conformity Emissions - Virginia	15,266	0.1	0.7	6.0	45.3	246.3	8.3	8.0	3.2	0.0009	7.4
Worst-case Conformity Emissions - Maryland	4,502	0.0	0.2	1.8	12.9	74.1	2.5	2.4	0.7	0.0003	2.0
Worst-case Conformity Emissions - New York	22,781	0.1	0.5	4.2	85.5	268.8	9.1	8.9	22.1	0.0007	29.0
Emissions in Other Water beyond 25 NM	28,359	0.2	1.4	11.6	81.4	466.7	15.8	15.1	4.7	0.0017	12.4

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Over the assumed one-year construction period, Project-related air emissions could have ***short-term***, ***minor*** impacts to air quality. The majority of Project emissions will occur over relatively short spans of time, and occur offshore, approximately 19 miles (30.6 km, 16.5 nm) or more from land, in the case of the SFWF, or along an approximately 26-mile (41.8-km) SFEC cable route. Impacts to air quality near populated areas is not anticipated, with the small exception of the SFEC - Onshore installation.

Operations and Maintenance

Annual total, OCS, and Conformity emissions from SFWF and SFEC O&M activities are summarized in Table 4.2-5 by port location. Similar to construction emissions, O&M conformity emissions vary slightly by port location, but OCS emissions do not vary by port location. O&M activities for the SFWF and SFEC are described in Sections 3.1.5 and 3.2.5, respectively, and would occur over a 25- year period. Potential O&M emissions will result from the operation of crew and maintenance vessels, vehicles, and emergency generators, which are anticipated to be located on the OSS and possibly on each WTG. The submarine segments of the SFEC are not expected to require routine O&M activity resulting in air emissions. However, SFEC-related emissions estimates include routine O&M activities at the SFEC – Interconnection Facility consisting of regular usage of standard pickup trucks, which are all considered Conformity emissions.

Table 4.2-5. Estimated Annual Total, OCS, and Conformity Emissions during Operations and Maintenance Period of the South Fork Wind Farm and South Fork Export Cable

Emissions Type	CO_2	CH_4	N_2O	Black Carbon	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Shinnecock Fish Dock, NY - Crew Vessels; Port of New Bedford, MA - Working Vessels											
Total O&M Emissions	**5,421**	**0.0**	**0.3**	**2.1**	**16.6**	**87.3**	**2.8**	**2.7**	**0.6**	**0.000 3**	**1.9**
Worst-case OCS Emissions (SFWF)	5,160	0.0	0.3	2.0	15.7	83.3	2.7	2.6	0.5	0.000 3	1.7
Worst-case Conformity Emissions - Massschusetts	303	0.0	0.0	0.1	0.9	5.2	0.2	0.2	0.0	0.000 0	0.1
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.000 1	0.3
Shinnecock Fish Dock, NY - Crew Vessels; Port of of Providence, RI - Working Vessels											
Total O&M Emissions	**5,635**	**0.0**	**0.3**	**2.1**	**17.2**	**91.0**	**2.9**	**2.8**	**0.6**	**0.000 4**	**1.9**
Worst-case OCS Emissions (SFWF)	5,173	0.0	0.3	2.0	15.8	83.5	2.7	2.6	0.5	0.000 3	1.7
Worst-case Conformity Emissions - Rhode Island	492	0.0	0.0	0.2	1.4	8.5	0.3	0.3	0.1	0.000 0	0.2
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.000 1	0.3
Shinnecock Fish Dock, NY - Crew Vessels; Port of New London CT - Working Vessels											
Total O&M Emissions	**5,666**	**0.0**	**0.3**	**2.2**	**17.3**	**91.5**	**2.9**	**2.8**	**0.6**	**0.000 4**	**2.0**
Worst-case OCS Emissions (SFWF)	5,440	0.0	0.3	2.1	16.5	88.1	2.8	2.7	0.5	0.000 3	1.8
Worst-case Conformity Emissions - Rhode Island	334	0.0	0.0	0.1	1.0	5.7	0.2	0.2	0.0	0.000 0	0.1
Worst-case Conformity Emissions - Connecticut	196	0.0	0.0	0.1	0.6	3.4	0.1	0.1	0.0	0.000 0	0.1
Worst-case Conformity Emissions - New York	1,154	0.0	0.1	0.4	4.0	16.0	0.5	0.5	0.1	0.000 1	0.3
Paulsboro Marine Terminal, NJ											
Total O&M Emissions (tons)	**10,10 3**	**0.1**	**0.5**	**3.9**	**30.1**	**167. 7**	**5.3**	**5.1**	**1.2**	**0.000 6**	**3.6**
Worst-case OCS Emissions (SFWF)	5,716	0.0	0.3	2.2	17.3	92.9	3.0	2.8	0.5	0.000 4	1.9
Worst-case Conformity Emissions - New Jersey	2,915	0.0	0.1	1.1	8.4	50.1	1.5	1.5	0.4	0.000 2	1.1

Table 4.2-5. Estimated Annual Total, OCS, and Conformity Emissions during Operations and Maintenance Period of the South Fork Wind Farm and South Fork Export Cable

Emissions Type	CO_2	CH_4	N_2O	Black Carbon	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Worst-case Conformity Emissions - New York	2,017	0.0	0.1	0.7	6.5	30.8	1.0	1.0	0.2	0.0001	0.7
Emissions in Other Water beyond 25 NM	1,122	0.0	0.1	0.4	3.2	19.3	0.6	0.6	0.1	0.0001	0.4
Sparrows Point, MD											
Total O&M Emissions (tons)	**13,023**	**0.1**	**0.6**	**5.0**	**38.5**	**217.9**	**6.8**	**6.6**	**1.5**	**0.0008**	**4.7**
Worst-case OCS Emissions (SFWF)	5,497	0.0	0.3	2.1	16.7	89.1	2.8	2.7	0.5	0.0004	1.8
Worst-case Conformity Emissions - Maryland	1,995	0.0	0.1	0.8	5.7	34.3	1.1	1.0	0.3	0.0001	0.8
Worst-case Conformity Emissions - Virginia	2,208	0.0	0.1	0.9	6.4	37.9	1.2	1.1	0.3	0.0001	0.8
Worst-case Conformity Emissions - New York	1,511	0.0	0.1	0.5	5.1	22.1	0.7	0.7	0.1	0.0001	0.5
Emissions in Other Water beyond 25 NM	3,260	0.0	0.2	1.3	9.4	56.0	1.7	1.7	0.4	0.0002	1.2
Port of Norfolk, VA											
Total O&M Emissions (tons)	**9,876**	**0.1**	**0.5**	**3.8**	**29.4**	**163.8**	**5.2**	**5.0**	**1.1**	**0.0006**	**3.5**
Worst-case OCS Emissions (SFWF)	5,494	0.0	0.3	2.1	16.7	89.1	2.8	2.7	0.5	0.0004	1.8
Worst-case Conformity Emissions - Virginia	521	0.0	0.0	0.2	1.5	8.9	0.3	0.3	0.1	0.0000	0.2
Worst-case Conformity Emissions - Maryland	521	0.0	0.0	0.2	1.5	8.9	0.3	0.3	0.1	0.0000	0.2
Worst-case Conformity Emissions - New York	1,507	0.0	0.1	0.5	5.1	22.0	0.7	0.7	0.1	0.0001	0.5
Emissions in Other Water beyond 25 NM	3,279	0.0	0.2	1.3	9.5	56.3	1.7	1.7	0.4	0.0002	1.2

Notes: All units in tpy. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated air emissions from the proposed O&M activities are expected to have ***negligible*** impacts to regional air quality. The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.

Potential impacts from O&M would be expected to be smaller compared to the impacts anticipated during construction activities. The only air emissions anticipated during O&M would result from maintenance vessels and crew transport vessels and would not be expected to cause an adverse impact on air quality within the surrounding area of the SFWF.

Decommissioning

Estimated air emissions from the conceptual decommissioning activities for the SFWF and SFEC are summarized in Table 4.2-6 by port location. Similar to construction and O&M emission estimates, the decommissioning conformity emissions vary based on port location, but the OCS air emissions do not vary by port location. These estimates are based on the conceptual approach for decommissioning the SFWF and SFEC, as explained in Sections 3.1.6 and 3.2.6, respectively. Decommissioning emissions would be an order of magnitude less than those for construction activities and would result largely from the operation of the construction equipment and vessels or aircraft. There would be no air emissions from the Project once decommissioning is complete.

Table 4.2-6. Estimated Emissions from Decommissioning for the South Fork Wind Farm and South Fork Export Cable by Port

Emissions Type	CO2	CH4	N2O	Black Carbon	CO	NOX	PM10	PM2.5	SO2	Lead	VOC
Port of New Bedford, MA											
SFWF	3,288	0.0	0.2	1.2	8.9	51.3	1.7	1.6	0.6	0.0002	1.5
SFEC	4,844	0.0	0.1	1.0	16.9	58.0	2.0	1.9	4.0	0.0002	5.4
Port of Providence, RI											
SFWF	3,654	0.0	0.2	1.4	9.9	57.5	1.9	1.8	0.7	0.0002	1.6
SFEC	4,896	0.0	0.1	1.0	17.1	58.7	2.0	2.0	4.0	0.0002	5.4
Port of New London, CT											
SFWF	3,958	0.0	0.2	1.4	11.1	61.4	2.0	1.9	0.9	0.0002	1.9
SFEC	4,904	0.0	0.1	1.0	17.1	58.8	2.0	2.0	4.0	0.0002	5.4
Paulsboro Marine Terminal, NJ											
SFWF	11,280	0.1	0.5	4.6	31.4	186.8	6.3	6.0	2.3	0.0006	5.4
SFEC	5,994	0.0	0.2	1.4	20.6	74.9	2.6	2.5	4.1	0.0003	5.7
Sparrows Point, MD											
SFWF	16,515	0.1	0.8	6.7	46.4	274.4	9.2	8.8	3.5	0.0009	8.1
SFEC	6,711	0.0	0.2	1.7	22.9	85.5	2.9	2.8	4.1	0.0003	5.9
Port of Norfolk, VA											
SFWF	12,791	0.1	0.6	5.2	35.6	212.5	7.1	6.8	2.6	0.0007	6.1
SFEC	6,211	0.0	0.2	1.5	21.3	78.1	2.7	2.6	4.1	0.0003	5.8

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated total, OCS, and Conformity emissions were also calculated for the decommissioning phase and are presented in Table 4.2-7. Appendix L breaks down decommissioning emissions on an annual basis for OCS permitting purposes.

Table 4.2-7. Estimated Total, OCS, and Conformity Emissions during Decommissioning for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

	CO_2	CH_4	N_2O	Black Carbon	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Port of New Bedford, MA											
Total Decommissioning Emissions	**8,132**	**0.0**	**0.3**	**2.2**	**25.8**	**109.2**	**3.7**	**3.6**	**4.7**	**0.0004**	**6.9**
Worst-case OCS Emissions (SFWF)	5,296	0.0	0.3	2.0	12.7	81.0	2.7	2.6	0.5	0.0004	1.8
Worst-case Conformity Emissions - Massschusetts	841	0.0	0.0	0.3	2.7	12.9	0.4	0.4	0.3	0.0000	0.5
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
Port of Providence, RI											
Total Decommissioning Emissions	**8,550**	**0.0**	**0.3**	**2.4**	**27.0**	**116.2**	**3.9**	**3.8**	**4.7**	**0.0004**	**7.1**
Worst-case OCS Emissions (SFWF)	5,322	0.0	0.3	2.0	12.8	81.4	2.7	2.6	0.5	0.0004	1.8
Worst-case Conformity Emissions - Rhode Island	1,210	0.0	0.1	0.4	3.8	19.0	0.6	0.6	0.4	0.0001	0.7
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
Port of New London, CT											
Total Decommissioning Emissions	**8,862**	**0.0**	**0.3**	**2.5**	**28.2**	**120.2**	**4.0**	**3.9**	**4.9**	**0.0004**	**7.4**
Worst-case OCS Emissions (SFWF)	5,843	0.0	0.3	2.2	14.0	89.1	3.0	2.9	0.6	0.0004	2.0
Worst-case Conformity Emissions - Rhode Island	901	0.0	0.0	0.3	2.9	13.9	0.5	0.4	0.3	0.0000	0.6
Worst-case Conformity Emissions - Connecticut	635	0.0	0.0	0.2	2.2	9.4	0.3	0.3	0.3	0.0000	0.5
Worst-case Conformity Emissions - New York	3,720	0.0	0.1	0.6	14.3	41.3	1.4	1.4	3.9	0.0001	5.1
Paulsboro Marine Terminal, NJ											
Total Decommissioning Emissions (tons)	**17,274**	**0.1**	**0.7**	**6.0**	**52.0**	**261.8**	**8.8**	**8.5**	**6.3**	**0.0009**	**11.1**
Worst-case OCS Emissions (SFWF)	6,382	0.0	0.3	2.4	15.8	99.1	3.3	3.2	0.7	0.0004	2.3

Table 4.2-7. Estimated Total, OCS, and Conformity Emissions during Decommissioning for the South Fork Wind Farm and South Fork Export Cable for Monopile Foundations

	CO_2	CH_4	N_2O	Black Carbon	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Worst-case Conformity Emissions -New Jersey	5,941	0.0	0.3	2.4	17.3	98.0	3.3	3.2	1.3	0.0003	2.9
Worst-case Conformity Emissions - New York	5,405	0.0	0.2	1.3	19.1	69.4	2.4	2.3	4.3	0.0002	5.9
Emissions in Other Water beyond 25 NM	2,191	0.0	0.1	0.9	6.3	36.6	1.2	1.2	0.4	0.0001	1.0
Sparrows Point, MD											
Total Decommissioning Emissions (tons)	**23,226**	**0.1**	**1.0**	**8.4**	**69.3**	**359.9**	**12.1**	**11.6**	**7.6**	**0.0012**	**14.0**
Worst-case OCS Emissions (SFWF)	5,955	0.0	0.3	2.3	14.6	92.0	3.1	3.0	0.6	0.0004	2.1
Worst-case Conformity Emissions - Maryland	4,145	0.0	0.2	1.7	12.2	68.0	2.3	2.2	0.9	0.0002	2.1
Worst-case Conformity Emissions - Virginia	4,561	0.0	0.2	1.8	13.4	74.9	2.5	2.4	1.0	0.0003	2.3
Worst-case Conformity Emissions - New York	4,418	0.0	0.1	0.9	16.3	52.9	1.8	1.8	4.1	0.0001	5.4
Emissions in Other Water beyond 25 NM	6,364	0.0	0.3	2.6	18.2	106.2	3.6	3.4	1.2	0.0004	3.0
Port of Norfolk, VA											
Total Decommissioning Emissions (tons)	**19,002**	**0.1**	**0.8**	**6.7**	**56.9**	**290.6**	**9.8**	**9.4**	**6.7**	**0.0010**	**11.9**
Worst-case OCS Emissions (SFWF)	5,949	0.0	0.3	2.3	14.6	91.9	3.1	3.0	0.6	0.0004	2.1
Worst-case Conformity Emissions - Virginia	3,437	0.0	0.2	1.4	10.2	56.2	1.9	1.8	0.8	0.0002	1.8
Worst-case Conformity Emissions - Maryland	1,016	0.0	0.0	0.4	2.9	17.0	0.6	0.5	0.2	0.0001	0.5
Worst-case Conformity Emissions - New York	4,409	0.0	0.1	0.9	16.3	52.8	1.8	1.8	4.1	0.0001	5.4
Emissions in Other Water beyond 25 NM	6,403	0.0	0.3	2.7	18.3	106.8	3.6	3.4	1.2	0.0004	3.0

Note: All units in tons. Black carbon is the sooty black material emitted from combustion sources and it is included because it comprises a significant portion of particulate matter or PM.

Estimated emissions anticipated during decommissioning would result largely from the operation of the construction equipment and vessels or aircraft and would not be expected to cause an adverse impact on air quality within the surrounding area of the SFWF. There would be no further air emissions from the SFWF once decommissioning is complete. Overall, air quality impacts from decommissioning would be considered ***negligible***.

4.2.1.3 Proposed Environmental Protection Measures

The construction activities for the SFWF and SFEC are planned and designed in a manner that will avoid, minimize, and mitigate the potential impacts to air quality.

- Vessels providing construction or maintenance services for the SFWF will use low sulfur fuel where possible.
- Vessel engines will meet the appropriate EPA air emission standards for NO_X emissions when operating within Emission Controls Areas.
- Equipment and fuel suppliers will provide equipment and fuels that comply with the applicable EPA or equivalent emission standards.
- Marine engines with a model year of 2007 or later and non-road engines complying with the Tier 3 standards (in 40 CFR 89 or 1039) or better will be used to satisfy best available control technology (BACT).

In addition, the use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions. Table 4.2-8 presents the estimated annual avoided emissions from the operation of the SFWF. Avoided emissions were based on New York's annual nonbaseload outputs and rates. The estimated annual and lifetime (25 years) emissions were calculated based on 392,500 MW hours. The Project is expected to annually displace CO_2, NO_x, and SO_2 produced by the New York electric grid and decrease the creation of GHG in the atmosphere from these sources.

Table 4.2-8. Estimated Annual and Lifetime Avoided Emissions for the Operation of the South Fork Wind Farm over a 25-year Period

Pollutant (metric tons)	CO_2	NOx	SO_2	N_2O	CH_4	CO_2e
Annual Avoided Emissions	217,653	234	164	1,454	6	798,125
Lifetime Avoided Emissions	5,441,325	5,855	4,091	36,355	147	19,535,130

Note: All units in metric tons.

4.2.2 Water Quality and Water Resources

This section provides a description of water quality and water resource conditions in the SFWF and SFEC, as defined by several parameters including: dissolved oxygen; chlorophyll; nutrient content; seasonal variations in algae or bacterial content; upwelling conditions; contaminants in water or sediment; and turbidity or water visibility. This section also briefly discusses relevant anthropogenic activities that have in the past or currently may impact water quality, including point and nonpoint source pollution discharges, deposition and spills, and pollutants in the water or in sediment.

The description of the affected environment and assessment of potential impacts for water quality and water resources was evaluated by reviewing the revised Environmental Assessment completed as part of the BOEM NEPA review for the RI-MA WEA (BOEM, 2013) and the OSAMP (RI CRMC, 2010). In addition, current public data sources related to water quality and water resources in Suffolk County and on Long Island, including local, regional, state, and federal agency-published papers and reports and published journal articles were reviewed.

4.2.2.1 Affected Environment

The SFWF and SFEC will occur in federal and state marine waters, and the SFEC - Onshore will occur near surface water (tidal waters and freshwater wetlands) and groundwater resources. This section describes the water resources in the SFWF and SFEC and the metrics used to describe their condition according to available data.

Regional Overview

The SFWF and SFEC - OCS are located in offshore marine waters where available water quality data are limited. However, the threat to marine water quality is reduced at greater distances from shore and with exposure to the movement of high-water volume through oceanic circulation, causing pollutants to be dispersed, diluted, and biodegraded (BOEM, 2013).

The SFEC - NYS is located in coastal marine waters of New York State where there is also limited water quality data available. The EPA rated the quality of the nation's coastal waters as "poor," "fair," and "good" for the 2010 National Coastal Condition Assessment (NCCA) (EPA, 2015) from data collected at 238 Northeast Coast sampling locations from Maine through Virginia. The NCCA used physical and chemical indicators to rate water quality, including phosphorous, nitrogen, dissolved oxygen, salinity, water clarity, pH, and chlorophyll a. The National Coastal Condition Report (NCCR) presents a summary of data collected for assessing the ecological and environmental conditions of U.S. coastal waters. Data have been collected since 1997 and summarized in four different reports. This NCCR IV presents an assessment of data collected from 2003 to 2006. The water quality of the coastal waters ranging from Maine to North Carolina, which is inclusive of the SFWF and SFEC, was rated as "good" to "fair" (EPA, 2012). This survey only included four sites located near the SFWF and SFEC: four sampling locations within Block Island Sound.

<u>Dissolved Oxygen</u>

Dissolved oxygen (DO) is the amount of oxygen present in water received from the atmosphere and from aquatic plants. Low levels of oxygen (hypoxia) or no oxygen levels (anoxia) can occur when excess organic material, such as large algal blooms, are decomposed by microorganisms (LICAP, 2016). Water sampling conducted at four stations in Rhode Island Sound in 2002 by the USACE found that DO concentrations both at the surface and in bottom waters remained above established levels for the "highest quality marine waters" and suggests that hypoxic and anoxic conditions do not typically occur in those areas (RI CRMC, 2010).

The NCCR IV (EPA, 2012) points out that the overall condition of DO in the Northeast Coast region is fair. However, a summary of data in the NCCA shows the stations within Block Island Sound area to have good water quality conditions (EPA, 2015).

Chlorophyll a

Chlorophyll *a* is the main photosynthetic pigment in green algae. The concentration of chlorophyll gives an indication of the volume of aquatic plants present in the water column. For this reason, chlorophyll *a* is used as a metric of plant production, called "primary production" because of the ability of plants to capture energy from sunlight and is described in units of grams of carbon per meter square per day (g C m^{-2} day^{-1}). The RI CRMC adapted a table (Table 4.2-9) from Hyde (2009) to compare the range of primary production throughout the year for OSAMP waters and nearby ecosystems. Primary production in the OSAMP area is comparable to other coastal systems, just slightly lower than the value ranges presented for Narragansett Bay and New York Bight.

Table 4.2-9. Comparison of the Range of Primary Production (g C m^{-2} day^{-1}).

Ecosystem	Production	Reference
OSAMP	143-204	Hyde, 2009
Narragansett Bay	160-619	Oviatt et al., 2002
Massachusetts Bay	160-570	Keller et al., 2001; Oviatt et al., 2007; Hyde et al., 2008
New York Bight	370-480	Malone and Chervin, 1979

Table adapted from RI CRMC, 2010

Limited data are available on nutrient levels (e.g., silica, nitrogen, and phosphorus) in the waters south of Rhode Island and Massachusetts. Dissolved nutrients are discharged from Narragansett Bay, Long Island Sound, and Buzzards Bay; research on Block Island Sound water quality also suggests that nutrient concentrations had seasonal variation, with peaks in the autumn, and nearly undetectable levels in the late spring and early summer months (Staker and Bruno, 1977).

Water quality data collected in Northeast coastal waters indicates that concentrations of chlorophyll *a* continue to be elevated when compared to thresholds used to evaluate water quality in coastal waters; therefore, the waters are considered to represent fair water quality conditions (EPA, 2012; EPA, 2015).

Algae and Bacterial Content

Nutrients are chemical elements that all living organisms need for growth. Problems arise when too much of a nutrient is introduced into the environment through human activities. In surface waters, excess nutrients fuel algal blooms which can lead to water quality degradation. Severe or harmful algal blooms can result in the depletion of oxygen in the water that aquatic life needs for survival. Algal blooms also reduce water clarity preventing desirable plant growth, such as seagrasses, reduce the ability of aquatic life to find food, and clog fish gills. In groundwater, excess nitrogen can cause nitrate concentrations to rise to levels unsafe for drinking water (LICAP, 2016). Freshwaters are primarily affected by excess phosphorus, while in coastal waters, nitrogen is the nutrient of highest concern. In some cases, both nutrients may interact and contribute to the water pollution problem (RI DEM, 2010).

Waterborne pathogens include bacteria, viruses, and other organisms that may cause disease or health problems in native species and in humans. When pathogens are present in water at elevated concentrations, the beneficial uses of waters are adversely affected prompting restrictions (closures) at public beaches and on the harvest of shellfish.

The SFWF and SFEC is located in waters that are considered temperate and therefore, subject to highly seasonal variation in temperature, stratification, and productivity. There is little information on the algal and bacteria dynamics in either Block Island or Rhode Island Sounds. According to RI CRMC (2010), there were no documented reports of harmful algal blooms or waterborne pathogen outbreaks in the waters of either Block Island or Rhode Island Sounds as of 2010.

Upwelling/Currents

The physical oceanographic and meteorological conditions of the SFWF and SFEC are described in Section 4.2.4.

Contaminants in Water or Sediment

Data on water-column contaminant levels in Rhode Island Sound are limited. Organic contaminants (polychlorinated biphenyls [PCBs] and pesticides) measured in 2001 and 2002 were generally below method detection limits (USACE, 2004). For example, total PCB concentrations were less than 46 parts per trillion, and total dichlorodiphenyltrichloroethanes (DDTs) were less than 4 parts per trillion. Water-column dissolved metals concentrations in Rhode Island Sound were also low, with concentrations generally less than 1 part per billion. Dissolved metal concentrations appeared similar throughout the year and throughout Rhode Island Sound. Metals, PCBs, and pesticide concentrations measured in the water column within the OSAMP area in 2002 were well below ambient RI DEM water quality criteria for toxic pollutants (RI CRMC, 2010).

SFW completed chemical analyses of geotechnical sediment samples from the SFEC - NYS and completed testing for the following contaminants: arsenic; cadmium; copper; lead; mercury; benzene; total benzene, toluene, ethylbenzene, and xylenes (BTEX); total PAH; Sum of DDT + dichlorodiphenyldichloroethene (DDE)+ dichlorodiphenyldichloroethane (DDD); mirex; chlordane; dieldrin; PCBs (sum of aroclors); dioxin (Toxic Equivalency Total); grain size; and total organic carbon. The methods used for this sampling procedure and the results are described in the following section on water quality in the SFEC - NYS, and in greater detail in Appendix H.

Toxicity testing at dredged materials disposal sites in Rhode Island Sound indicates that the constituents do not appear to pose a significant threat to water quality in the Rhode Island Sound area (RI CRMC, 2010).

Turbidity

Turbidity is the measure of cloudiness or haziness in water caused by suspended solids (e.g., sediments or algae). Ocean waters beyond 3 miles (4.8 km, 2.6 nm) offshore typically have very low concentrations of suspended particles and low turbidity. Turbidity in Rhode Island Sound from five studies cited in USACE (2004) ranged from 0.1 to 7.4 mg/L TSS. Bottom currents may re-suspend silt and fine-grained sands, causing higher suspended particle levels in benthic waters. Storm events, particularly frequent intense wintertime storms, may also cause a short-term increase in suspended sediment loads. (BOEM, 2013)

Additional information on turbidity impacts (TSS and deposition) resulting from construction activities in the SFWF and SFEC are described further in the Hydrodynamic and Sediment Transport Modeling Results in Appendix I.

Anthropogenic Activities

Current anthropogenic activities that are sources of water quality degradation include point source pollution and nonpoint source pollution. Point source pollutants, which enter waterways at well-defined locations, such as pipe or sewer outflows are the most common sources of water pollution. There are no direct municipal wastewater or industrial point sources for pollution into or within the SFWF and SFEC.

Nonpoint source pollutants, however, are considered the largest contributors to water pollution and water quality degradation. Various human land-use practices, such as agriculture, construction activities, urban runoff, and deposition of airborne pollutants, can introduce nutrients, bacterial and chemical contaminants, and sediments, which all can impact coastal water quality and water resources (NYSDEC, 2018).

There is a 1.3 square mile (3.24 km^2) site in east-central Rhode Island Sound (the Rhode Island Sound Disposal Site) that was designated in December 2004 for the disposal of dredge material, including approximately 120 million cubic feet (Mft^3; 3.4 million cubic meters [Mm^3]) of sediment from Providence River. The disposal site is located approximately 13 miles (21 km) south of Narragansett Bay and is approximately 6 miles (9 km) northwest from the nearest part of the SFWF and SFEC (RI CRMC, 2010). There are no other active open water disposal sites in federal waters near the SFWF, SFEC – OCS, and SFEC - NYS (USACE, 2018).

South Fork Wind Farm

As described previously, there is minimal available information related to offshore water quality specific to the SFWF. The movement of water and currents through the SFWF are described in Section 4.2.4. In addition, SFW completed the geophysical and geotechnical (G&G) survey reports of the seafloor within the SFWF to categorize the geophysical and chemical properties of the sediment for the purposes of improved micro-siting of the WTGs, as well as to understand the risks associated with seafloor disturbance and contaminants in the sediment at the SFWF (Appendix H).

South Fork Export Cable

This section discusses water quality and water resources that could be impacted by the SFEC - OCS, SFEC - NYS, and SFEC - Onshore.

SFEC - OCS

The SFEC - OCS extends from the SFWF passing through the OSAMP area, to the boundary of New York State waters, south of the two potential landing sites (Figure 1.1-2). As noted for the SFWF, SFW completed testing of the seafloor along a proposed SFEC - OCS route corridor to categorize the geophysical and chemical properties of the sediment for the purposes of improved micro-siting of the cable route, as well as to understand the risks associated with seafloor disturbance and contaminants in the sediment along the path of the SFEC - OCS (Appendix H).

SFEC - NYS

The SFEC - NYS extends from where the SFEC - OCS crosses into New York State waters and connects on shore at one of the potential landing sites on the south shore of Long Island in East Hampton. These waters are categorized by the NYSDEC as a Class SA saline surface waterbody and are described as "suitable for fish, shellfish, and wildlife propagation, and survival." The best uses of Class SA waters are "shellfishing for market purposes, primary, and secondary contact recreation and fishing" (NYSDOS, 2018a).

SFW completed a geotechnical analysis of 12 vibracores collected in New York State waters using techniques described in Appendix H3, Geotechnical Data Report. Samples were analyzed along the two proposed SFEC - NYS routes and landing sites at Beach Lane and Hither Hills, with six cores collected from each approach. Sediment contaminant concentration results from these cores correspond to Class A (No Appreciable Contamination) as defined in the Sediment Quality Thresholds described in the Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1999) for in-water/riparian placement.

SFEC - Onshore

Onshore surface waters found along the SFEC - Onshore route options include marine subtidal and intertidal waters, mudflats, as well as a variety of freshwater water resource types including bogs, marshes, ponds, streams, swamps, and various groundwater-influenced ditches and swales. These tidal and freshwater wetlands and waterbody features are regulated by the USACE, NYSDEC, and the town and/or the village of East Hampton. Descriptions of the tidal and freshwater wetlands and water bodies are provided in the Onshore Biological Resources Report (Appendix M) and in Section 4.3.1.

Surface Waters

The fresh and marine water resources of eastern Suffolk County are diverse and abundant with coastal waters forming the county's boundaries to the north, east, and south. Most of the bays along Suffolk County's southern coast are designated as impaired; that is, they are in violation of state water quality standards. A variety of algae blooms proliferates in warmer weather. In addition to regular algae blooms, there are "harmful" algae blooms, "red tides," "rust tides" and "brown tides" comprising different types of problematic microscopic organisms, all linked to excess nitrogen pollution from wastewater-derived effluent (primarily cesspools and septic systems) and atmospheric deposition (Suffolk County Department of Health Services, 2017). These algal blooms could have adverse impacts on swimming, fishing, shellfishing, and boating.

Suffolk County's fresh surface water resources are also considered abundant and generally of sufficient quality to support multiple uses. Within the county, New York State has classified more than 200 freshwater streams and ponds and regulates over 1,050 freshwater wetlands covering nearly 24,000 acres (9,712 ha) (Suffolk County, 2015). Suffolk County surface waters are regularly monitored, and their quality is assessed as part of other ongoing programs, including New York State's identification of impaired waters under Section 303(d) (NYSDEC, 2017c).

However, coastal waters throughout eastern Suffolk County are impacted to varying degrees by contaminants introduced by nonpoint sources. Nonpoint sources are considered to be the major contributors of nutrients and pathogens. Nitrogen and pathogens were identified as the parameters with the greatest impacts in terms of limiting uses and stressing the living marine resources. As of 2014, almost 30,000 acres (12,140 ha) are closed to shellfishing year-round, and approximately 9,000 acres (3,642 ha) are closed on a seasonal basis (NYSDEC, 2014; Suffolk County, 2015). Toxic contaminants along with emerging contaminants such as pharmaceuticals and personal care products also play a role in imparting stress on the living resources of Suffolk County's coastal waters.

Most of the marine surface waters in the East Hampton area are classified by the NYSDEC as Class SA saline waters (NYSDEC, 2017c; Suffolk County, 2015). The NYSDEC classifies the best usages of Class SA waters as shellfishing for market purposes, primary and secondary contact recreation, and fishing. These waters would be considered suitable for fish propagation and survival. Freshwater classifications for waterbodies in the SFEC - Onshore are classified by the NYSDEC as Class C or Class D waters. Class C waters are for fishing. These waters are also suitable for fish propagation and survival. The water quality of Class C waters is suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. The best usage of Class D waters is fishing. The NYSDEC states that natural water conditions, such as intermittency of flow, are not conducive to propagation of game fishery, or stream bed conditions; therefore, these waters generally would not support fish propagation. The Class D waters would be suitable for fish survival. The water quality also would be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes (NYSDEC, 2017c).

Groundwaters

Long Island is considered a sole source aquifer region, which means that groundwater is the single water supply source. Most of Long Island's drinking water is from groundwater with surface water an insignificant contributor. There are four primary formations, which are layered and make up the Long Island aquifer system: Upper Glacial Aquifer, Magothy Aquifer, Raritan Clay, and Lloyd Aquifer. The three most important Long Island aquifers are the Upper Glacial Aquifer, the Magothy Aquifer, and the Lloyd Aquifer (USGS, 2017; NYSDEC, 2017d). Most of the private groundwater wells and the wells that provide water to farms, golf courses, and industry tap the Upper Glacial Aquifer. Because the population is less dense and the threat of contamination in the aquifer is reduced, public supply wells in eastern Suffolk County also take water from the Upper Glacial Aquifer (LICAP, 2016).

Groundwater throughout most of eastern Suffolk County is of generally high quality (NYSDOH, 2003). All freshwater groundwater in New York State is Class GA, a source for potable water supply (NYSDOS, 2018b) With rare exceptions, potable water supplied by community water systems in Suffolk County meet all drinking water quality standards.

However, according to Suffolk County, median groundwater nitrogen levels in the Upper Glacial Aquifer have risen 40 percent to 3.58 mg/L, and the Magothy Aquifer has seen a 93 percent increase in nitrogen levels to 1.76 mg/L since 1987. While nitrogen levels are generally below the drinking water standard, there are some areas that now exceed the 10 mg/L limit. These aquifers, of course, are recharged through surface water and subsurface wastewater infiltration.

Groundwater along the SFEC – Onshore corridor and at the SFEC – Interconnection Facility generally flows both downward and horizontally to the south, toward the Atlantic Ocean, and ranges from a depth of zero feet below ground surface (bgs) at the Beach Lane and Hither Hills landing sites to approximately 40 feet (12 m) bgs at the proposed SFEC – Interconnection Facility.

The Beach Lane and Hither Hill landing sites are underlain by the Upper Glacial and Magothy aquifers. The area is vulnerable to saltwater intrusion from over-pumping of groundwater (Nemickas and Koszalka, 1982). Groundwater depths to the Upper Glacial Aquifer at the potential landing sites are estimated to be less than 11 feet (3.4 m) from the ground surface (USGS, 2017), but typical groundwater depths along the south coastline of eastern Suffolk County have been shown to be depths ranging from approximately 4 to 5 feet (1.2 to 1.5 m) bgs (GZA, 2018).

4.2.2.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to impact water quality and water resources, as discussed in the following sections. All impacts are anticipated to be short-term and not result in permanent or long-term impacts to water quality or water resources. An overview of the potential IPFs and their potential impacts to water quality and water resources associated with the SFWF and SFEC is presented on Figure 4.2-2.

The IPFs that may impact water quality and water resources include seafloor and land disturbance, sediment suspension and deposition, discharges and releases, and trash and debris. Supporting information on the negligible level of impact from the trash and debris IPF is provided in Section 4.1. An evaluation of the remaining IPFs that may impact water quality are presented in the following sections.

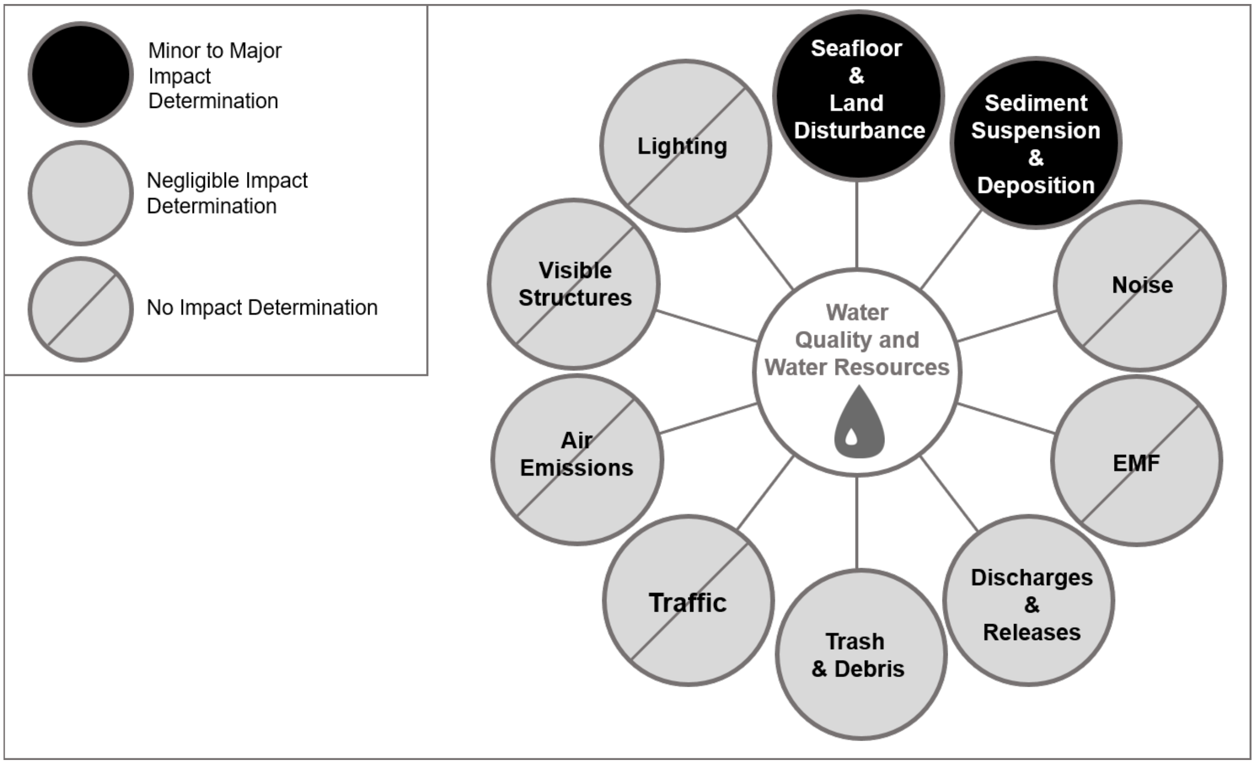

Figure 4.2-2. IPFs on Water Quality and Water Resources
Illustration of potential impacts to water quality resulting from SFWF and SFEC activities

South Fork Wind Farm

Construction

Seafloor Disturbance

Impacts to marine water quality resulting from seafloor disturbance activities during the construction of the SFWF are expected to be ***minor*** and ***short-term***. Sediment disturbance from pile-driving, foundation placement, cable-laying, and the positioning of jack-up barges and vessel anchors would result in a ***short-term*** and ***localized*** increase in suspended sediment concentrations at the seafloor, as addressed below.

Sediment Suspension and Deposition

All seafloor-disturbing construction activities including foundation work, installation of the Inter-array Cable using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, positioning of jack-up barges, boulder relocation, and positioning of vessel anchors will result in ***short-term*** and ***localized*** suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For jet plow activity, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the Inter-Array Cable (Appendix I).

A modeling simulation was conducted on a representative section of the Inter-Array Cable which estimated that the maximum modeled TSS concentration from SFWF Inter-Array Cable installation is 100 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) within 18 minutes (0.3 hour) from the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation. These localized impacts to marine water quality would be ***short-term*** and ***minor*** and should not impact DO, chlorophyll *a*, or nutrient balance in the region. In addition, the sediment in the SFWF is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments.

Discharges and Releases

Multiple vessels will be used during the construction of the SFWF, as addressed in Section 3.1.3.1. Vessels will comply with regulatory requirements for management of onboard fluids and fuels, including prevention and control of discharges and accidental spills. Vessels will be navigated by trained, licensed vessel operators who will adhere to navigational rules and regulations, and vessels will be equipped with spill handling materials. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). The likelihood of discharges and releases is expected to be low and impacts to water quality are unlikely and considered ***negligible***.

Some liquid wastes are allowed to be discharged to marine waters during the construction phase of the SFWF. These discharges include domestic water, deck drainage, treated sump drainage, uncontaminated ballast water, and uncontaminated bilge water, as described in Appendix F. These discharges are not expected to pose a water quality impact to marine water, because these releases would quickly disperse, dilute, and biodegrade (BOEM, 2013). All project vessels will comply with USCG standards in U.S. territorial waters to legally discharge uncontaminated ballast and bilge water, and standards regarding ballast water management.

Other liquid wastes such as sewage, chemicals, solvents, and oils and greases from equipment, vessels, or facilities will be stored and properly disposed on land. A list of chemicals to be utilized during the project is provided as required by 30 CFR 585.626 in Appendix F.

<u>Operations and Maintenance</u>

Seafloor Disturbance

Seafloor disturbance during O&M is expected to only occur if the Inter-array Cable or scour protection around the WTGs require maintenance that exposes the Inter-array Cable or disturbs the area around the scour protection. These maintenance activities are considered nonroutine events and are not expected to occur with any regularity. Impacts associated with exposing the Inter-array Cable or disturbing the scour protection may be similar to, but less frequent than, those described for the construction phase for the SFWF.

In addition, vessels are not expected to anchor during O&M activities unless the Inter-array Cable or WTGs require maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to those discussed in the construction phase for the SFWF.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M would primarily result from vessel anchoring and any maintenance activities associated with a repair of the Inter-array Cable. These activities are expected to be nonroutine events and not expected to occur with any regularity. If maintenance or an emergency repair of the Inter-array Cable is required, impacts on water quality would only include local increases in turbidity and resuspension of sediments. Sediment suspension and deposition impacts resulting from vessel activity or maintenance and repair during SFWF O&M are expected to be similar, or less than sediment suspension and deposition impacts described for the construction phase.

Discharges and Releases

There may be a small, temporary diesel generator at each WTG location on the work deck of the foundation. If present, the generator will have a 50-gallon diesel tank with secondary containment. The OSS may also include a small permanent diesel generator with a 500-gallon diesel tank with secondary containment.

The operation of the SFWF is not anticipated to generate any sources of pollutants to the marine environment. To make sure that no discharges of fluids (oil, hydraulic, cooling, etc.) occur even under abnormal circumstances, the WTG and the OSS will be designed for secondary levels of containment as described in more detail in Section 3.1 and in Appendix F. Most maintenance would occur inside the WTGs, thereby reducing the risk of a spill, and no oils or other waste is expected to be discharged during service events. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). The original coating system on the towers is designed to last the lifetime of the structure; therefore, no painting is anticipated during the life of the turbines other than to repair minor surface damage. As a result, impacts to surface water quality during O&M is expected to be ***negligible***.

As with vessels associated with construction, any vessels used for O&M activities will comply with USCG regulations and applicable spill prevention, control, and countermeasure (SPCC) plans; therefore, potential impacts from spills are considered unlikely resulting in ***negligible impacts*** to water quality.

The proposed Inter-array Cable and SFEC do not contain any fluid. There will be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials will be released.

<u>Decommissioning</u>

Decommissioning of the SFWF is expected to have similar impacts to water quality as construction of the WTGs, OSS, and Inter-array Cable.

SFEC – OCS

<u>Construction</u>

Seafloor Disturbance

Impacts to marine water quality resulting from seafloor disturbance activities during the installation of the SFEC - OCS are expected to be ***minor*** and ***short-term***, consisting of sediment disturbance from cable-laying and the positioning of vessel anchors. These seafloor disturbance activities will result in a ***short-term*** and ***localized*** increase in suspended sediment concentrations, which is described in more detail in the next subsection.

Sediment Suspension and Deposition

Installation of the SFEC - OCS using cable installation equipment that could include either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, and positioning of vessel anchors will result in ***short-term*** and ***localized*** suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For jet plow activity, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the SFEC - OCS (Appendix I).

A modeling simulation was conducted for one of three types of equipment that could be used for cable installation along the SFEC - OCS which indicated that the maximum modeled TSS concentration from SFEC - OCS installation is 1,347 mg/L. The highest TSS concentrations are predicted to occur in locations where the jet plow passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route – see Appendix H), but concentrations above 30 mg/L otherwise remain within approximately 328 feet (100 m) of the source during the simulation. For the maximum predicted TSS concentrations, water column concentrations of 100 mg/L or greater are predicted to extend up to 1,115 feet (340 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.4 hours after the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation. These localized impacts to marine water quality would be ***short-term*** and ***minor*** and are not anticipated to affect DO, chlorophyll *a*, or nutrient balance in the region. In addition, the sediment in the SFEC - OCS is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments**.**

Discharges and Releases
Impacts associated with discharges and releases during construction of the SFEC - OCS are expected to be similar to those described for the SFWF Inter-array Cable.

<u>Operations and Maintenance</u>

Seafloor Disturbance
Seafloor disturbance during O&M would only occur if the SFEC - OCS requires maintenance or repair. Maintenance or repair of the SFEC - OCS is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the SFEC - OCS are expected to be similar to but less frequent than those described for the construction phase.

In addition, vessels are not expected to anchor during O&M activities unless the SFEC - OCS requires maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to those discussed in the construction phase for the SFWF.

Sediment Suspension and Deposition
Impacts associated with sediment suspension and deposition during O&M of the SFEC - OCS are expected to be similar to those described for O&M of the SFWF Inter-array Cable.

Discharges and Releases
Impacts associated with discharges and releases during O&M of the SFEC - OCS are expected to be similar to those described for O&M of the SFWF Inter-array Cable.

<u>Decommissioning</u>

Decommissioning of the SFEC - OCS would have similar impacts as construction.

SFEC - NYS

<u>Construction</u>

Seafloor Disturbance
Impacts to marine water quality resulting from seafloor disturbance activities during the installation of the SFEC - NYS would be ***minor*** and ***short-term***, consisting of sediment disturbance from cable-laying, the temporary cofferdam, and the positioning of vessel anchors. Sediments disturbed during these activities are not expected to introduce contaminants into the water column based on results of vibracores collected along the SFEC - NYS as presented in Appendix G of the Fugro Geotechnical Data Report (Appendix H3). These seafloor disturbance activities will result in a ***short-term*** and ***localized*** increase in suspended sediment concentrations which is described in more detail in the next subsection.

HDD will avoid disturbance to inter-tidal zone, beach, and dunes. For the HDD landing, spoils from the trench excavation will be stored and returned to the trench after the SFEC is installed. Based on the composition of the surficial materials surrounding the boreholes, it is unlikely the drilling mud will penetrate more than 3 feet (0.9 m) of the aquifer (GZA, 2018).

The slurry used for the drilling process is comprised of bentonite clay and water; bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. No impacts to chemistry or hydrogeology are anticipated at any depths.

HDD operations are not expected to threaten private, residential wells because they will occur at safe distances. For example, at areas near the Beach Lane landing site, water pumped from residential wells draw from approximately 5 feet (1.5 m) away from the intake around the well site.

Sediment Suspension and Deposition
Installation of the SFEC - NYS using a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow, positioning of vessel anchors, and sediment disturbance during installation of the temporary cofferdam will result in short-term and localized suspension of sediment in the water column. The magnitude of these impacts depends on the sediment grain size, the volume and rate of sediment suspended, and the currents transporting the sediment. For jet plow activity and excavation in the temporary cofferdam, a sediment transport study was completed that estimated the suspended solids concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the SFEC - NYS and temporary cofferdam construction (Appendix I).

The results of the project-specific sediment sampling of vibracores collected along the SFEC - NYS were compared against the sediment quality thresholds for in-water/riparian placement in the Technical Guidance for Screening Contaminated Sediments (NYSDEC-DFWMR, 1999) and determined to correspond to Class A – No Appreciable Contamination. The results of the sediment sampling and chemical analysis are summarized in Appendix G of the Geotechnical Data Report included in Appendix H3.

As previously stated, a modeling simulation was conducted for one of three types of equipment that could be used for cable installation along the SFEC - NYS which indicated that the maximum modeled TSS concentration from SFEC - NYS installation is 578 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 394 feet (120 m) horizontally from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.3 hours after the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation.

A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore was also conducted. The maximum predicted TSS concentration from suction dredging at the HDD site is 562 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 476 feet (145 m) horizontally from the source and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.1 hours after the conclusion of suction dredging.

These localized impacts to marine water quality would be ***short-term*** and ***minor*** and are not anticipated to affect DO, chlorophyll *a*, or nutrient balance in the region. In addition, based on project-specific vibracore sampling results (Appendix H), the sediment in the SFEC - NYS is not expected to contain contaminants; therefore, water quality will be affected primarily by the short-term physical suspension of sediments.

Discharges and Releases
Impacts associated with discharges and releases during construction of the SFEC - NYS are expected to be similar to those described for the SFWF. However, additional water quality impacts could occur during HDD operations, described as follows.

Both HDD landing site alternatives will require the use of HDD drilling fluid, which typically consists of a water and bentonite mud mixture or another nontoxic drilling fluid. Bentonite is a natural clay that is mined from the earth, and similar to the clay minerals that are present in the drilling location. While the mixture is not anticipated to significantly impact water quality if released, SFW will implement BMPs during construction to minimize potential release for a frac-out of the drilling fluid associated with HDD activities.

A frac-out occurs when the drilling fluids migrate unpredictably to the surface through fractures, fissures, or other conduits in the underlying rock or unconsolidated sediments. A frac-out could potentially increase turbidity and possibly impact marine and coastal habitats. Because SFW has avoided sensitive habitats in selection of the cable landing sites, a potential frac-out will result in only ***negligible*** and ***localized*** impacts to water quality in the shallow marine and freshwater environments along the SFEC route. In addition, SFW will develop an HDD frac-out contingency plan for the inadvertent releases of drilling fluid before construction to further minimize the potential risks associated with a frac-out.

Operations and Maintenance

Seafloor Disturbance
Impacts associated with seafloor disturbance during O&M of the SFEC - NYS are expected to be similar to those described for the SFEC - OCS.

Sediment Suspension and Deposition
Impacts associated with sediment suspension and deposition during O&M of the SFEC - NYS are expected to be similar to those described for O&M of the SFEC - OCS.

Discharges and Releases
Impacts associated with discharges and releases during O&M of the SFEC - NYS are expected to be similar to those described for O&M of the SFEC - OCS.

Decommissioning

Decommissioning of the SFEC - NYS will have similar impacts as construction.

SFEC – Onshore

Construction

The activities that could impact water quality and water resources in the SFEC – Onshore include the installation of the underground transition vault at the Beach Lane or Hither Hills landing sites, installation of the underground SFEC – Onshore route, and construction of the SFEC – Interconnection Facility. However, the SFEC – Onshore would be located underground within public roadways and MTA-owned LIRR ROW, or along roadway corridors that are characterized as impervious road surfaces or railroad beds.

Land Disturbance
The underground transition vault will be installed above mean high water, several hundred feet landward of the MHWL within a paved roadway or a parking lot and will have a manhole cover at the ground surface. The onshore transition vault will be located outside wetlands and other waterbodies. ***No impacts*** in the intertidal areas from construction at the landing sites are anticipated due to subsurface installation techniques proposed (i.e., HDD) to connect the SFEC – NYS to the SFEC - Onshore transition vault. The transition vault is located within an area identified as an "adjacent area" to a NYSDEC-regulated tidal wetland. However, as discussed in Section 4.3.1, the transition vault and HDD work area will be located within paved surfaces, and erosion and sedimentation controls will be utilized. Therefore, impacts, if they occur, to surface water quality or to surface water resources from construction activities would be ***short-term*** and ***negligible***.

Wetland resources located in the vicinity of the potential routes for the SFEC – Onshore include both freshwater and tidal wetlands. Potential impacts to wetland resources are discussed further in Section 4.3.1, Coastal and Terrestrial Habitat.

The SFEC – Interconnection Facility will be located adjacent to and on the same parcel as the existing LIPA East Hampton substation on Cove Hollow Road. ***Negligible, short-term impacts*** to water quality and water resources are expected from increased erosion and sedimentation during land clearing and construction for the SFEC – Interconnection Facility. Similarly, impacts to water quality and water resources from erosion of disturbed soils and transport by stormwater during construction of the onshore cable duct bank and the SFEC – Interconnection Facility would be expected to be ***negligible*** and ***short-term***. All earth disturbances from onshore construction activities will be conducted in compliance with the SPDES General Permit and an approved SWPPP.

Discharges and Releases
Although ***no impacts*** from discharges and releases are anticipated during routine construction activities, some spills and accidental releases of fuels, lubricants, and hydraulic fluids may occur. These non-routine spills or accidental releases may result in ***negligible*** and ***short-term impacts*** to stormwater quality. However, pollution of local wetlands and waterbodies will be avoided and minimized through the implementation of an SPCC.

Operations and Maintenance

The SFEC – Onshore has no maintenance needs unless a fault or failure occurs. Therefore, O&M of the SFEC - Onshore is not expected to generate sources of pollutants that would impact water quality and water resources.

Land Disturbance
Given that no maintenance needs are anticipated for the SFEC – Onshore, ***no impacts*** to water quality or water resources are expected from land disturbance activities. In the event of a fault or failure, impacts are expected to be similar to those described for the SFEC - Onshore construction phase.

Discharges and Releases
No impacts associated with discharges and releases during O&M of the SFEC – Onshore are expected; however, in the event there is a fault or failure, the impacts are expected to be similar to those described for construction of the SFEC – Onshore construction.

Decommissioning

Decommissioning of the SFEC – Onshore would have similar impacts as construction.

4.2.2.3 Proposed Environmental Protection Measures

The protection of water quality in marine and onshore environments is incorporated into many facets of the SFWF and SFEC design and construction. Site selection and routing, installation techniques and equipment technologies have been selected to avoid and minimize potential impacts to the environment, including water quality.

Several environmental protection measures will reduce potential impacts to water quality.

- Installation of the SFWF Inter-Array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize turbidity and total suspended solids.
- Vessels will comply with regulatory requirements related to the prevention and control of discharges and accidental spills.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- At the onshore HDD work area for the SFEC, drilling fluids will be managed within a contained system to be collected for reuse as necessary
- An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out.
- A SWPPP, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.

4.2.3 Geological Resources

An overview of the regional geological setting and characterization of the potentially affected environment is provided in this section. These descriptions provide the basis for an evaluation of potential Project-related impacts to geological resources. In accordance with 30 CFR 585.626, a G&G survey was conducted for the SFWF and SFEC route, including the two potential landing sites. These surveys collected data for characterizing shallow hazards, geological conditions, geotechnical characteristics, and to provide data for marine archaeological resource assessment and benthic studies. The results of the G&G survey work are summarized below and discussed in detail in a series of G&G reports included in Appendix H. In addition, geological hazards that could affect SFWF and SFEC siting and development are discussed. Related assessments, such as the characterization of the benthic and shellfish resources anticipated within the SFWF and along the SFEC as well as an assessment of the potential Project-related impacts are found in Section 4.3.2 and Appendix N1 and Appendix N2.

4.2.3.1 Affected Environment

Regional Overview

Regional geology and geomorphology are a product of glacial action and post-glacial coastal processes. The continental ice sheet advanced and retreated several times over the area, leaving behind a wide range of glacial deposits and outwash, depending on the location of the edge of the ice sheet at any given time. The geomorphology of the ocean bottom, shorelines, and island masses in this area are all products of glacial processes. In general, deposits range from fine-grained clays to sand, gravel, and interlaying boulders as evidenced on the exposed erosional cliffs of the offshore islands, such as Block Island (RI CRMC, 2010).

The surficial expression of Rhode Island Sound was formed during the advance and retreat of the last continental ice sheet in the northeastern United States, part of the Laurentide glaciation, and the subsequent erosion and reworking of the glacial deposits during the Holocene (10,000 years ago to the present) sea-level rise. Characteristic glacial deposits are moraine and outwash. Glacial moraines are formed at the leading edge of an ice sheet when it is no longer advancing, and melting has begun. Typically, moraine includes poorly sorted, fine-grained to gravel sediments with boulders, which can be called glacial till deposits. Glacial outwash (also referred to as glacial drift) is well-sorted material, formed from meltwater within glaciers or from drainage off the front of a glacier across an outwash plain. These can be thick deposits of primarily sandy material and may include incised channels where meltwater drained. Following the glacial period, the shoreline transgressed across the area to its current location, leaving behind fine-grained to sandy fluvial-estuarine deposits (RI CRMC, 2010).

In the Atlantic OCS, glacial deposits on top of shallower shelfs resulted in the formation of Block Island, Martha's Vineyard, and Long Island. The shelfs surrounding the island masses, received post-glacial sediments from erosion of the islands.

The sounds in this area – Block Island Sound and Rhode Island Sound – were formed by the presence of the glacial features Block Island, Martha's Vineyard and Long Island, and the Rhode Island and Massachusetts shorelines.

Other major geologic characteristics of the area from the SFWF, along the proposed SFEC route to the southern shore of Long Island, are illustrated on Figure 4.2-3 and listed as follows:

- **Cox Ledge**. The SFWF is in an area identified as Cox Ledge on the southern side of Rhode Island Sound. Bottom geology is expected to be sandy with varying amounts of coarser material, including boulders.
- **Rhode Island Sound Channel.** Cox Ledge is bound to the west by a glacial/post glacial drainage channel incised into the ledge. The channel may contain soft fine or sandy sediments, depending on the water current velocities within the channel feature.

- **Block Island Platform and Slope** is located west of the Rhode Island Sound channel and contains glacial deposits which could include boulder zones.
- **Block Island Sound Channel** is located between Block Island and the coast of mainland Rhode Island and appears to have steep side slopes and may contain sandy to soft deposits.
- **Endeavor Shoals (Montauk Point Shoals)** is a shallow platform of glacial deposits extending off Montauk Point. Bottom deposits include sand and gravel, with possible boulders. Actively migrating sand waves up to 16 feet (5 m) tall have been mapped here.
- **Nearshore along Southern Shoreline of Long Island to Wainscott Area** is a medium- to high-energy wave environment, resulting in sandy deposits along the beach front and near shore. Varying amounts of gravel and larger material up to boulders may also be present.

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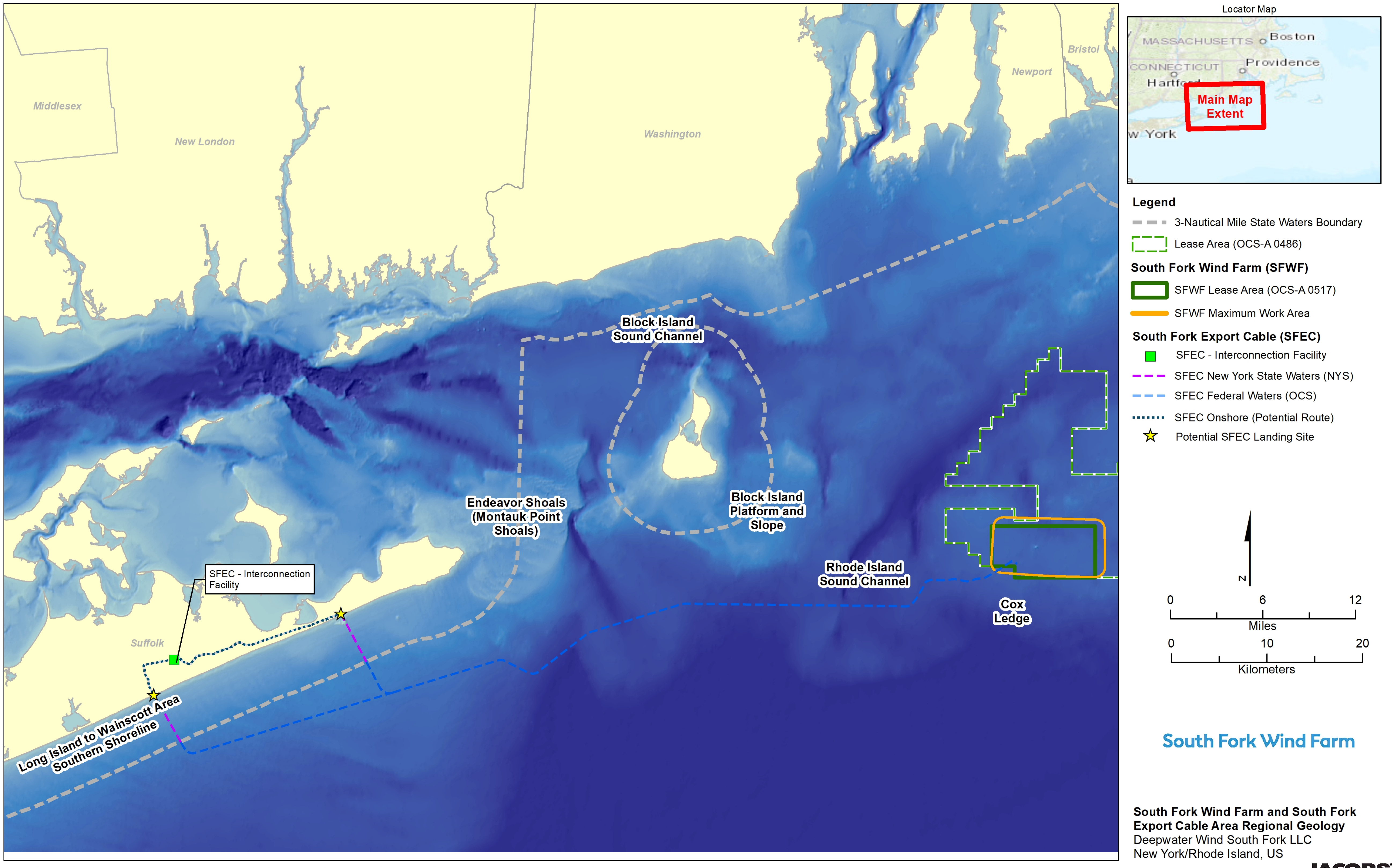

Figure 4.2-3. South Fork Wind Farm and South Fork Export Cable Area Regional Geology
Depiction of the major geologic characteristics in the SFWF and along the SFEC route.

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A site characterization report was developed from the Project-specific survey work completed from 2017 to 2019. This report is incorporated into this section by reference as Appendix H. The regional stratigraphy of the area consists of Cenozoic-aged geologic units that were generally deposited in marine or fluvial environments that formed in response to the cyclic rise and fall of the sea level. Cenozoic aged deposits generally thicken and dip gently seaward. As mentioned earlier, glacial and post-glacial processes during the Quaternary period dramatically shaped the geology of the region encompassing the SFWF and SFEC. In descending order, the site is inferred to be underlain by Quaternary, Tertiary, Cretaceous, and Paleozoic age strata with the youngest marine deposits comprising the uppermost strata as described:

- **Recent – Marine Deposits:** Marine deposits cover much of the seafloor and are comprised of sand to silty sand where moderate to strong currents are present and silt to clay in deeper, quiet water areas.
- **Holocene age – Transgressive Deposits:** As the Laurentide ice sheet melted, sea level rose, and the shoreline transgressed across the continental shelf. As the area transitioned into a submerged environment, Holocene age sediments were deposited over the Late Pleistocene surface. The transgressive deposits typically exhibit a fining-upward sequence that commonly consist of gravel and basal sand deposits that transition into silt and clay. The materials may be interbedded or predominantly sand or fine-grained. These deposits are presumed to be thicker where they have filled glacial drainages cut into old surface strata (Appendix H).
- **Pleistocene age – Glacial Drift and Post-Glacial Deposits:** During the Pleistocene, glaciers advanced into region and then retreated as they melted. This depositional environment resulted in a wide variety of materials that were deposited. Glacial deposits underlying the site most likely include tills, moraine (stratified and unstratified), and/or outwash deposits (Veeger et al., 1996). The glacial outwash or ice-contact stratified drift can be characterized as acoustically well-layered sequences although some glacial moraine deposits may result in a more chaotic seismic character (signal) and with numerous indicators of glacial erratics (boulders) (O'Hara and Oldale, 1980).
- **Late Cretaceous/Tertiary age – Coastal Plain Deposits:** The seaward extension of the Atlantic Coastal Plain is likely made up of late Cretaceous to possibly Tertiary age deposits overlaying basement bedrock. These deposits are inferred to be primarily of marine origin with generally parallel strata that dip gently seaward. Limited information is available about the physical properties of the Coastal Plain deposits that underlie the survey area. However, they are inferred to be comprised of semi-consolidated to unconsolidated sand, silt, clay, and gravel deposits (Appendix H).
- **Bedrock:** Consolidated sediments and crystalline bedrock in the region is thought to be comprised of Paleozoic and Proterozoic rock units. Metasedimentary, metavolcanics and plutonic rocks of Proterzoic and early Paleozoic age outcrop along the southern Massachusetts coast and southeastern Rhode Island (Quinn, 1971).

The site characterization report provides a categorization of the area's soil/geomorphic provinces. These regional soil provinces include moraine zones, moraine flank, glacial outwash plain and proximal fan, Pleistocene tunnel valley channel complex, and Holocene channel complex. Characteristics of these provinces are summarized as follows and further explained in Appendix H.

- **Moraine:** Moraine zone sediments are comprised predominantly of dense to very dense sand and gravel. Abundant boulders and cobbles are observed across the seafloor in the side scan sonar and multibeam echo sounder (MBES) bathymetry data (Appendix H). Boulders are the dominant features on within the moraine zone and are generally most exposed between buried paleo-channels in the central and western margin of the SFWF. Diffractions in the seismic data within the glacial unit suggest abundant buried boulders may also be present. Boulders may extend from the seafloor up to approximately 98 feet (30 m) depth. Overall, moraine sediments vary from coarse sands to gravel, cobbles, and boulders – some of which could be greater than 32 feet (10 m) in diameter. Overlying marine and transgressive deposits can range from 0 (missing) to greater than 9.8 feet (3 m) in these areas. The thicker overlying sediment may mask the presence of boulders on the seafloor (Appendix H).

- **Moraine Flank:** The moraine flank zone marks a transition between the boulder-dominant moraine to the glacial outwash plain, where surficial boulders become less prevalent. In general, thicknesses of marine and transgressive sediments are similar to those found in the moraine zone; however, dense glacial outwash sands begin to accumulate in this zone. The thickness of the glacial outwash sands ranges from less than 3.3 feet (1 m) to approximately 8 feet (2.5 m) depth. Exposed and buried boulders are still considered a significant hazard with respect to cable route and burial in this area (Appendix H).
- **Glacial Outwash Plain and Proximal Fan:** The glacial outwash plain extends from the moraine flank near the SFWF to the shore of Long Island, New York. The USGS mapped a proximal outwash fan along the Long Island coast in 1999 extending from the shore landing of the SFEC route (Appendix H). The glacial outwash plain and proximal fan zones are distinguished from other glacial units by a paucity of boulders detected in side scan sonar and bathymetric data. Despite a decrease in the density of surficial boulders in this zone, boulders are likely still present in the subsurface (Appendix H).
- **Pleistocene Tunnel Valley Channel Complex:** It is interpreted that tunnel valley channels formed beneath the terminal glacier lobes across the SFWF and SFEC. These channels partly split the ice and eroded underlying strata to drain subglacial water (Hanson, 2000). A channel complex was identified in the SFWF buried approximately 19.6 to 65.6 feet (6 to 20 m) below the seafloor (Appendix H).
- **Holocene Channel Complex:** A second generation of channels formed post-glaciation as sea-level began to rise. These fluvial channels are filled with re-worked glacial sands and capped by younger marine sediments. Generally, these channels formed in the same location as the older Pleistocene channels; however, the drainage direction reversed as glaciers retreated, with a gradient indicating southward flow. Holocene channel zones are identified in the SFWF and SFEC route (Appendix H).

Seismic activity and other potential hazards are summarized as follows and further detailed in Appendix H. Seismic activity was documented from a review of the Northeast States Emergency Consortium (NESEC) data. NESEC states that approximately 40 to 50 earthquakes are detected annually in the Northeast, which includes Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont (NESEC, 2017a). Regionally, there has been one occurrence of seismic activity of a magnitude or intensity 4 or greater since 1965, recorded in East Hampton, New York, in March 1992 (NESEC, 2017b).

Potential geological hazards within the region were identified per 30 CFR 585.626. Geologic hazards are considered any significant geological features that can pose a significant hazard with respect to cable route and burial in the SFWF and SFEC. Boulders are the predominant geohazard in the region and may occur anywhere throughout the area based on the glacial history of the region. Sharp topographic features may also pose a hazard. Sand waves up to 16 feet (5 m) tall, have been identified mainly between Block Island and the Montauk Shelf (RI CRMC, 2010). Although, sand waves more commonly encountered in the region can be up to 1.6 feet (0.5 m) high and display a wavelength (peak-to-peak) ranging from approximately 65.6 to 164 feet (20 to 50 m) (Appendix H). Geological hazards within the SFWF and along the SFEC are discussed further in the sections below and in the G&G reports included in Appendix H.

South Fork Wind Farm

The SFWF is located approximately 19 miles (30.6 km, 16.6 nm) southeast of Block Island, Rhode Island near Cox Ledge, in Rhode Island Sound on the Atlantic OCS. The SFWF is located on a terminal glacial moraine which is defined as a high boulder hazard area (Appendix H). The G&G

survey in Appendix H confirmed a high-density of boulders mainly located in the western and central portion of the SFWF. Sources for boulders typically include moraine deposits, glacial outwash, and glacial erratics transported by ice rafts in front of the glaciers and were deposited when the ice rafts melted.

Seafloor and shallowly buried boulders with seafloor expression are observed throughout the SFWF area. Corridors were identified where surface boulders appear to be infrequent to absent. Those zones correlate to buried paleochannel systems. The boulders are inferred to be related to a terminal moraine deposit which has been mapped across the footprint of the SFWF site. Seismic data were used to interpret the thickness of the moraine unit. The moraine unit is interpreted to be approximately 66 to 98 feet (20 to 30 m) thick and up to approximately 295 to 328 feet (90 to 100 m) thick in the deeper paleochannel of the SFWF where folding has increased the thickness of this unit. This report presents the interpreted top and bottom elevation of the boulder unit and the inferred thickness based on the seismic data. Buried boulders present a significant potential hazard to piled foundations at this site (Appendix H).

Seafloor boulders mapped from MBES bathymetry data estimated the diameter of boulders based on the assumption that the most common expression of a surface boulder is circular. After correcting for this assumption, boulder size generally measures 1.5 to 32 feet (0.5 to 10 m) across (Lundblad et al., 2006; Appendix H). The highest density area of seafloor boulders is in the western and central portions of the SFWF and interpreted to represent Ronkonkoma and Harbor Hill moraine deposits observed onshore. Generally, within the SFWF, the areas of fewer seafloor boulders correspond to the extents of mapped buried paleo-channels. It is inferred that these south-southeast to north-northwest trending paleo-channels eroded and downcut into the glacial moraine deposit and removed boulders in that area. Surficial boulders rise less than 3.5 feet (1 m) to approximately 11.5 feet (3.5 m) above the seafloor, with an unknown number of boulders remaining buried. Slope angles along the flanks of seafloor boulders range from about 3 to over 30 degrees, and some flanks show clear signs of scouring. Unidentified shallowly buried boulders may be present below the widespread seafloor sand waves (Appendix H).

Sand waves occur across the SFWF. Sand waves are migrating depositional features, generally understood to form from sediments that are transported and redeposited by bottom currents (Wynn and Stow, 2002). Sand wave crests generally trend north – south to northeast – southwest. The sand waves can be up to 1 to 2 feet (0.3 to 0.5 m) high and display a wavelength (peak-to-peak) ranging from approximately 65.6 to 164 feet (20 to 50 m). Mobility assessments (e.g., migration rate and direction) of sand waves across the SFWF area could not be determined based on the available datasets. Lower MBES backscatter intensity (blues and greens) indicate that the sand waves are most likely fine-grained sands to sandy-silts overlain on denser reworked glacial till and/or glacial moraine (yellow and reds) (Appendix H).

Ripples were identified in relative lows between sand wave bodies. The ripples are approximately 0.4 to 1.9 inches (1 to 5 cm) high (trough-to-peak) and display a wavelength (peak-to-peak) ranging from approximately 3.2 to 6.5 feet (1 to 2 m). The crests of the ripples display highly variable trends. The mobility of the ripples could not be estimated with the current data (Appendix H).

Soil provinces delineated within the SFWF include Moraine zone sediments, moraine flank, glacial outwash plain, Pleistocene tunnel valley channel complex, and Holocene channel complex (Appendix H).

A Pleistocene Tunnel Valley Channel Complex was identified in high resolution geophysical seismic data in the SFWF area as large valleys buried approximately 65.6 feet (6 to 20 m) below the sea floor. The base of this complex is characterized by high-amplitude reflector that corresponds to harder material composing the valley beds. The walls and base of these channels likely contain reworked glacial material, including boulders, cobbles, and gravel pavement (i.e., dense material that would cause high positive impedance contrast with overlying outwash sand infill). Channel floor elevation may vary greatly within tunnel valleys, preserving drumlins, eskers, and transverse ridges. This undulating base is generally attributed to the water flowing under hydrostatic pressure in enclosed conduits. (Appendix H)

Three channels transect the SFWF survey area – the Western Channel, Central Channel, and Eastern Channel. Despite elevation variation of the channel base, overall each channel deepens to the north, suggesting glacial drainage to the north. The Western Channel trends north-south and generally underlies the planned locations for the western-most column of WTGs. This is the smallest tunnel valley channel in the complex, measuring approximately 2,624 feet (800 m) across. Thickness of infilled sediment varies from approximately 13 to 65.6 feet (4 to 20 m). The southern extent of the Central Channel is divided into thin fingers approximately 328 to 984 feet (100 to 300 m) wide. These fingers are shallow and only cut approximately 16.4 feet (5 m) into the underlying strata. They join to create a single channel (approximately 5,905 feet [1,800 m] across) that incises to the underlying moraine approximately 49 to 65.6 feet (15 to 20 m). Channel geomorphology changes again to the north of the SFWF as the Central Channel splits into two fingers.

The Eastern Channel exhibits a dramatically different morphology than the other two. This tunnel valley formed over deformation within the underlying unit, which is inferred to have been caused by glacial loading (Hanson, 2000). Compressional deformation thickened and folded the underlying strata, while also creating a preferential pathway for subglacial water to drain to the north. This preferential drainage pattern formed the deepest and widest of the three channels. This channel cuts at an oblique angle to the other two Pleistocene channels. Like the other two channels, channel bed morphology varies significantly in the Eastern Channel, ranging from about 19 to 82 feet (6 to 25 m) of sediment infill. However, the Eastern Channel is generally straighter than the other two channels, likely because of a flow constraint caused by deformation. It is the widest channel in the tunnel valley channel complex, measuring approximately 7,545 feet (2,300 m) wide and contains a southward branching segment composed primarily of fine-grained sediment (Appendix H).

Compared to the Pleistocene-aged complex, Holocene-aged channels are narrower and generally contain less than 3.2 feet (1 m) of sediment. Presence of Holocene Western and Central Channels in the SFWF span approximately 1,312 to 1,640 feet (400 to 500 m) and 1,640 to 2,624 feet (500 to 800 m), respectively. The branches of the two channels join in the southern extent of the survey area. Morphology of the Holocene Eastern Channel is drastically different than the underlying Pleistocene-aged channel. The channel branches from a single segment approximately 3,280 feet (1,000 m) wide into two smaller segments to the southeast. Each branch measures about 984 feet (300 m) (Appendix H).

The seafloor also includes fine-grained to coarse-grained sediments. Underneath the seafloor surface, a layer of sand with gravels was encountered, with a nominal thickness between approximately 3.2 to 6.6 feet (1 to 2 m) with some interbedded fine soil content, and below a layer of low plastic clays with sand and gravel. Other geological resource characteristics at the SFWF are summarized further in the Geotechnical Data Report and the Sediment Profile Imaging and Benthic Survey Report included as Appendix H.

South Fork Export Cable

The eastern end of the SFEC – OCS route starting at the SFWF until the bend in the route as represented between mile marker 3 to mile marker 13, shown on Figure 4.2-4, had a high proportion of gravel, cobbles, and boulders on the upper surface. Underneath fine-grained sands and clay were present. Westward between mile markers 6 and 31 along the SFEC – OCS route the surface was generally fine sand overlaying layers of either clayey sand or silty sand. Further west along the SFEC corridor, the gradation increases and generally includes various percentages of fine, medium, and coarse sand and gravel.

The highest density areas of observed seafloor boulders are located from mile marker 0 to mile marker 13 and mile marker 47 to mile marker 58. Glacial deposits encountered in the SFEC route were outwash plain/proximal fan. The outwash plain consists of dense to very dense sands of varying particle size with seams and lenses of fine gravels. Mean tip resistance calculated from cone penetration testing (CPT) in the outwash plain is 17.7 megaPascals (MPa) with a standard deviation of 7.9 MPa. Outwash sand thickness is estimated to be greater than the penetration of the longest geotechnical exploration in this zone: CPT C-300 at 35.37 feet (10.78 m). All vibracores and CPTs in the outwash plain terminated in this unit. (Appendix H)

A proximal outwash fan exists along the Long Island Coast from the shore landing of the SFEC at Beach Lane and terminates near Hither Hills (Foster et al., 1999). Mapping conducted as part of the Site Characterization Report (Appendix H), indicates that the glacial outwash extends beyond this initial mapped outwash fan, approximately 12.4 miles (20 km) further to the northeast along the proposed SFEC route. The general thickness of marine deposits, transgressive sediments, and glacial outwash sand increase with distance from the east, except for a rocky outcrop area long the proposed cable route between mile marker 47 and mile marker 58. The proposed SFEC route was deviated around this area to avoid the surficial boulders and rocky outcrops and to improve cable burial feasibility.

Pleistocene channel complexes are identified along the SFEC route between mile markers 13 and 39, mile markers 43 and 54, and mile markers 77 and 80 (Appendix H).

Holocene channel zones are identified along the SFEC route between mile markers 14 and 23, mile markers 27 and 30, mile markers 33 and 47, and mile markers 71 and 79 (Appendix H).

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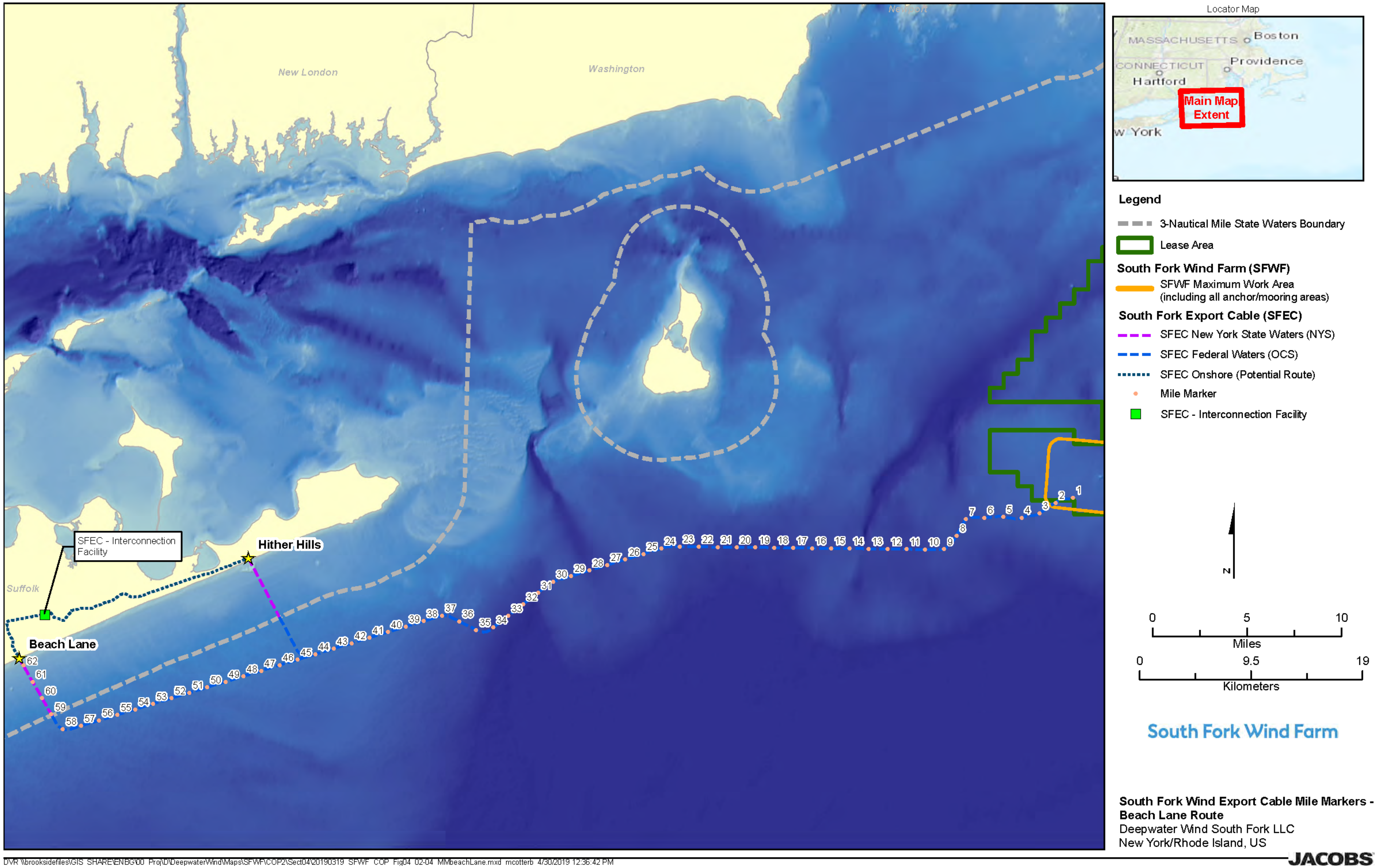

Figure 4.2-4. South Fork Wind Export Cable Mile Markers and SFEC - Onshore Routes

Depiction of Mile Markers from SFWF and along the SFEC route, including landing site options, and interconnection point at SFEC - Interconnection Facility.

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SFEC – OCS and SFEC – NYS

Geology along the SFEC route on the OCS is characterized by recent fine marine surficial sediments, with underlying glacial drift, and the possibility of boulders and other coarser materials occurring in the subsurface and at the surface. As shown on Figure 4.2-4, the SFEC route crosses the southern ends of the Rhode Island Sound and Block Island Sound paleochannels and may encounter shallow representations of these features.

As the SFEC route enters shallower New York State waters, the surface layer of re-worked glacial deposits may become increasingly coarser sands, with the continuing possibility of boulders. The SFEC landing site approach at either potential Beach Lane or Hither Hills locations consists of similar glacial outwash deposits.

SFEC – Onshore

The land mass of Long Island is also a product of glacial and post-glacial processes. The Wisconsin epoch is predominantly responsible for the surficial geology of the modern Long Island region. During the Wisconsin glacial stage, an ice sheet moved to approximately the center of Suffolk County, New York and stopped, leaving before it two terminal moraines, which are now known as the Ronkonkoma moraine and the Harbor Hills moraine. After the ice sheet reached its southern limits in Suffolk County, it began to melt. The melted water flowed into streams and carried a large volume of sand and gravel farther south. This sand and gravel were deposited in two relatively flat outwash plains; one between the Ronkonkoma moraine and the Atlantic Ocean, where the South Fork of Long Island and the town of East Hampton are located, and the other between the Harbor Hill moraine, which extends from the western edge of Nassau County, along the north shore of Long Island, to its easternmost point at Fisher's Island, and the Ronkonkoma moraine. (USDA, 1975)

The Ronkonkoma moraine and the Harbor Hills moraine are parallel in the western half of Long Island but diverge near Peconic Bay. The Harbor Hill moraine and the Ronkonkoma moraine are comprised primarily of poorly sorted till, including sand, pebbles, rocks, and boulders, while the outwash plains located between the moraines, and south of the Ronkonkoma moraine, include varying amounts of well sorted sand and gravel. The Ronkonkoma moraine was deposited as a terminal moraine at the end of a glacial lobe and forms the spine of Long Island (Sanders and Merguerian, 1994). Streams draining southward at the edge of the glacier deposited an outwash plain of sandy material that is now the southern Long Island coastal zone and shore. In general, at low ground elevations near the shore, the groundwater table is encountered at shallow depths (Como et al., 2015). At higher ground elevations along the SFEC onshore route, the groundwater table may occur at deeper depths.

The bedrock under Suffolk County varies in depth from approximately 400 feet (121 m) bgs along the northern coastline of the town of Southold, to approximately 2,000 feet (609 m) bgs along the central part of the southern coastline of Fire Island (i.e., an outer barrier island parallel to the south shore of Long Island). Depth to bedrock, proximate to the SFEC – Onshore, ranges from approximately 1,400 feet (426 m) bgs at the Beach Lane landing site to approximately 1,300 feet (396 m) bgs at the point of the SFEC – Onshore intersection with the LIRR ROW (USGS, 1995).

The soils along the SFEC – Onshore and at the SFEC – Interconnection Facility were characterized in accordance to the Soil Survey of Suffolk County, New York (USDA, 1975) (the "Soil Survey"), in which soils were classified according to distinct characteristics and placed accordingly into series and mapping units. A series is a group of mapping units formed from partly disintegrated and partly weathered rocks that lie approximately parallel to the surface and that are similar in arrangement and differentiating characteristics, such as color, structure, reaction, consistency, mineralogical composition, and chemical composition. Mapping units differ from each other according to slope and may differ according to characteristics, such as texture (USDA, 1975). The predominant soil series found along the SFEC – Onshore and at the SFEC – Interconnection Facility include Bridgehampton, Carver, and Plymouth series (USDA, 1975).

The landing sites and surrounding areas are underlain by beach deposits, consisting of beach sand and gravel, and dune sand, that range from less than 5 feet (1.5 m) to approximately 20 feet (6 m) in thickness (USDA, 1975). The beach deposits are underlain by glacial deposits consisting of clay, silt, clayey and silty sand, sand, and gravel, that comprise the upper glacial aquifer, which ranges up to approximately 200 feet (60.9) in thickness below the landing sites and is one of the principal water sources of Suffolk County. According to data from the USGS, depth to groundwater around the landing sites typically ranges from approximately 4 to 5 feet (1.2 to 1.5 m) bgs (GZA, 2017).

4.2.3.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to cause both direct and indirect impacts on geological resources, as discussed in the following sections. IPFs associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are described in Section 4.1.

An overview of the IPFs for geological resources associated with the SFWF and SFEC is presented on Figure 4.2-5. IPFs not expected to impact geological resources are depicted with slashes through the circle. For the IPFs that could impact geological resources but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. The IPFs with potential to impact geological resources are indicated by gray shading.

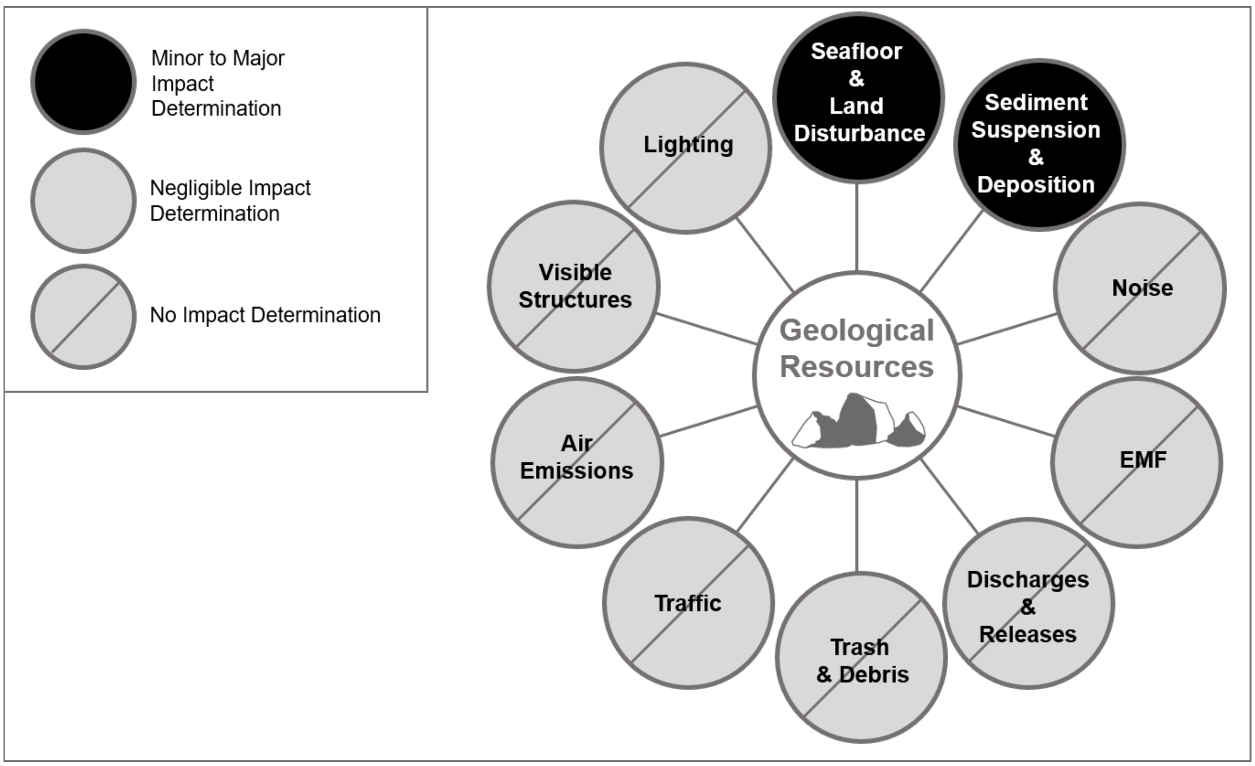


Figure 4.2-5. IPFs on Geological Resources
Illustration of potential impacts to geological resources resulting from SFWF and SFEC activities

South Fork Wind Farm

Construction

Seafloor Disturbance

Seafloor disturbance from foundation installation, Inter-array Cable installation, and anchoring would impact geologic resources. Mainly surficial and subsurface geological resources at specific installation locations would be impacted from penetration (i.e., pile driving), cable installation, and anchoring. Monopile foundation installation will result in subsurface impacts extending up to approximately 164 feet (50 m) into the seabed. Alteration of the strata by the installation of the foundations will occur at each pile point but would not result in a broader scale impact to the geologic setting of the area. Impacts from seafloor disturbances during construction described above would be ***short-term localized*** and ***minor***. The presence of boulders on the seafloor within the SFWF are the primary geologic hazards identified by pre-construction assessments, as described in the Site Characterization Report included in Appendix H. The siting of the SFWF areas avoided shallow hazards to the extent practicable. However, where construction activities result in the movement of boulders or depositional features (e.g., ripples, sand waves) impacts would be ***short-term***, ***localized,*** and ***minor***.

Sediment Suspension and Deposition

Surficial geological resources, mostly comprised of (recent) Holocene pre-transgressive and transgressive marine sediments, would be impacted mainly because of sediment suspension/deposition from Inter-array Cable installation resulting in localized changes to surficial geology and bottom topography. Installation of the Inter-array Cable using the mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow is expected to result in the disturbance and temporary suspension and re-deposition of these deposits, as described in the Hydrodynamic and Sediment Transport Modeling Results Report included in Appendix I. Recent marine deposits would also be disturbed during foundation installation. Sedimentation resulting from the installation of the Inter-array Cable would be limited to the area immediately adjacent to the burial route. These impacts are considered to be s***hort-term, localized***, and ***minor*** because of the limited extent of sedimentation predicted by the model and highly dynamic nature of the marine sediments in the SFWF.

As explained above in the discussion of seafloor disturbance, the presence of boulders and topographic features (channels and sand waves) on the seafloor within the SFWF are the primary geologic hazards identified by pre-construction assessments, as described in the Site Characterization Report included in Appendix H. The siting of the SFWF Inter-array Cable avoids these hazard areas to the extent practicable. However, where construction activities result in the movement of boulders or depositional features (e.g., ripples, sand waves) impacts would be ***short-term***, ***localized*** and ***minor***.

Operations and Maintenance

Seafloor Disturbance

Once the SFWF is constructed and operational, ***no impacts*** to geologic resources are anticipated except for vessel anchoring during planned and unplanned maintenance, and the very low likelihood that the Inter-array Cable requires replacement, relocation, or additional armoring. In the very rare circumstances that seafloor disturbances occur during the O&M phase, impacts would be similar to those discussed for construction of the SFWF.

Sediment Suspension and Deposition

Scour at the base of the WTG foundations will locally impact surficial geology during the O&M phase. Scour protection will be placed at the base of each WTG foundation and on top of the segments of the Inter-array Cables where they emerge from the trench and connect into the WTG. ***Negligible impacts*** to Holocene marine deposits from sediment suspension and deposition around the artificial structures are expected during O&M, but broad-scale geologic resources impacts are unlikely.

Decommissioning

Impacts to geologic resources from seafloor disturbance and sediment suspension and deposition would be similar to those impacts described for construction if removal of the SFWF components takes place using similar equipment and methods.

SFEC – OCS and SFEC – NYS

Construction

Seafloor Disturbance
Impacts to geologic resources during construction of the SFEC in OCS waters would be limited to the mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plowing of the seafloor during cable installation, vibratory pile driving for sheet pile cofferdam, or gravity cell installation for the sea-to-shore transition. Similar to the seafloor disturbance described above for the SFWF foundations and Inter-array Cable, trenching and sheet pile installation would result in ***short-term*** and ***minor impacts*** to localized geologic resources such as marine deposits (sediments) and near-surface stratigraphy. Broad-scale geologic features would not be measurably impacted.

In New York State waters, SFEC installation impacts to Holocene deposits consisting of medium to coarse sand with some gravel resources would be from the SFEC sea-to-shore transition (e.g., HDD); impacts to the Holocene sediment layers at this depth would be ***minor*** because the cable will be installed within the conduit. This technique will minimize impacts, compared to an open trench installation. Also, measurable impacts to geologic resources from the SFEC cable installation, including the HDD process, would be ***negligible*** to the overall geologic resources and processes in the area. The temporary cofferdam installed nearshore would result in ***short-term, localized,*** and ***minor impacts*** to Holocene sediments but ***no permanent*** or ***long-term impact*** to geologic resources are expected.

Sediment Suspension and Deposition
According to the modeling simulation of SFEC installation with a jet plow, one of three potential types of equipment to be used for cable installation (Appendix I), sediment will be disturbed and temporarily suspended during installation of the SFEC and during suction dredging of the cofferdam for the offshore sea-to-shore transition between the SFEC – NYS and SFEC - Onshore. The model predicted that sediment suspension and deposition resulting from installation of the SFEC – OCS and SFEC – NYS will be limited to the area immediately adjacent to the burial route. Localized impacts to marine deposits would be ***short-term*** and ***minor***.

Sediment suspension and deposition from suction dredging at the sea-to-shore transition were predicted to occur within a very small radius of the activity without the confinement of the steel sheetpile or gravity cell cofferdam. Any localized impacts to marine deposits would be ***short-term*** and ***minor***.

Operations and Maintenance

Seafloor Disturbance
No impacts to geological resources from SFEC operations are anticipated. If mechanical damage to the SFEC – OCS and/or SFEC - NYS should occur, repair of the cable may result in disturbance to the seafloor from maintenance vessels and activities. Localized impacts to marine deposits would be ***short-term*** and ***minor***.

Sediment Suspension and Deposition
No impacts to geological resources from SFEC operations are anticipated. If mechanical damage to the SFEC – OCS and/or SFEC - NYS should occur, repair of the cable may result in sediment suspension and deposition from maintenance vessels and activities. Localized impacts to marine deposits would be ***short-term*** and ***minor***.

Decommissioning

Impacts to geologic resources from seafloor disturbance and sediment suspension and deposition would be similar to those impacts described for construction if removal of the SFEC takes place using similar equipment and methods.

SFEC – Onshore

Construction

Land Disturbance
HDD will be used to connect the SFEC – NYS with the SFEC – Onshore in the sea-to-shore transition area resulting in ***long-term minor impacts*** to the subsurface geology along the cable alignment. ***No impacts*** to the geomorphology of the beach and adjacent coastal area will occur because of the subsurface installation technique.

Previously disturbed areas within and along roadways and railways will be excavated and trenched for burial of the SFEC – Onshore. The upper layers of soil in these areas will be reconfigured. Following installation all trenches will be back-filled and surface grades will be returned to pre-construction conditions where practicable. Overall, impacts to geological resources would be ***short-term*** and ***negligible***.

Sediment Suspension and Deposition
Sediment suspension and deposition along the SFEC – Onshore would have ***negligible impacts*** to surficial geology because all earth disturbances from onshore construction activities will be conducted in compliance with the SPDES General Permit and an approved SWPPP.

Operations and Maintenance

Land Disturbance
Negligible impacts to geological resources could occur during the O&M phase in the unlikely event that SFEC - Onshore requires repair or replacement.

Decommissioning

Decommissioning impacts to geological resources would be similar to impacts described for construction.

4.2.3.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to geological resources.

- The SFWF and SFEC - Offshore will avoid, to the extent practicable, identified shallow hazards.
- Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging this method will minimize impacts to surficial geology.
- Use of monopiles with associated scour protection will minimize impacts to surficial geology, compared to other foundation types.
- Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to surficial geology, as compared to use of a vessel relying on multiple-anchors.
- A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. SFEC - Onshore is sited within previously disturbed existing ROWs.

4.2.4 Physical Oceanography and Meteorology

The physical oceanographic and meteorological conditions within the SFWF and SFEC are described in this section. Physical oceanographic conditions include circulation, currents, and water column stratification by temperature and salinity. Meteorological conditions include wind speed and direction, and occurrence of storms. This section is intended to provide an overview of conditions to form the basis of evaluating potential impacts of the Project construction, operation, and decommissioning on physical processes. These topics will be assessed in greater detail during the FDR and Fabrication and Installation Report (FIR) phases in accordance with 30 CFR 585.700-702.

4.2.4.1 Affected Environment

The following are key sources of oceanographic and meteorological information on the SFWF and SFEC reviewed in the support of the development of this COP section:

- *Rhode Island Ocean Special Area Management Plan* (OSAMP) (RI CRMC, 2010).
- Environmental Assessment prepared by BOEM for the RI-MA WEA, Appendix C: *Additional Resource Information: Geology and Physical Oceanography* (BOEM, 2013).
- Wind speed and directional data obtained from the National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) product for 2001-2010 (Saha et al., 2010) and from Environmental Assessment prepared by BOEM for the RI-MA WEA (BOEM, 2013).
- Data on regional current and circulation data for the area was obtained from the HYbrid Coordinate Ocean Model (HYCOM) hindcast reanalysis performed by the U.S. Naval Research Laboratory (Chassignet et al., 2007).
- The National Aeronautics and Space Administration (NASA) Global Modeling and Assimilation Office project, the Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) provides wind data from 1980 to the present (Gelaro et al., 2017).
- The Integrated Ocean Waves for Geophysical and Other Applications (IOWAGA), funded by the European Commission, provides wave-related information through a model that simulates sea state conditions from 1996 to 2016.
- NOAA's National Data Buoy Center (NDBC) manages a U.S. data buoy network to collect meteorological and environmental data and includes buoys and a Coastal-Marine Automated Network (C-MAN) (NOAA, 2018; Appendix X).
- Current and water level data were also extracted from a Global Tide Model included in a model package created by IOWAGA called MIKE 21 (Appendix X).
- A time series of sea-level data were obtained from Oregon State University's (OSU) Tidal Inversion Software model that assimilated tide gauges along the East coast.
- Tidal elevations information was obtained from the Admiralty Total Tide (ATT) software (Appendix X).
- Tropical cyclone track data were obtained from the International Best Tracks for Climate Stewardship (IBTrACS) database (version IBTrACS v03r09), which is a historical global dataset of tropical cyclones.

Regional Overview

The SFWF is located at the southern end of Rhode Island Sound, which is bounded by Block Island to the west, mainland Rhode Island to the north, Martha's Vineyard to the east, and is open to the Atlantic Ocean to the south. The SFWF and a portion of the SFEC are at the southern end of the OSAMP study area. Block Island Sound lies to the west of Block Island and extends to

Long Island Sound, as depicted on Figure 1.1-2 in Section 1. The SFEC - OCS and SFEC - NYS occupy waters south of Block Island and Montauk until the cable makes landfall.

Circulation

Circulation patterns are influenced by winds, tides, differences in water density (dependent on temperature and salinity), and geomorphology (bathymetry and land masses). Overall, net transport of water from Rhode Island Sound moves toward the southwest and west. However, bottom water may flow toward the north, particularly during the winter. Circulation patterns are influenced by water moving in from Block Island Sound and the colder water coming in from the Gulf of Maine. Also, "warm core rings" split off from the northward flowing Gulf Stream could move into Rhode Island Sound, bringing entrained warm water biota (RI CRMC, 2010).

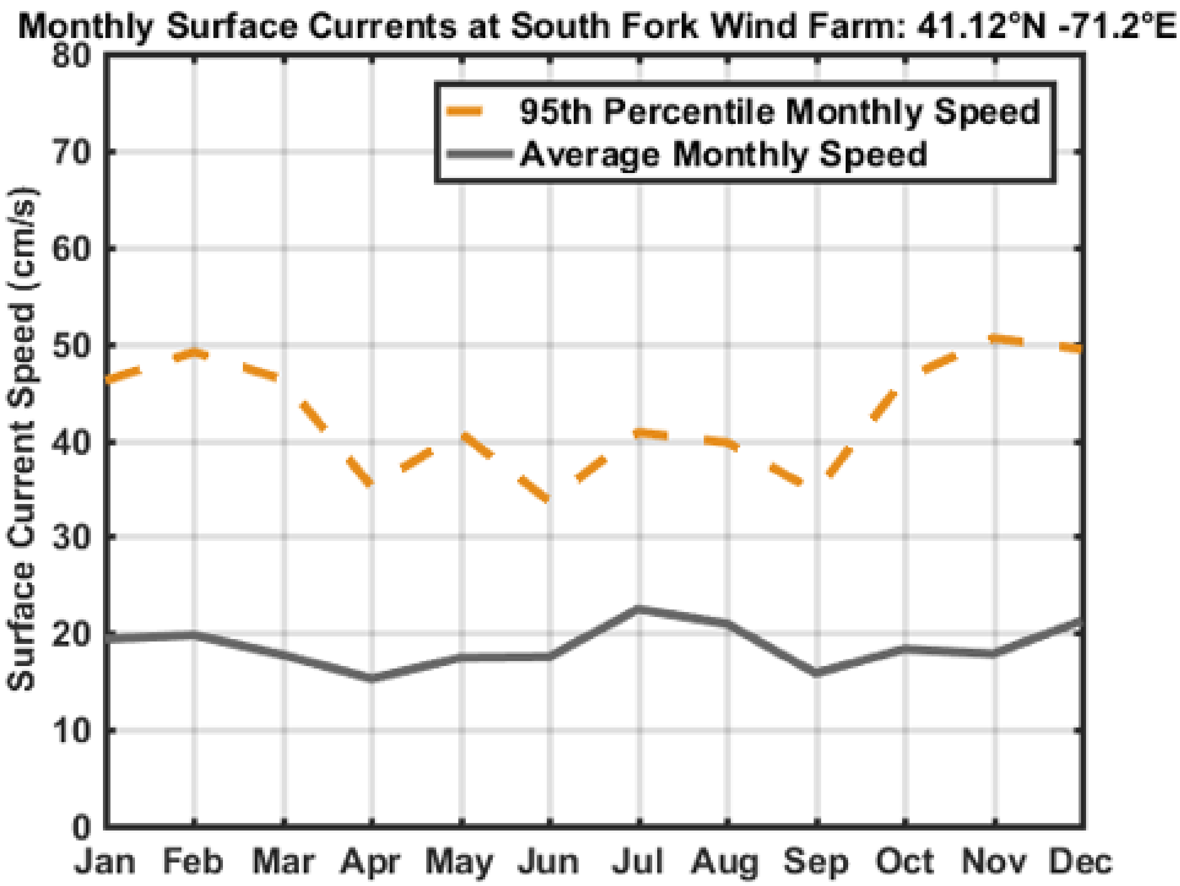
Regionally, currents from Rhode Island Sound meet outflow from Block Island Sound off Montauk Point and flow towards the southwest below Long Island. Although current flow south of Long Island follows the overall southwestern movement, nearshore currents flow towards the east (RI CRMC, 2010).

Waves generally move across the area from the south and are on average between 3.3 and 9.8 feet (1 and 3 m). Highest storm waves are up to 30 feet (9 m). Under normal conditions, wave action results in little disturbance to bottom waters or sediments. Semi-diurnal (i.e., twice daily) tides come in from the southeast, with an average tidal range of 3.2 feet (1.0 m) across Block Island and Rhode Island Sounds (RI CRMC, 2010).

Evaluation of Available Data Sets for Circulation

As a preliminary assessment of ocean currents within the SFWF and SFEC, statistics were generated based on modeled hindcast reanalysis of inputs for the years 2001 to 2010, from the HYCOM 1/12-degree global simulation assimilated with Navy Coupled Ocean Data Assimilation (NCODA) from the U.S. Naval Research Laboratory (Halliwell, 2004). The 2001 to 2010 data period was chosen as the most recent 10 years of re-analysis data for HYCOM currents and its matching wind CFSR that is available.

The study area for this assessment was centered on the SFWF, but spatial coverage extended to the SFEC route. At the SFWF, average surface current speeds were consistently about 8 inches per second (in./s; 20 centimeters per second [cm/s]) throughout the year, with the strongest currents of 20 in./s (50 cm/s; as the 95th percentile) in late fall and early spring, as depicted on Figure 4.2-6. Estimated average currents at depth of 98.4 feet (30 meters) range between approximately 2.8 in./s (7 cm/s) as the mean, to 6.7 in./s (17 cm/s) as the 95th percentile. Currents show directional variability from the surface to the bottom depth, changing from easterly in the surface to north-easterly/west-south-westerly at depth. Differences between surface currents and seabed currents can be attributed partly to the influence of wind effect on the surface layer and bathymetric features around the study area on the bottom layer, as depicted on Figure 4.2-7.



Sources: Halliwell, 2004; Chassignet et al., 2007

Figure 4.2-6. HYCOM Monthly Current Speed Statistics Near the SFWF and SFEC Study Area from January 2001 to December 2010

Graphical representation of estimated average surface current and 95th percentile monthly speed at the SFWF and SFEC.

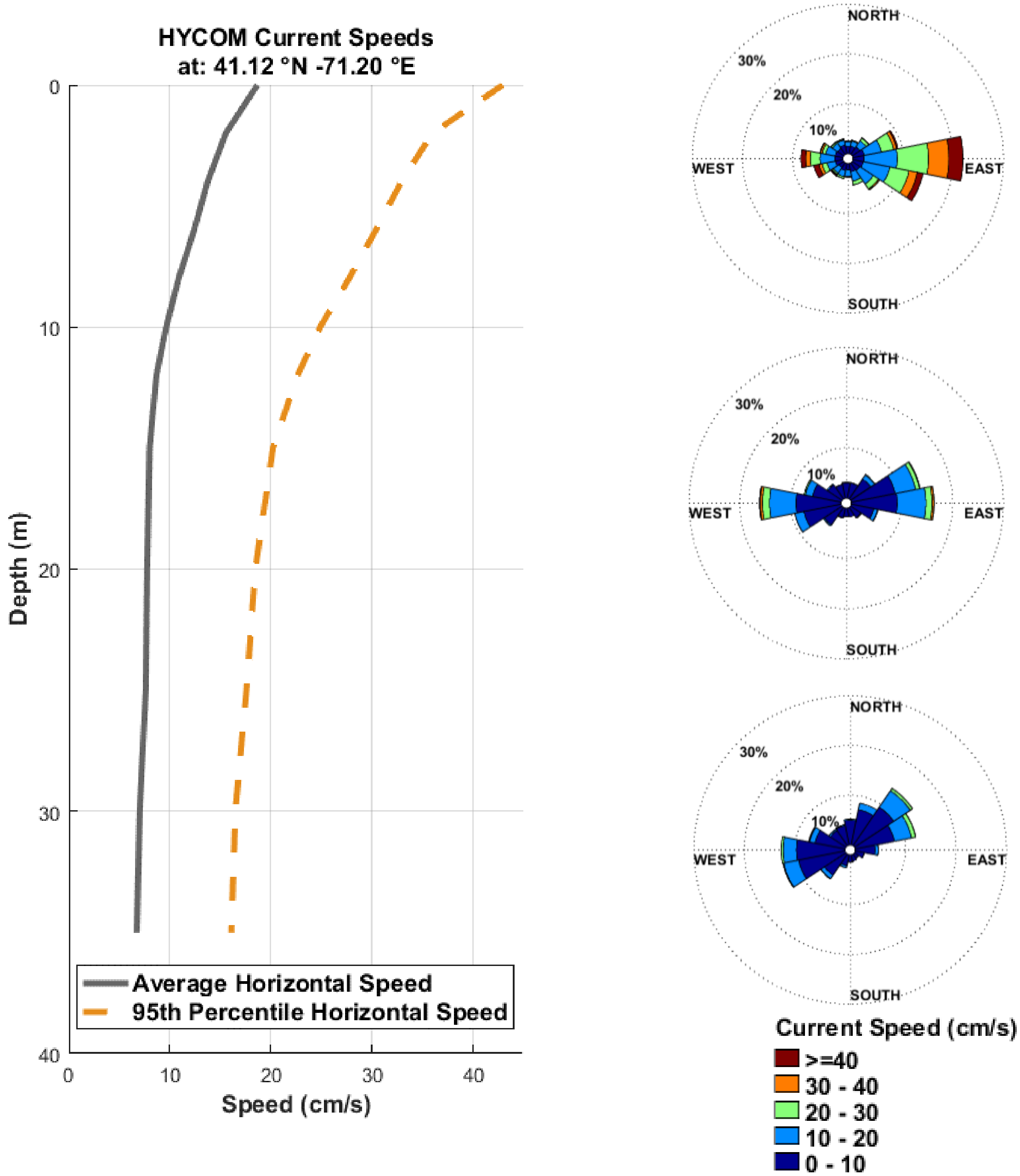
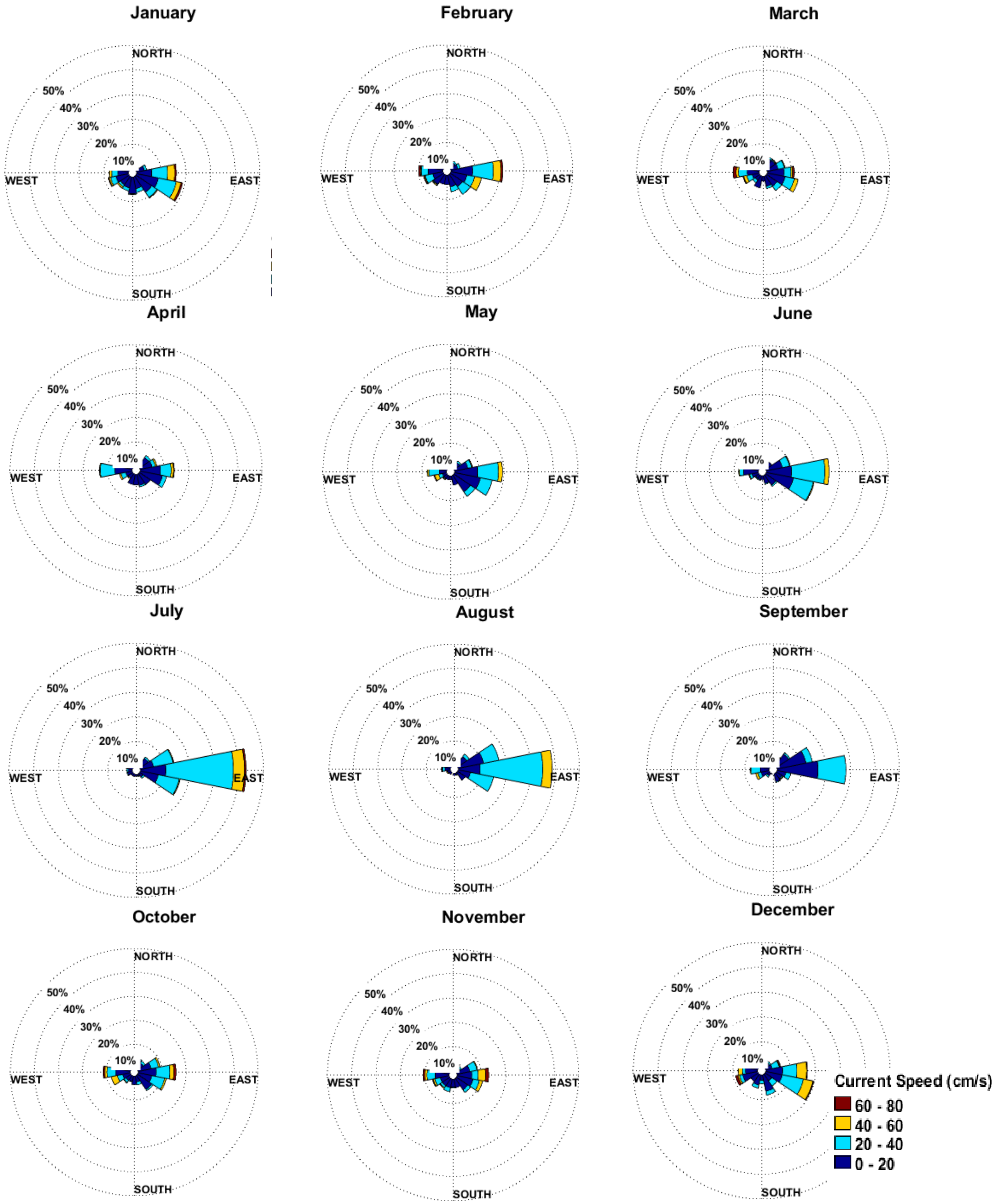


Figure 4.2-7. Vertical Profile of the HYCOM 2001-2010 Horizontal Current Speed (cm/S) Dataset

Depiction of average and 95th percentile speed and variation with depth near the study area. Current roses of annual current are from the surface, 15 m and 30 m water depths. Current roses show the direction to which the current is flowing.

Figure 4.2-8 illustrates that surface currents consistently move toward the east. The direction of flow shifts westerly as depth increases. Currents moving along the southern Long Island shoreline near the SFEC – NYS had higher average velocities, up to 9.8 in./s (25 cm/s). A map of surface currents on Figure 4.2-9 indicates flow direction at peak flood and peak ebb. Based on this preliminary assessment of currents at the SFWF, it appears that the SFWF may be located outside the zone of regional southwestward surface current flow from Block Island and Rhode Island Sounds.

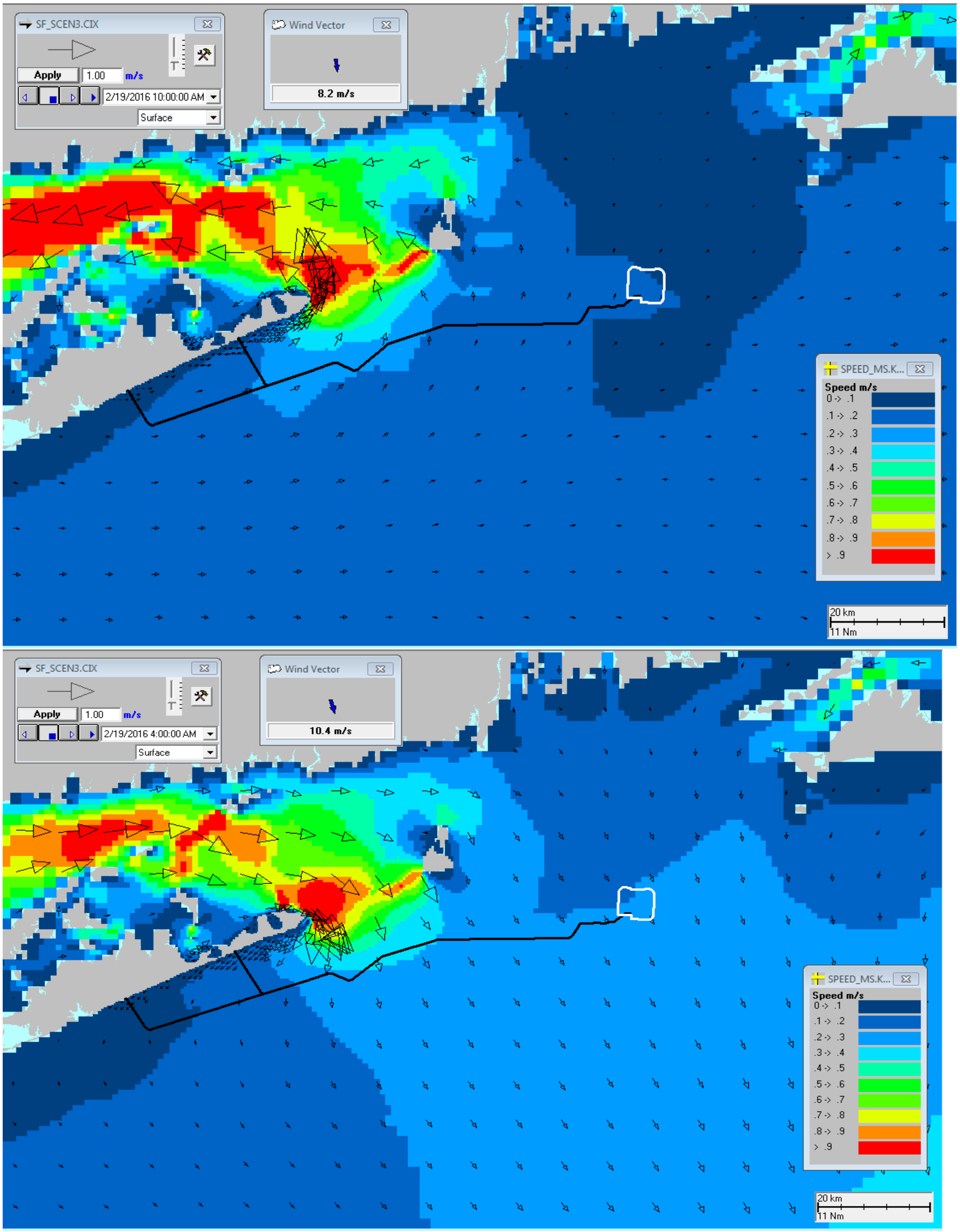


Note: Direction convention is standard (i.e., direction currents are headed).

Source: Saha et al., 2010

Figure 4.2-8. Monthly Averaged HYCOM Surface Currents near the Study Area from January 2001 to December 2010

Depiction of current roses showing monthly averaged surface current direction and speeds.



Source: Appendix I

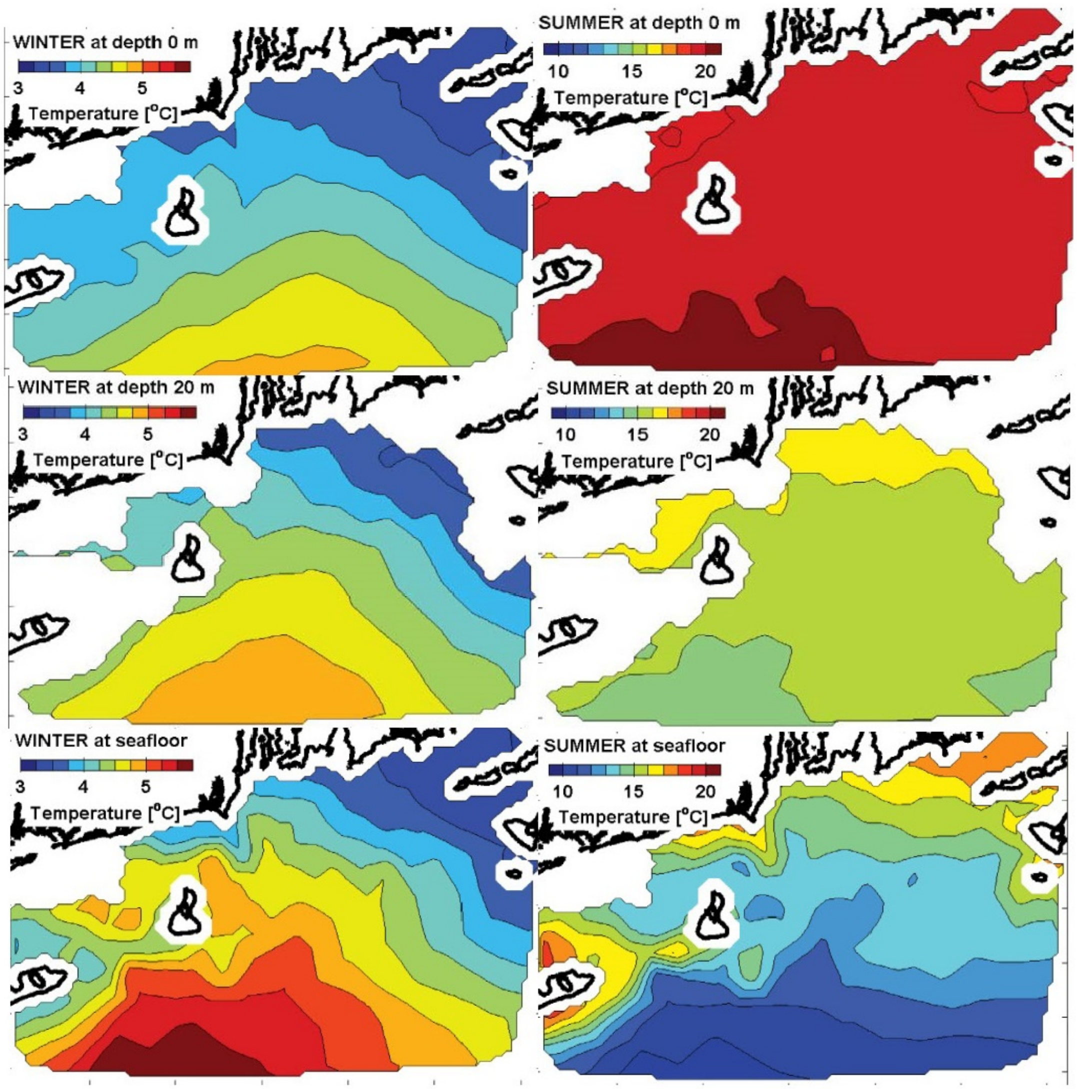
Figure 4.2-9. Surface Currents with Flow Direction Indicated at Peak Flow and Peak Ebb Tides

Depiction of the surface current flow directions at peak flood and peak ebb tides throughout the Project Area.

Water Column Stratification

In general, the heating of water and increased salinity during the late summer and early fall results in a stratified water column that is subjected to mixing in the fall from upwelling bottom waters and storm action. The temperature and salinity trends described below contribute to this seasonal stratification.

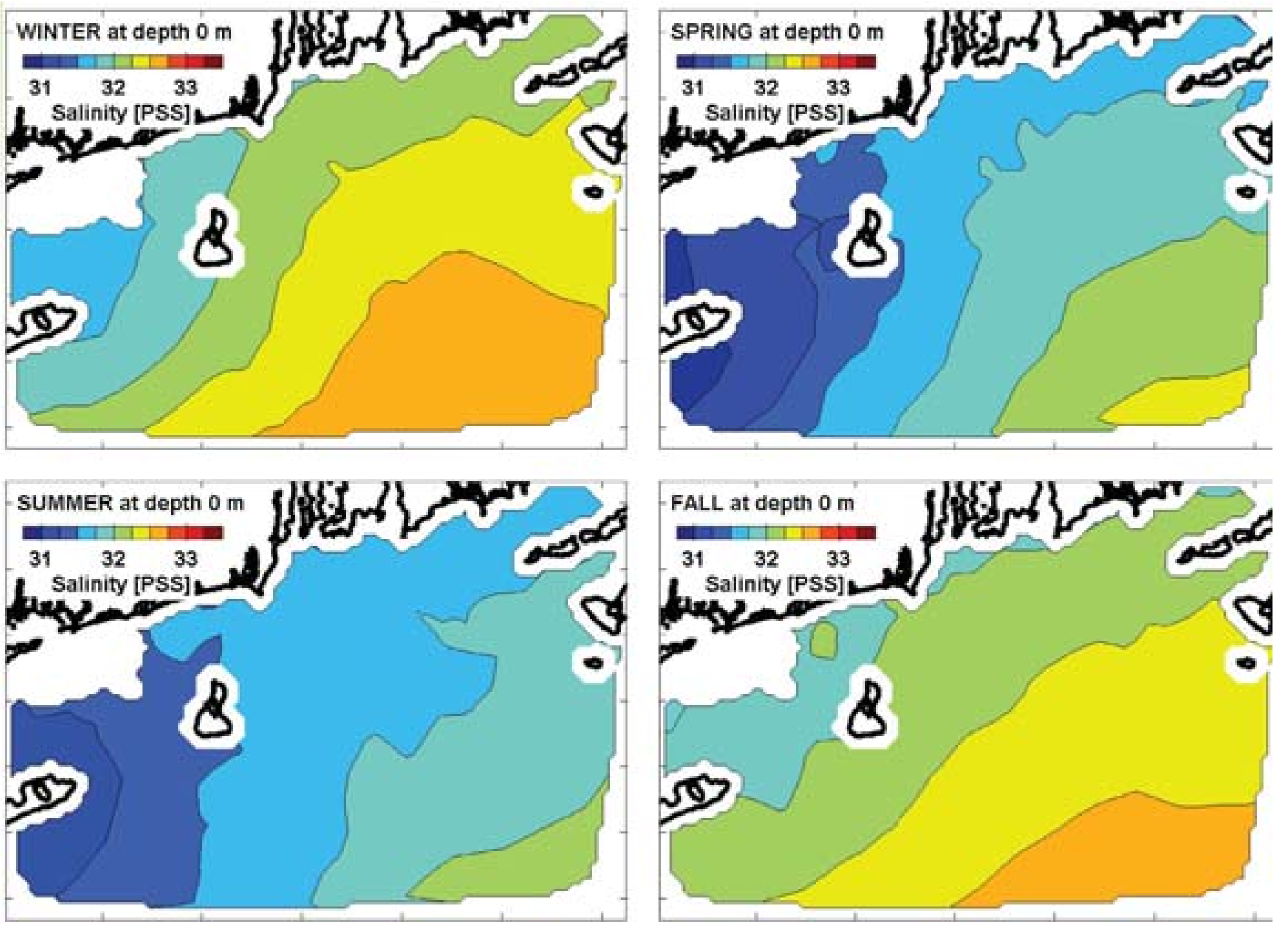
Averages of seasonal water temperature data collected by the RI CRMC between 1980 and 2007 are depicted on Figure 4.2-10 (RI CRMC, 2010). Surface water temperatures fluctuate up to 59 degrees Fahrenheit (°F) (15 degrees Celsius [°C]) seasonally, and as expected, bottom waters have smaller seasonal temperature fluctuation of approximately 41°F (5°C). Water temperatures are highest in July/August when the water column becomes stratified; surface water temperatures are close to 68°F (20°C), with bottom waters in the SFWF area of about 50°F (10°C). During the winter, average surface water temperatures range from approximately 39 to 41°F (4 to 5°C), with bottom waters staying slightly warmer at the southern edge of Rhode Island Sound in the SFWF.



Source: RI CRMC, 2010

Figure 4.2-10. Seasonal Water Temperature Based on Data Collected Between 1980 and 2007
Depiction of seasonal water temperature data in Rhode Island Sound.

Surface water salinity decreases in the spring with fresh water inflows from ice melts and spring rains, and increases with temperature in the summer, with highest surface water salinities in the fall and winter. Bottom water salinities are higher than surface water salinities throughout the year, setting up for the stratification described above. Highest salinities within Rhode Island Sound (approximately 33 Practical Salinity Scale [PSS]) are bottom waters at the southern end of the Sound, near the SFWF. Seasonal water salinities at the sea surface in Rhode Island Sound are shown on Figure 4.2-11.



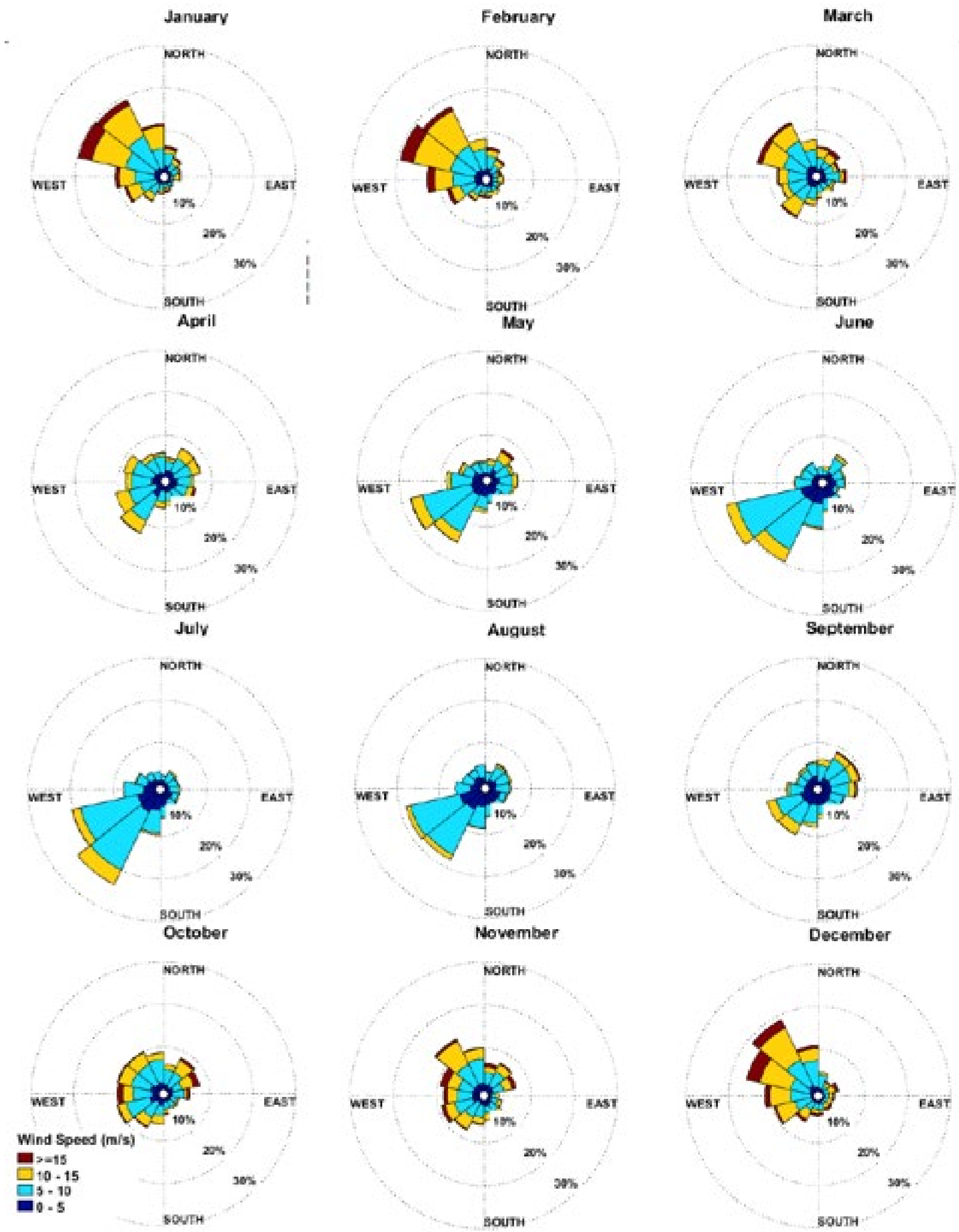
Source: RI CRMC, 2010

Figure 4.2-11. Seasonal Water Salinities at Sea Surface (Depth 0 m), Based on Archived Conductivity, Temperature, and Depth Data Collected Between 1980 and 2007

Illustration of the seasonal water salinities at sea surface in Rhode Island Sound.

Wind

Wind data were obtained from the NCEP CFSR product for 2001 through 2010 to provide a preliminary evaluation of wind direction and speed. Predominant wind direction is from the southwest during the summer months, and from the northwest during the winter when wind speeds are higher. Monthly wind direction and speed at a representative point within the Rhode Island Sound are depicted on Figure 4.2-12.



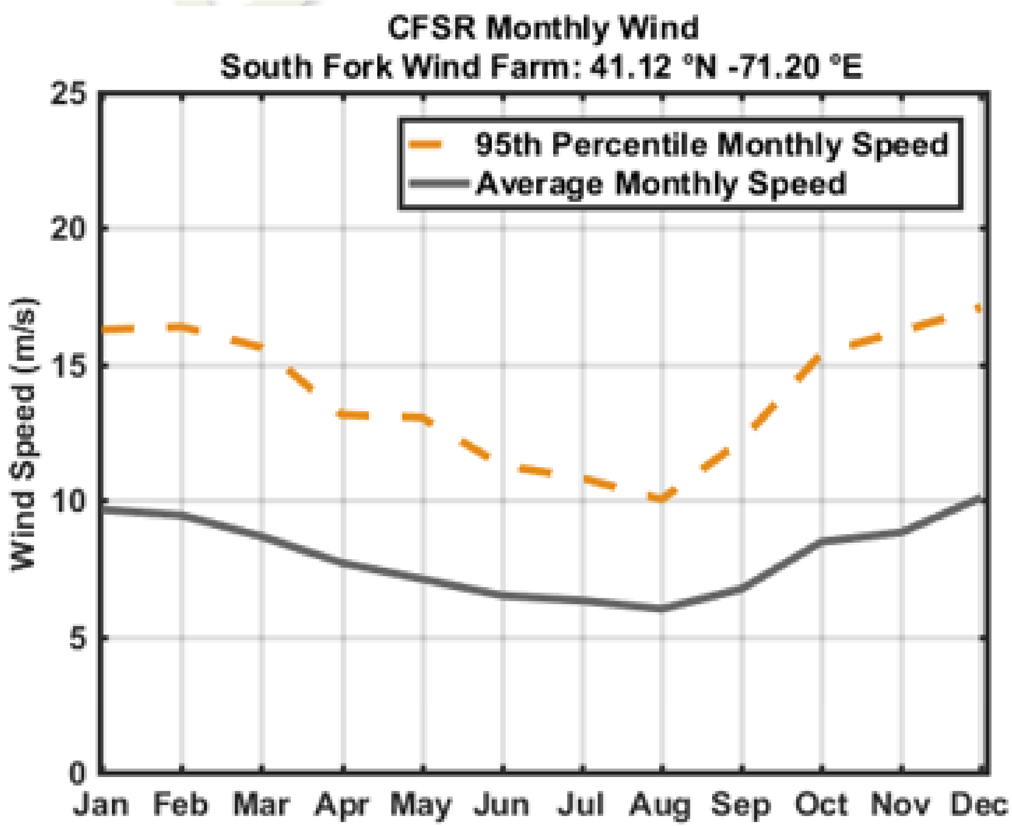
Note: Wind speeds are in m/s. using meteorological convention (i.e., direction from which wind is coming.

Source: Saha et al., 2010

Figure 4.2-12. Monthly Wind Roses for the CFSR Grid Point Nearest to the SFWF

Depiction of the monthly wind direction and speed at a representative point within the Rhode Island Sound.

Average monthly wind speeds and strongest winds (represented by the 95th percentile) are depicted on Figure 4.2-13 for the years 2001 through 2010. Average wind speeds are between 16 and 32 feet per second (ft/s) (5 and 10 meters per second [m/s]), with stronger wind in the winter. The occurrence of stronger winds from the northwest during winter is seen by the 95th percentile curve that reaches over 49 ft/s (15 m/s). According to wind measurements from meteorological measurement sites in Massachusetts and Rhode Island, the wind rose figures show the predominant winds for Block Island, Martha's Vineyard, and Nantucket during the years 2003 through 2012 are from the southwest through northerly directions and the average speeds are between 12.5 and 20.3 ft/s (3.8 and 6.2 m/s).



Source: Halliwell, 2004; Chassignet et al. 2007

Figure 4.2-13. Monthly Wind Speed Statistics for the CFSR Grid Point Nearest to the SFWF

Graphical representation of the average monthly wind speeds and strongest winds (represented by the 95th percentile) at the SFWF and SFEC.

Storms

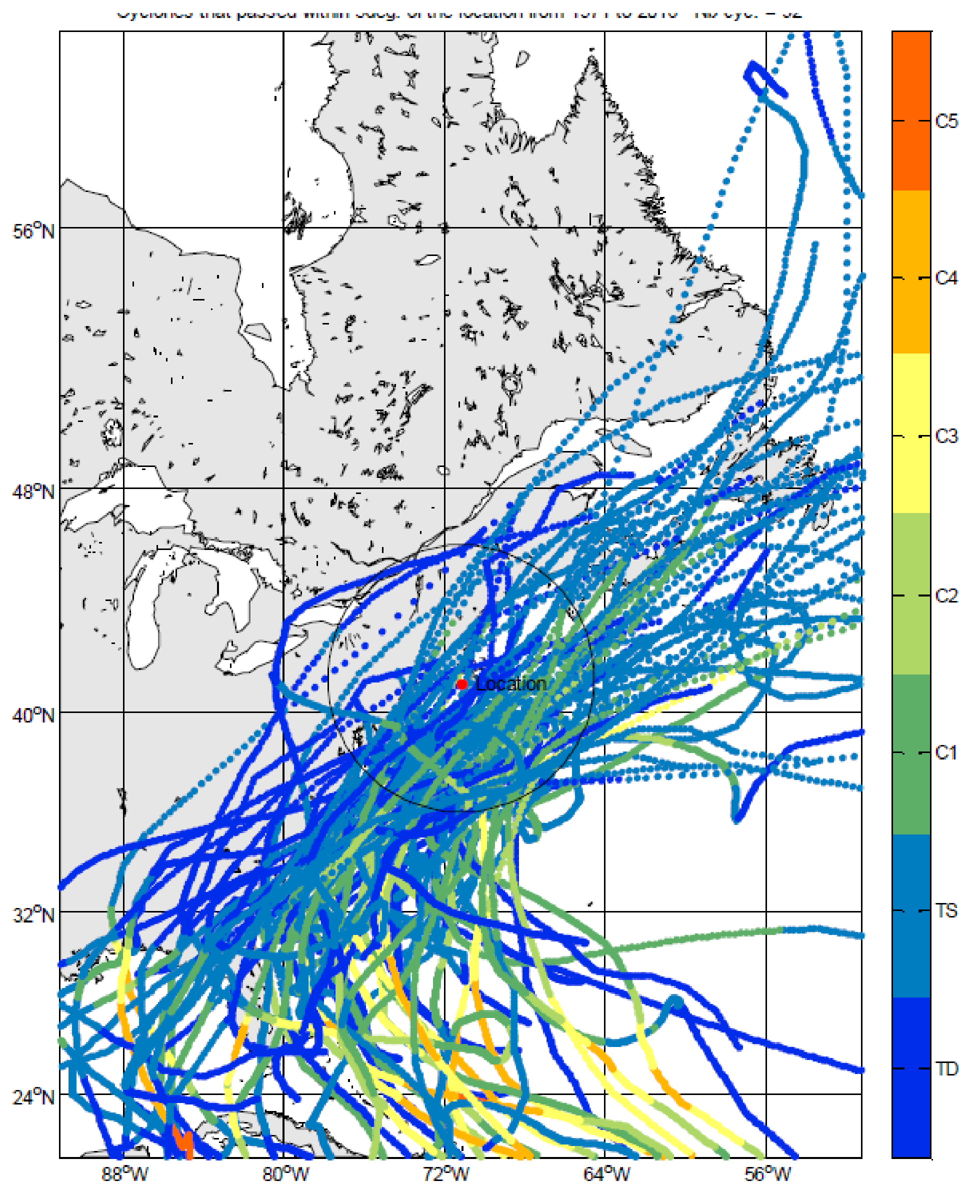
Regional data reports indicating the magnitude of wind events within the NOAA National Centers for Environmental Information Storm Events Database, provides a characterization of recently recorded wind events in the general vicinity of the project. Table 4.2-10 includes the high wind events for Barnstable and Nantucket Counties in Massachusetts between January 2017 and March 2018. Few hurricanes pass through New England, but the area is subjected to frequent Nor'easters that form offshore between Georgia and New Jersey, and typically reach maximum intensity in New England. These storms are usually characterized by winds from the northeast, and can bring heavy precipitation, wind, storm surges, and rough seas. They primarily occur between September and April but can form any time of the year. Although hurricanes are relatively infrequent in New England, wave heights up to 30 feet (9 m) were recorded south of Block Island (Scripps Buoy 44097) during Hurricane Sandy in 2012 (NOAA, 2012).

Table 4.2-10. Recorded High Wind Speeds for Barnstable and Nantucket Counties, Massachusetts for January 2017 to March 2018

Date of Measurement	Magnitude (knots)	Magnitude (m/s)	Measured (MG) or Estimated (EG)
23-Jan-17	51	26.2	MG
13-Feb-17	50	25.7	EG
2-Mar-17	50	25.7	MG
14-Mar-17	69	35.5	MG
14-Mar-17	51	26.2	MG
19-Mar-17	52	26.8	MG
1-Apr-17	54	27.8	MG
1-Apr-17	56	28.8	MG
25-Oct-17	50	25.7	MG
29-Oct-17	81	41.7	MG
30-Oct-17	61	31.4	MG
25-Dec-17	57	29.3	MG
25-Dec-17	66	34.0	EG
4-Jan-18	65	33.4	EG
4-Jan-18	53	27.3	MG
12-Jan-18	57	29.3	EG
30-Jan-18	36	18.5	MS
2-Mar-18	84	43.2	EG
2-Mar-18	78	40.1	EG
5-Mar-18	35	18.0	MS
13-Mar-18	67	34.5	EG

Cyclones

The IBTrACS project contains the most complete global set of historical tropical cyclones available. It combines information from numerous tropical cyclone datasets, simplifying interagency comparisons by providing storm data from multiple sources in one place. As part of the IBTrACS project, the quality of storm inventories, positions, pressures, and wind speeds are checked and information about the quality of the data are passed on to the user. The version of the database that has been used is IBTrACS v03r09, which contains cyclone data from 1848 up to 2015 and was released in September 2016. Figure 4.2-14 illustrates the track of cyclones having passed within 5 degrees of the SFWF project area between 1971 and 2015.



Source: NOAA IBTrACS, 2010

Figure 4.2-14. Cyclone Tracks Having Passed within 5 degrees of the SFWF between 1971 and 2015
Overview of the cyclone tracks near the SFWF Project Area over the past 44-year time period

Available data for all cyclones passing within a certain radius (e.g., 270 NM) of the SFWF were examined using the IBTrACS data. For each of those cyclones, the SFW team employed a parametric wind model to identify the maximum wind speed caused at the location due to the passing of the cyclone. An extreme value analysis was then undertaken on the distribution of maximum wind speeds caused by all cyclones within the 270-NM radius in order to determine the extreme wind speeds with a given return period. A number of different locations along the cyclone tracks were included and the analysis was applied to those locations with the highest cyclone risk. Appendix Z includes the technical report for a meteorological and oceanographic study of the SFWF area (SFWF MetOcean Conditions Report). Table 4.2-11 is excerpted from Appendix Z and provides predicted cyclonic conditions near the SFWF based on previously recorded events. The results presented are omni-directional so that predominant wind or wave directions are not indicated.

Table 4.2-11 Possible Cyclone Conditions, including Omni-directional Extremes, within the SFWF Area for 10, 50, 100, 500- and 1,000-Year Model Return Periods

Season - CYCLONE	All-year	All-year	All-year	All-year	All-year
Return Period	**10**	**50**	**100**	**500**	**1,000**
WIND SPEED					
1-minute mean wind speed at 10m [m/s]	27	39	44	56	61
3-second gust wind speed at 10m [m/s]	30	44	50	65	71
SEA STATE (3-HOUR)					
Maximum individual wave height [m]	9.8	13.7	15.2	18.9	20.5
Associated period [s]	9.4	11.0	11.7	13.0	13.5
Associated wave length [m]	138	183	201	239	255
Significant wave height [m]	5.6	7.8	8.7	10.8	11.7
Zero crossing period [s]	7.7	9.0	9.5	10.6	11.1
Peak energy period [s]	10.2	12.0	12.7	14.1	14.7
WATER LEVELS					
Wave crest elevation [m]	5.6	8.1	9.3	12.2	13.5
Tidal rise [m]	1.4	1.4	1.4	1.4	1.4
Storm surge [m]	0.4	0.9	1.1	1.7	1.9
Safety margin [m]		1.5	1.5	1.5	1.5
Minimum airgap [m]		11.9	13.3	16.7	18.3
CURRENT					
Total surface current [m/s]	1.1	1.4	1.5	1.8	1.9
Current at 25% of water depth [m/s]	0.9	1.2	1.3	1.6	1.7
Current at mid-depth [m/s]	0.8	1.0	1.1	1.3	1.4
Current at 75% of water depth [m/s]	0.7	0.8	0.9	1.1	1.1
Current at 1m above seabed [m/s]	0.4	0.5	0.6	0.7	0.7

Icing and Fog

Given the cold air temperatures experienced during many New England winters, there is potential for icing of equipment and vessels above the water line in the SFWF and SFEC. To evaluate the potential for icing and fog conditions within the OSAMP, Merrill (2010) assessed data from two locations: the Buzzard's Bay Tower (west of the Elizabeth Islands) and the Martha's Vineyard Coastal Observatory (1.9 miles [3 km] offshore). Results of the data analysis indicate the highest potential for fog development during the summer, with 10 potential days in June, compared to 1 to 4 potential days during each of the winter months. As expected, days with potential for icing conditions were limited to November through March, with the highest number of days (9) in January.

4.2.4.2 Potential Impacts

An overview of the IPFs for physical oceanography and meteorology are depicted on Figure 4.2-15. IPFs which would not impact physical oceanography and meteorology are shown as circles with a slash. IPFs that could impact physical oceanography and meteorology but were found to be negligible in the analyses in Section 4.1, are shown as gray circles without a slash.

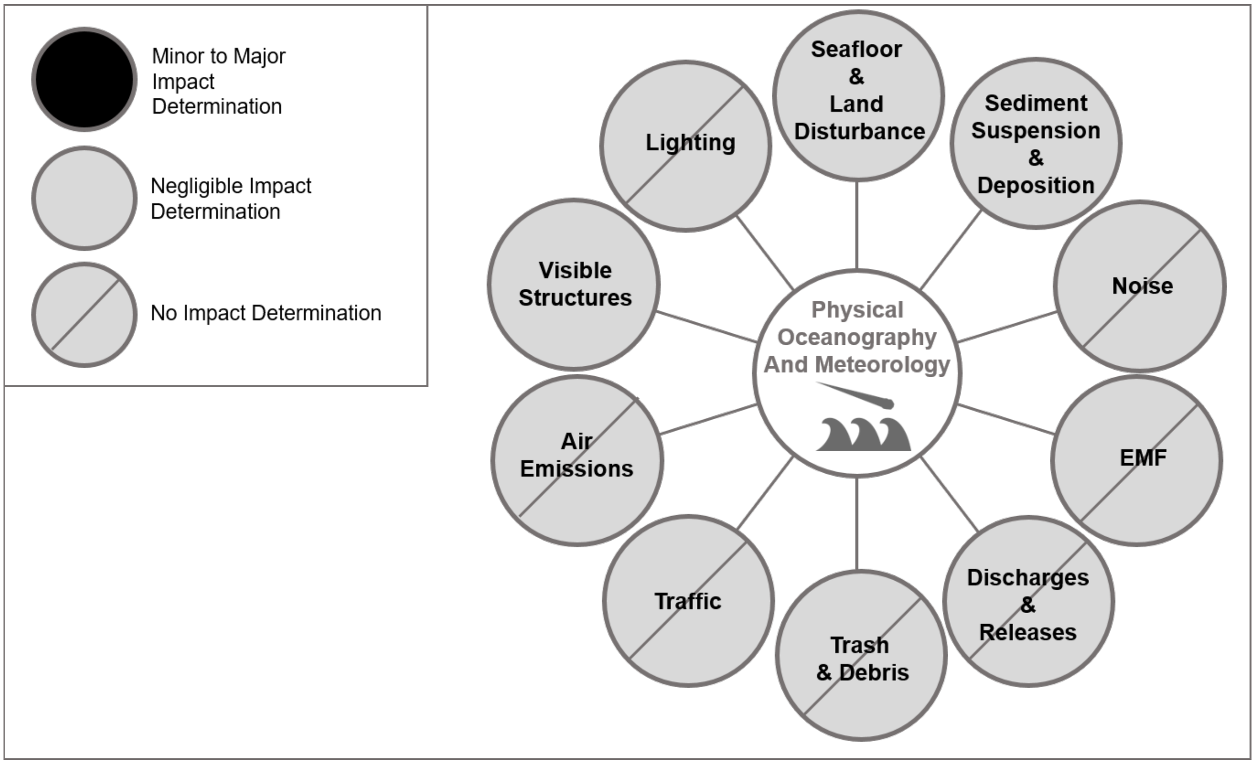


Figure 4.2-15. IPFs on Physical Oceanography and Meteorology
Illustration of potential impacts to physical oceanography and meteorology resulting from SFWF and SFEC activities

Three, inter-related IPFs were identified that will result in ***negligible impacts*** to physical oceanographic processes and conditions or meteorological conditions. Seafloor and Land Disturbance, Sediment Suspension and Deposition, and Visible Structures from the construction activity and physical presence of the SFWF and SFEC will affect water and wind currents as well as seafloor topography that, on a small scale, impact oceanographic and meteorological conditions but not to a degree to alter these conditions or processes. Because of the inter-related nature of these IPFs and consequent impacts, they are addressed together below.

Meteorological and oceanographic conditions could potentially affect all phases of the SFWF and SFEC, including construction, operations, and decommissioning. The SFWF and SFEC will be designed to address risks that the identified oceanographic and meteorological factors pose. The design will be reviewed by BOEM during the FDR in accordance with 30 CFR 585.700-702.

South Fork Wind Farm

Construction

Seafloor and Land Disturbance/Sediment Suspension and Deposition
Disturbance of the seafloor and increases in sediment suspension and deposition during construction of the SFWF may result in ***short-term, localized,*** and ***negligible impacts*** to physical oceanographic conditions because of relatively small and isolated changes to currents and seafloor topography.

Operations and Maintenance

Seafloor and Land Disturbance/Sediment Suspension and Deposition/Visible Structures
Over the operational period, the presence of the SFWF foundations will result in relatively small and isolated changes to bottom current patterns, sediment scour, suspension, and transport. However, only appreciable changes in sediment distribution patterns are expected and would result in ***localized, negligible impacts*** to oceanographic conditions. However, because the

foundations would be spaced widely apart (e.g., approximately 1.15 mile (1.8 km, 1 nm) and given the small footprint of the SFWF relative to the oceanic current systems, currents would likely not be affected by the presence of the foundations, and impacts are considered ***negligible***.

Similarly, the presence and operation of the WTGs has the potential to create turbulence in the immediate vicinity of the tower, nacelle, and blades. However, impacts to air flow would be ***localized*** and are considered ***negligible***.

<u>Decommissioning</u>

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, ***short-term, localized,*** and ***negligible.***

SFEC – OCS

<u>Construction</u>

Seafloor and Land Disturbance/Sediment Suspension and Deposition
Disturbance of the seafloor resulting in increases in sediment suspension and deposition during construction of the SFEC - OCS would result in ***short-term, localized,*** and ***negligible impacts*** to physical oceanographic conditions in the installation because of effects on currents and seafloor topography.

<u>Operations and Maintenance</u>

Seafloor Disturbance
No disturbance to physical oceanographic conditions is expected during routine operations because there is no routine maintenance of the SFEC – OCS requiring work on the seafloor. Should there be a need for construction-related maintenance of the SFEC - OCS, vessels similar in size to the cable lay barge spread or smaller would likely be used for the repair. Therefore, routine operations of the SFEC - OCS are expected to result in ***no impact*** to physical oceanographic conditions with the potential for ***localized, negligible impacts*** if a repair is needed.

Sediment Suspension and Deposition
The physical presence of the SFEC - OCS would have ***no impacts*** to currents because the cables will be buried beneath the seabed except in some areas of the SFEC - OCS that require protective armoring which could have the potential to affect currents. However, because of the small acreage associated with this protective armoring relative to the greater oceanic current systems in the region, this potential SFEC – OCS O&M impact is expected to be ***localized*** and ***negligible***.

<u>Decommissioning</u>

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, ***short-term, localized,*** and ***negligible.***

SFEC – NYS

<u>Construction</u>

Seafloor Disturbance/Sediment Suspension and Deposition
Similar to the SFEC - OCS, construction of the SFEC - NYS has the potential to result in ***short-term, localized,*** and ***negligible impacts*** to physical oceanographic conditions from seafloor disturbance and related sediment suspension and deposition because of small, isolated changes to currents and seafloor topography. The onshore segments of the SFEC - NYS will not impact physical oceanographic and meteorological conditions.

Operations and Maintenance

Seafloor and Land Disturbance/Sediment Suspension and Deposition

Impacts associated with seafloor disturbance during O&M of the SFEC - NYS are expected to be similar to those described for the SFEC - OCS.

Decommissioning

Impacts to physical oceanographic and meteorological conditions would be similar to those described above, ***short-term, localized,*** and ***negligible.***

4.2.4.3 Proposed Environmental Protection Measures

SFW has designed the Project to account for site-specific oceanographic and meteorological conditions within the Project Area; therefore, no additional measures are necessary.

4.3 Biological Resources

4.3.1 Coastal and Terrestrial Habitat

This section describes the affected environment and provides an assessment and discussion of potential impacts for existing coastal and terrestrial habitats, including sensitive habitats, during construction, O&M, and decommissioning of the SFWF and SFEC. The coastal and terrestrial habitats considered are along the Long Island south coastline in the vicinity of the two potential landing sites and inland along the SFEC – Onshore cable routes. Other habitats, such as benthic and shellfish habitats and essential fish habitat (EFH) are discussed separately in Sections 4.3.2 and 4.3.3, respectively.

To characterize existing coastal and terrestrial habitats within the vicinity of the various SFEC – Onshore components, information in this section was assembled from desktop research, agency consultations, and field surveys of biological resources. The following resources informed the description of the affected environment:

- Current public data sources related to coastal and terrestrial habitats in the town of East Hampton, village of East Hampton East Hampton, Suffolk County, and in Montauk Peninsula area on eastern Long Island including the town of East Hampton Local Waterfront Revitalization Program (Town of East Hampton, 2008).
- State and federal agency published reports including BOEM (2013), USFWS (1997), U.S. Department of Interior, Minerals Management Service (DOI-MMS; 2007), and NYSDEC.
- Project-specific studies included field surveys of onshore biological resources to aid in the characterization of the affected environment for coastal and terrestrial habitats (Appendix M). The field surveys included classification of observed habitats, delineations of freshwater and tidal wetlands, identification of plant and wildlife species, observations of rare and protected species and communities, and delineation of invasive species occurrences within the locations of the potential landing sites and routes for the SFEC – Onshore.

4.3.1.1 Affected Environment

Regional Overview

The SFWF and much of the SFEC will be located on the southern New England OCS and on the northern end of the Mid-Atlantic Bight. A portion of the SFEC will be located within New York State (SFEC – NYS) waters and onshore in the town or village of East Hampton on Long Island, New York.

Eastern Long Island's coastal and terrestrial environment varies widely and consists of a diversity of habitats. These range from exposed rocky shores and exposed bedrock, sandy coastal beaches, dunes, freshwater and brackish bays and ponds, and salt marshes fringing the shore of sheltered embayments to intertidal mud- and sandflats (BOEM, 2013). The sandy, coastal beaches along the southeastern coastline of Long Island are characterized by four zones: nearshore bottom (submerged areas below mean low water to 29.5 feet [9 m]); foreshore (intertidal areas between mean low water to the high tide zone); backshore (exposed sandflats above high tide line to dunes, but occasionally submerged during storms or exceptionally high tides); and dunes (areas of wind-blown sand ridges or mounds above the highest tide line and exposed to wind action) (USFWS, 1997).

These coastal and terrestrial habitats are constantly changing because of wave action and tidal currents that cause sediment transport (DOI-MMS, 2007). Eroding beaches and sand shoals on the inner continental shelf are the primary sources of sand that are deposited on and maintain the sand beaches (BOEM, 2013). In addition, small, sheltered beaches between rocky headlands are the predominant shoreline type for Long Island Sound, Rhode Island, and Massachusetts coastlines (DOI-MMS, 2007).

The vegetated habitat areas along the coastal beaches of eastern Long Island are generally found from the high tide line inland to the mainland. The backshore of the beach (high tide line to dunes) is usually sparsely vegetated. Just inland, at the toe of the dune, American beachgrass (*Ammophila breviligulata*) occurs along with dusty miller (*Artemesia steleriana*), beach pea (*Lathyrus japonica*), and saltwort (*Salsoli kali*). On the primary dunes, beachgrass is dominant along with seaside goldenrod (*Solidago sempervirens*); on the backside of the dunes, beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), and bayberry (*Myrica pensylvanica*) occur. Interdunal swales are wetlands that are formed where blowouts in the dunes intersect the water table and typical wetland plants such as sedges, rushes, herbs, and low shrubs become established. Characteristic species of these swale wetlands include purple gerardia (*Agalinis purpurea*), sundews (*Drosera* spp.), cranberry (*Vaccinium macrocarpon*), highbush blueberry (*Vaccinium corymbosum*), and bayberry. The upland transition zone along the south coastline of eastern Long Island has stands of shrublands/woodlands dominated by bayberry, arrowwoods (*Viburnum spp*.), and pitch pine (*Pinus rigida*) (USFWS, 1997).

South Fork Wind Farm

The SFWF is located offshore and therefore does not include coastal or terrestrial habitat. Marine habitats in the SFWF are discussed in Section 4.3.2 and finfish habitat and EFH are discussed in Section 4.3.3. Water quality in the SFWF is described in Section 4.2.2.

South Fork Export Cable

<u>SFEC - OCS and SFEC - NYS</u>

Much of the SFEC –OCS, including off the coast of Long Island and the SFEC – NYS approaching the coastline of Long Island, supports coastal subtidal marine habitats, not coastal and terrestrial habitats. Subtidal coastal marine habitats, such as submerged aquatic vegetation (SAV), macroalgal assemblages, hard bottom habitat, microbenthic and macrobenthic communities, soft bottom habitat, and shellfish resources are discussed in Sections 4.3.2 and 4.3.3.

<u>SFEC – Onshore</u>

The coastal and terrestrial habitats associated with the SFEC – Onshore would include those habitats in the vicinity of the landing sites, along the SFEC – Onshore cable routes, and at the SFEC – Interconnection Facility.

The coastal habitats in the SFEC – Onshore include the area from the ocean inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. Habitats could include nesting and feeding areas for beach-nesting birds, rare beach and interdunal swale communities and plants, and wintering waterfowl habitat.

Wetland habitats in the region are shown on Figures 4.3-1 and 4.3-2 and consist of fresh, brackish, and salt marshes and mudflats. Salt marshes and mudflats occur in the intertidal zones. Estuaries, which are shallow semi-enclosed areas where stream or river inflows mix with marine waters, include a range of intertidal and subtidal habitats from fresh to brackish and saline. Coastal wetlands and estuaries are highly productive, yet fragile, environments that support a great diversity of fish and wildlife species (DOI-MMS, 2007). The Peconic Bay Estuary, Narragansett Bay Estuary, and Long Island Sound are major estuaries in the region. Subtidal habitats such as seagrass beds occur offshore in shallow water and are addressed in Section 4.3.2.

New York State Significant Coastal Fish and Wildlife Habitats (SCFWH) are shown on Figure 4.3-2 (NYSDOS, 2018). New York State SCFWH are NYSDOS-designated special coastal and terrestrial habitat areas that are mapped along with a technical narrative providing site-specific information. The habitat narrative constitutes a record of the basis for the SCFWH's designation and provides specific information regarding the fish and wildlife resources that depend on this area.

The coastal and terrestrial habitats along the SFEC – Onshore cable routes are described below and summarized in Table 4.3-1. The habitats along the routes generally include a successional shrubland community located adjacent to the various roadway ROWs and the LIRR ROW. The vegetated cover types observed adjacent to the SFEC – Onshore cable routes include various upland and wetland plant communities (Appendix M).

- The landing sites consist of the marine intertidal gravel/sand beach and maritime beach communities as classified by the New York Natural Heritage Program (NYNHP) Ecological Communities of New York State (ECNYS) publication (Edinger et al., 2014; Town of East Hampton, 2008).
- The SFEC – Onshore cable routes traverse the following NYNHP-identified Significant Natural Communities: marine intertidal gravel/sand beach, maritime dunes, maritime heathland, maritime pitch pine dune woodland, maritime freshwater interdunal swales, high salt marsh, low salt marsh, salt shrub, brackish meadow, highbush blueberry bog thicket, coastal oak-heath forest, coastal oak-hickory forest, and pitch pine-oak forest (Edinger et al., 2014; Town of East Hampton, 2008). Neither of the proposed SFEC – Onshore route landing sites (Beach Lane and Hither Hills) is within a NYSDOS-designated SCFWH. However, the SFEC – Onshore cable route from the Hither Hills landing site would traverse three (Hither Hills Uplands, Napeague Beach, and Napeague Harbor) of the NYSDEC-designated SCFWH.
- The SFEC – Interconnection Facility consists of some ECNYS communities, including paved road path, unpaved road/path, and urban structure exterior, as well as a disturbed example of the coastal oak hickory forest community and a successional shrubland community (Edinger et al., 2014; Town of East Hampton, 2008).

Field surveys and desktop research for areas along the SFEC – Onshore cable routes identified habitat for a variety of birds, terrestrial mammals, and reptiles and amphibians, including species commonly associated with tidal, intertidal, and freshwater wetlands, freshwater surface waters, forests, successional habitats, agricultural fields, and developed areas. Observed avian, terrestrial mammal, and reptiles and amphibians documented near the SFEC – Onshore routes are described in Appendix M.

Wetland resources located in the vicinity of the SFEC – Onshore are illustrated on Figures 4.3-1 (Beach Lane) and 4.3-2 (Hither Hills). These include National Wetlands Inventory (NWI) and NYSDEC freshwater and tidal wetlands and adjacent areas. Figure 4.3-2 also shows the NYSDEC-designated SCFWH areas that would be traversed along the Hither Hills SFEC - Onshore route. Wetland delineation and results are presented in Appendix M, including a summary in Table 2 and maps in Appendix A (of Appendix M), Figure 4 (Sheets – 1-127).

The locations of rare and protected species and species habitats were observed during the field surveys of the SFEC – Onshore routes. Observed species documented near the SFEC – Onshore routes are described further in Appendix M.

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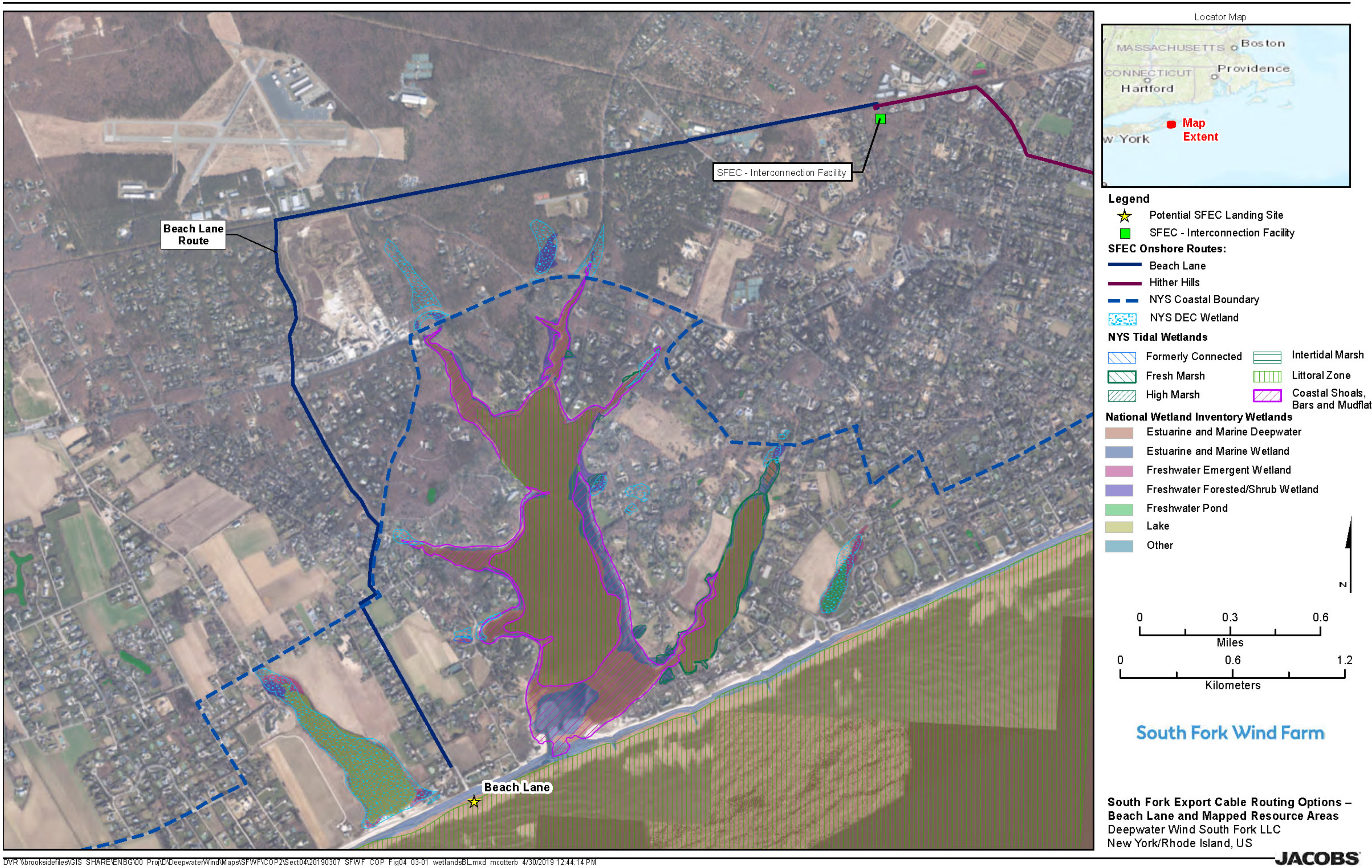

Figure 4.3-1. South Fork Export Cable Routing Options – Beach Lane and Mapped Resource Areas

Depiction of the wetland habitats and wetland resources in proximity of the Beach Lane landing and cable routing option.

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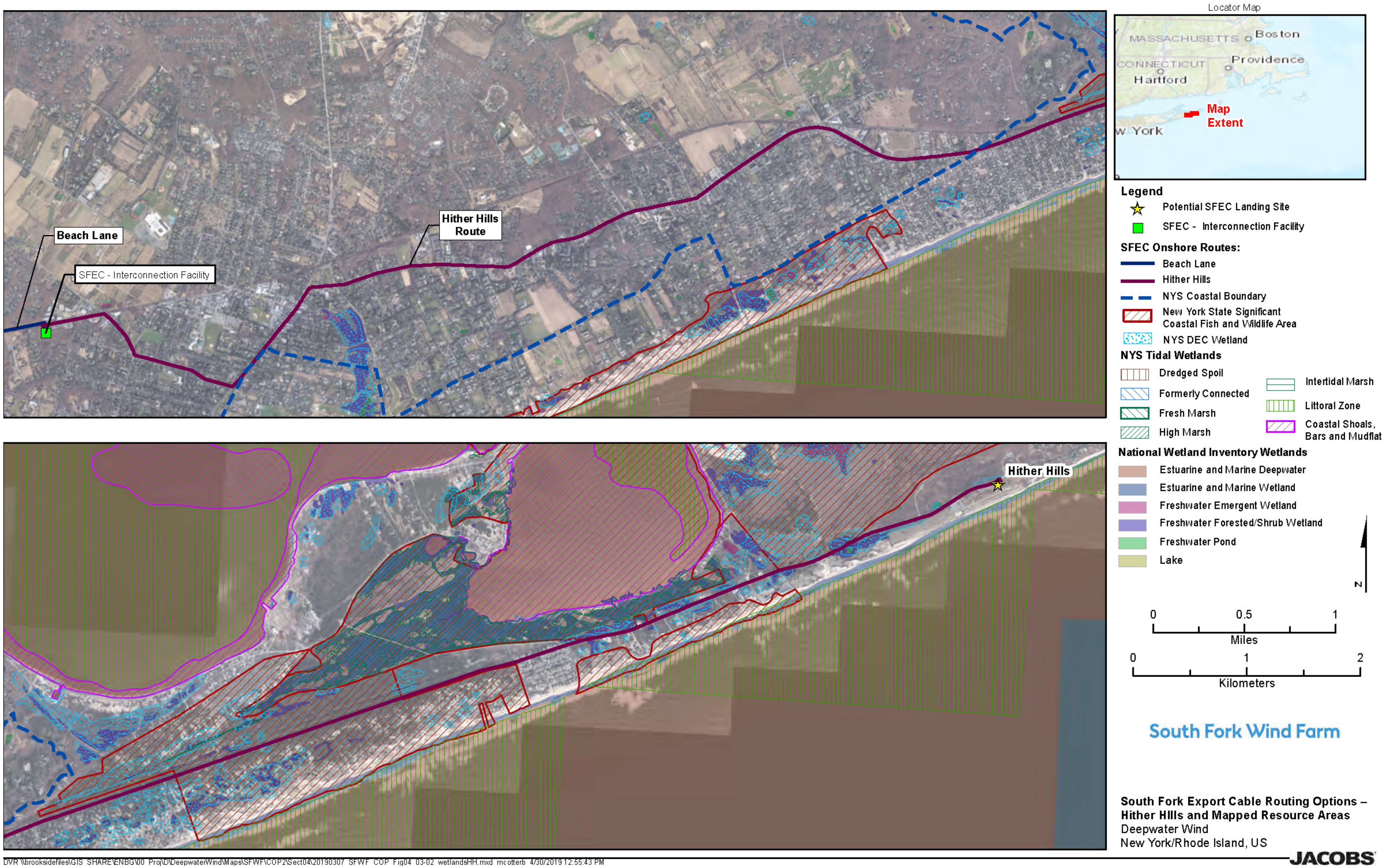

Figure 4.3-2. South Fork Export Cable Routing Options – Hither Hills and Mapped Resource Areas

Depiction of the wetland habitats and wetland resources in proximity of the Hither Hills landing and cable routing option.

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Table 4.3-1. Summary of Coastal and Terrestrial Habitats Observed for the SFEC - Onshore *Environmental Considerations and Onshore Habitats*

Project Component	NLCD Developed Land Cover Types (percent)	Delineated Wetlands and Wetland Adjacent Areas (number/ acres [ha])	Rare/Protected Species Observation (Number)	Invasive Species Occurrences (number)
SFEC – ONSHORE (BEACH LANE)				
Beach Lane Landing Site	91	0 / 0	2	2
Beach Lane – Route A	68.85	0 / 0	0	26
SFEC – ONSHORE (HITHER HILLS)				
Hither Hills Landing Site	42.47	0	0	3
Hither Hills Route B	99.45	34 / 19.96	49	89
Hither Hills – Route A	86.14	57 / 10.85 (4.39)	17	123
Hither Hills – Route C	97.18	50 / 13.34 (5.39)	49	83
SFEC – Interconnection facility				
SFEC – Interconnection Facility Site	0	0/0	0	1

NLCD = National Land Cover Database

4.3.1.2 Potential Impacts

Project-related IPFs that could potentially result in impacts to coastal and terrestrial habitats during the construction, O&M, and decommissioning phases of the SFWF and SFEC are described in this section. Impacts to benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH are discussed in Section 4.3.3. The IPFs that are discussed in this section that may impact coastal and terrestrial habitats are seafloor and land disturbance and sediment suspension and deposition IPFs. IPFs like discharges and releases and trash and debris could have indirect impacts on some of the coastal and terrestrial habitats included in this chapter but given the lack of direct impact with project activities (Section 4.1), these IPFs are dismissed as no impact for the remainder of this discussion. A summary of IPFs and the potential impacts to coastal and terrestrial habitats associated with the SFWF and SFEC is presented on Figure 4.3-3.

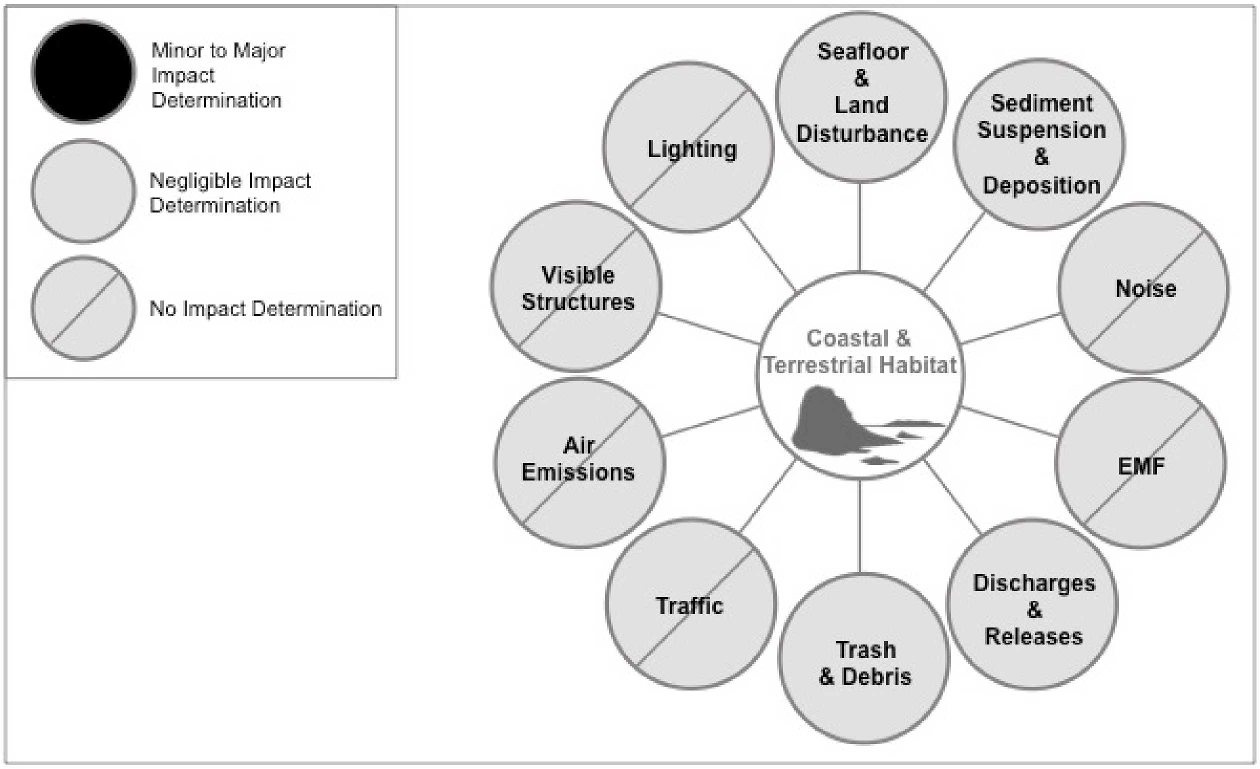

Figure 4.3-3. IPFs on Coastal and Terrestrial Habitat

Illustration of potential impacts to coastal and terrestrial habitats resulting from SFWF and SFEC activities.

South Fork Wind Farm

The focus of the coastal and terrestrial habitat section is on evaluating the presence of sensitive habitats that may be present along the Long Island coast and marginally inland where the SFEC route is being considered; therefore, the SFWF is not expected to have an impact on coastal and terrestrial habitats during construction, O&M, or decommissioning. Offshore benthic habitats, finfish habitat, and EFH are the marine habitats that could be impacted during construction, O&M, or decommissioning of the SFWF. Benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH is discussed in Section 4.3.3.

South Fork Export Cable

Impacts to coastal and terrestrial habitats that are anticipated to occur from activities associated with the SFEC – OCS and SFEC - NYS are discussed in Section 4.3.1. Activities associated with the SFEC – Onshore could impact onshore coastal and terrestrial habitats during construction, O&M, and decommissioning. Onshore coastal and terrestrial habitats may experience ***short-term*** and ***negligible impacts*** from construction activities, including HDD operations, trenching, equipment, and supplies laydown, and SFEC – Interconnection Facility construction.

Table 4.3-2 summarizes the level of impacts expected to occur to coastal and terrestrial habitat during the construction, O&M, and decommissioning phases of the SFEC. Additional details on potential impacts to coastal and terrestrial habitat from the various IPFs of the SFEC during construction are described in the following sections.

Table 4.3-2. IPFs and Potential Levels of Impact on Coastal and Terrestrial Habitat at the SFEC

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Land Disturbance	Negligible direct short-term localized
Sediment Suspension and Deposition		Negligible direct short-term localized
Discharges and Releases		Negligible indirect
Trash and Debris		Negligible indirect

SFEC-OCS and SFEC-NYS

Construction, Operations, and Decommissioning

Seafloor and Land Disturbance

Offshore, benthic habitats, finfish habitat, and EFH are the coastal and terrestrial habitats that could be impacted during construction, O&M, or decommissioning in the SFEC – OCS and SFEC – NYS. Benthic habitats are discussed in Section 4.3.2 and finfish habitat and EFH is discussed in Section 4.3.3.

SFEC-Onshore

Construction

Land Disturbance

Coastal and terrestrial habitat between the landing sites and SFEC – Interconnection Facility may experience ***direct, negligible,*** and ***short-term impacts*** from land disturbance during onshore construction activities.

Impacts to intertidal wetlands within the sea-to-shore transition area would be avoided by using HDD technology. Impacts to the marine intertidal gravel/sand beach and maritime beach communities near the landing sites and sea-to-shore transition area would be avoided by locating the sea-to-shore transition vault within the roadway by using HDD technology to bury the cable beneath the beach and dune.

No wetlands were delineated within the site proposed for the SFEC – Interconnection Facility.

During construction, there may be ***short-term, localized,*** and ***negligible impacts*** to coastal and terrestrial habitats along the SFEC – Onshore routes, including wetlands, from land disturbance, as described in Table 4.3-1. HDD technology may be used in locations along the cable routes, as needed, to avoid or minimize impacts to sensitive areas, such as wetlands, surface water crossings, or parklands. No long-term impacts resulting in habitat loss or alteration are anticipated. ***Long-term*** and ***negligible*** impacts are expected to result from the clearing at the SFEC – Interconnection Facility site.

In addition, depending on the route selected, construction of the SFEC – Onshore cable routes may result in ***short-term, negligible impacts*** to NYSDEC-regulated Freshwater Wetlands and 100-foot (30-m) Adjacent Area, NYSDEC-regulated Tidal Wetlands and 300-foot (91-m) Adjacent Area, and USFWS NWI Wetland coastal and terrestrial habitats, as described in Appendix M. Very limited sections of the SFEC – Onshore will be located in existing roads that intersect with FEMA-mapped 100-year or 500-year floodplains. Impacts to coastal and terrestrial habitats would be minimized along the alignment of and in the vicinity of the SFEC – Onshore cable routes because the cable will be located underground in previously disturbed areas, such as roadways and LIRR ROW.

Sediment Suspension and Deposition

Construction-related impacts to water quality from suspended sediment are discussed in Section 4.2.2, Water Quality and Water Resources. Indirect impacts to coastal and terrestrial habitat from ***short-term, localized*** decreases in water quality during SFEC – Onshore construction or decommissioning activities may occur, but they are considered ***negligible***. The risk of erosion and sedimentation will be managed according to federal, state, and local regulations through the implementation of the SWPPP.

Operations and Maintenance

Regular O&M activities would not be expected to cause further habitat alteration or involve activities that have potential to cause impacts. However, when cable inspection or repairs require excavation, resulting in land disturbance, there may be ***negligible, short-term,*** and ***localized impacts*** to coastal and terrestrial habitats from these O&M activities.

Decommissioning

Impacts to coastal and terrestrial habitats would be expected to be similar to the construction impacts, and the area is expected to return to pre-project conditions.

4.3.1.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to coastal and terrestrial habitat.

- SFEC - Onshore is sited within previously disturbed existing ROWs.
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- A SWPPP, including erosion and sedimentation control measures, and a SPCC Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.

4.3.2 Benthic and Shellfish Resources

The description of the affected environment and assessment of potential impacts for benthic and shellfish resources were determined by reviewing public data sources and conducting project-specific studies. Sources reviewed included state and federal agency-published papers and databases (McMullen et al., 2009; RI CRMC, 2010; LaFrance et al., 2010; Poppe et al., 2014a; Collie and King, 2016; Siemann and Smolowitz, 2017), published journal articles (McMaster, 1960), online data portals and mapping databases (Northeast Ocean Data, 2017; USGS, 2017), academic theses (Malek, 2015), and correspondence and consultation with federal and state agencies. Project-specific studies conducted to aid in the characterization of the affected environment and to address BOEM Benthic Habitat Guidelines (2013) for benthic and shellfish resources included:

- G&G Surveys, completed by Fugro between 2017 and 2019, characterized and evaluated seafloor conditions (Appendix H).
- Benthic Habitat Surveys, conducted by INSPIRE Environmental (INSPIRE) on November 11–15, 2017 and November 20, 2018, identified and confirmed dominant benthic macrofaunal and macrofloral communities (Appendix N1).
- Benthic Habitat Mapping, conducted by INSPIRE to support Essential Fish Habitat Consultation, further characterized benthic habitat types within the Project Area (Appendix N2).

Benthic and shellfish resources are described in the following subsections in terms of benthic habitat types and commonly associated taxa, including SAV, macroalgal assemblages, and micro- and macrobenthic communities. A brief discussion of ecologically and economically important shellfish species is also included. These descriptions and discussion of habitat distribution within the SFWF and along the SFEC are followed by an evaluation of potential project-related impacts.

4.3.2.1 Affected Environment

Regional Overview

The RI-MA WEA is located offshore on the northeastern Atlantic continental shelf in Rhode Island Sound. The waters in the vicinity of the SFWF and SFEC are transitional waters that separate Narragansett Bay and Long Island Sound from the OCS. Benthic communities in these areas are adapted to survive in this dynamic environment. In general, the benthic communities of the OCS areas are diverse, with lower densities of organisms than in the northern portion of the Mid-Atlantic Bight and in deeper areas of the OCS (DOI-MMS, 2007).

The area is composed of a mix of soft and hard bottom environments defined by dominant sediment grain size and composition. The U.S. Geological Survey (USGS) conducted sediment studies in the vicinity of Block Island and in Rhode Island Sound. These areas were found to have sandy sediments that ranged from very fine to medium sand; very fine sands were prevalent in deeper, lower energy areas, while coarser sediments were found in shallower and higher energy areas (McMullen et al., 2007a, 2007b, 2008; Poppe et al., 2011, 2014a, 2014b, 2014c). The USGS data and other data available for the SFWF area (RI CRMC 2010; Malek et al., 2014; USGS, 2017; Collie and King, 2016; BOEM, 2017) suggest that surface sediment cover in the SFWF and along the SFEC comprise mostly sandy sediments with some areas of coarser material (gravel or small cobble) and boulder fields, but there was very little site-specific data available (McMaster, 1960; Poppe et al., 2014a; McMullen et al., 2009; LaFrance et al., 2010). This range of grain sizes is typical of OCS glacial moraine depositional environments that include Holocene marine transgressive deposits. O'Hara and Oldale (1980) and subsequent authors recognized that within the broad distribution of the glacial moraine identified in the RI-MA WEA there are deep channels cut into the glacial moraine by meltwaters and subsequent reworking and deposition as the glaciers retreated and transgressive seas flooded the area. These processes have left a complex mosaic of geological deposits across the surface of the RI-MA WEA and SFEC-OCS.

Site-specific surveys revealed more detailed information on surficial and subsurface geology (Figure 4.3-4 and Appendix H).

The OSAMP assessed sediment data collected from two areas: (1) within state waters around the southern end of Block Island, and (2) in federal waters west of Martha's Vineyard in Rhode Island Sound (RI CRMC, 2010). Some OSAMP data from the federal waters west of Martha's Vineyard were collected from portions of the overall North Lease Area north of the SFWF. Results showed a wide range of depositional environments dominated by coarse sand and sand sheets (LaFrance et al., 2010). Sediment types found in lower areal coverages included boulder gravel concentrations, cobble gravel pavement, and sand waves.

The NYSDOS commissioned the Offshore Atlantic Ocean Study to better understand the biological and physical characteristics of the OCS waters (NYSDOS, 2013). This study, which encompassed the New York Offshore Planning Area (an area roughly the extent of the New York Bight), ended immediately west of the RI-MA WEA. However, this data set covers much of the SFEC - OCS and predicts a high likelihood of fine to coarse sand with areas of granules and pebbles (i.e., small, mobile gravels).

Marine substrata and surface sediments provide context and settings for many aquatic processes and living space for benthic biota. The Coastal and Marine Ecological Classification Standard (CMECS) (FGDC, 2012), the use of which is recommended by BOEM Benthic Habitat Survey Guidelines (2013), provides a means to categorize sediments using the Substrate Component. CMECS uses standard (Udden-Wentworth) grain size classes to define sediment types; these classes pair measurements to common terminology. For example, all grain sizes larger than 5/64 of an inch (2 mm) constitute gravels, which are further classified in order of increasing size as granules, pebbles, cobbles, and boulders. Habitats predominantly composed of larger gravels constitute hard bottom habitats, along with rock outcrops and rocky reefs. These habitats are considered stable and are not readily moveable by currents and wave energy. In contrast, soft bottom habitats composed of sands, silts, and clays are readily moved by such hydrodynamic forces. Sand is further divided into very fine sand (0.06 to 0.125 mm), fine sand (0.125 to 0.25 mm), medium sand (0.25 to 0.5 mm), coarse sand (0.5 to 1 mm), and very coarse sand (1 to 2 mm) and is very common on the OCS. Fine-grained sediments (silts and clays, 0.002 to 0.06 mm and 0.001 to 0.002 mm, respectively) are typically found in quiescent depositional environments.

Sediment grain size influences the biological communities likely found in each habitat (Steimle, 1982), and the CMECS Biotic Component provides a useful means to examine these relationships. The Biotic Component of CMECS is a classification of the living organisms of the seabed and water column, together with their physical associations at a variety of spatial scales. The Biotic Component is organized into a branched hierarchy of five nested levels: Biotic Setting, Biotic Class, Biotic Subclass, Biotic Group, and Biotic Community. The Biotic Subclass is a key CMECS classifier that presents valuable information about the surveyed area in terms of physical habitat and the potential presence of sensitive taxa. Although Biotic Subclasses are not directly based on sediment grain size distributions, they reflect those distributions at the scale of relevance to the dominant fauna present, thus integrating physical and biological characteristics of the seafloor. CMECS expressly states that "…substrate type is such a defining aspect of the Faunal Bed Subclass that CMECS Faunal Bed Subclasses are assigned as physical-biological associations involving both biota and substrate" (FGDC, 2012). Further, the Biotic Subclass is a key classifier that presents valuable information in terms of physical habitat and the potential presence of sensitive habitats.

Most relevant to the study region are the Attached Fauna and Soft Sediment Fauna Biotic Subclasses, which provide excellent broad-scale categories for seafloor habitats. The Soft Sediment Fauna Subclass in the Northwest Atlantic OCS typically includes common taxa, such as sand dollars, tube building worms, and clams, whereas the Attached Fauna Subclass indicates the dominant presence of sessile biota (macroalgae, sponges, bryozoans) living on hard bottom substrata. Attached Fauna habitats are also referred to in some documents as "live bottom."

These hard bottom habitats are considered to be potentially valuable and sensitive resources for regionally important taxa, such as Atlantic cod and lobster. Hard bottom habitats are limited in regional distribution compared to sandy and soft bottom habitats (CoastalVision and Germano and Associates, 2010).

Cobble and boulder habitat can serve as a nursery ground for juvenile lobster and as preferable habitat for squid to deposit their eggs. Both lobster and squid are specific in their habitat requirements and are also economically important species in New England. For these reasons, federal and state agencies consider evidence of these taxa to indicate the presence of potentially sensitive habitats. Along with valuable hard bottom habitats, additional potentially sensitive seafloor habitats include areas with corals present and submerged aquatic vegetation beds (BOEM, 2013). Corals are not predicted to commonly occur within the SFWF or along the SFEC, as corals are more commonly found at deeper depths in the Northwest Atlantic. SAV beds are not predicted to occur within the SFWF or along the SFEC - OCS route due to depth limitations and are not predicted to be present along the SFEC - NYS primarily due to wave energy in nearshore waters.

Benthic community structure has only been inferred from studies in surrounding areas, including the OSAMP and related publications (RI CRMC, 2010; LaFrance et al., 2010), studies conducted at the Block Island Wind Farm study (CoastalVision and Germano and Associates, 2010; Deepwater Wind, 2012; INSPIRE, 2016), and BOEM-funded research (Collie and King, 2016; Siemann and Smolowitz, 2017). Data available from most of these studies only suggest which physical substrata and biotic communities may be present within the SFWF and SFEC; although one study, which included lobster trawls, examined the RI-MA WEA in terms of lobster habitat and confirmed the importance of the lease area as lobster habitat compared to inshore areas (Collie and King, 2016).

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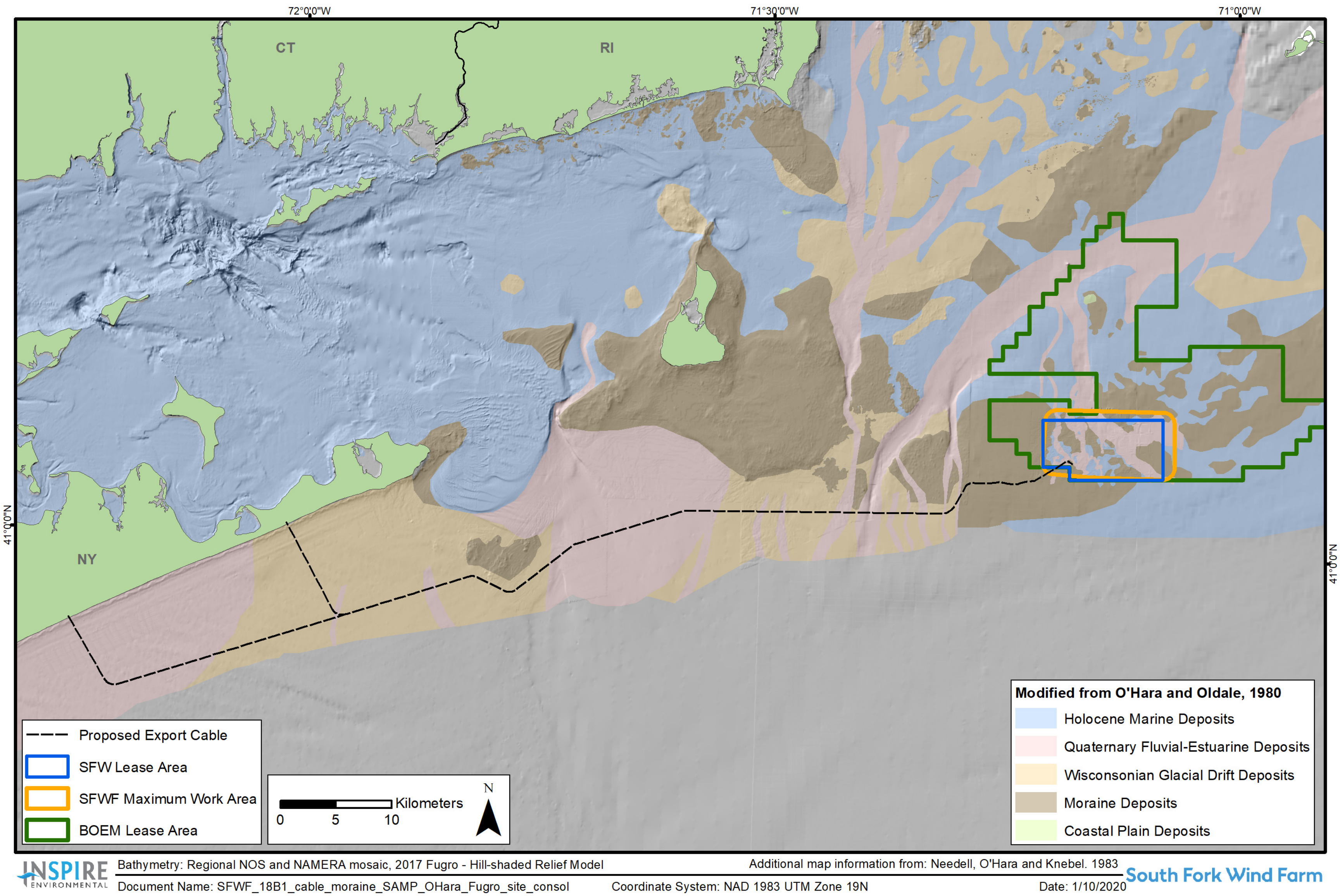

Figure 4.3-4. Interpreted Geologic Units Based on MBES and Shallow Seismic Data
Illustration of geologic units in relation to project components

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Benthic Habitats and Biota

Benthic Habitat Types

To better understand the site-specific benthic characteristics of the SFWF and the SFEC, SFW conducted a G&G survey (Appendix H) in the fall of 2017 and geophysical ground truthing and benthic habitat assessments (Appendix N1) in the fall of 2017 and 2018. A combined Sediment Profile and Plan View Imaging (SPI/PV) system was used to gather data to ground truth G&G data (multibeam echosounder and side scan sonar), and to provide a thorough characterization of surface sediment and biota found at the SFWF and along the SFEC. These data were used to meet BOEM Benthic Habitat Guidelines (BOEM, 2013) to characterize surface sediments; delineate and characterize hard bottom areas; identify and confirm benthic flora and fauna, including sessile and slow-moving invertebrates; identify sensitive habitats; establish preconstruction baseline benthic conditions against which postconstruction habitats can be compared; and determine the suitability of a sampled reference area to serve as a control site for future monitoring and assessment. These objectives were met, and more details are provided in the full SPI/PV reports presented as part of Appendices H and N. As part of the G&G survey, surficial and subsurface geological interpretation was conducted to determine and map the location of glacial and post-glacial deposits. The distribution of these geologic deposits provides context for the distribution of sedimentary habitats (Figure 4.3-5). A detailed map of the distribution of boulders on the seabed surface was derived from site-specific surveys MBES and sidescan sonar surveys in the SFWF MWA (Figure 3.1-1 and Appendix H).

Data provided by these site-specific surveys are discussed here in concert with previously existing data on surface sediments, biota, and habitat types found and likely to be found in the region. A list of species commonly associated with benthic habitats and the depth ranges found at the SFWF and the SFEC are provided in Table 4.3-3 (flora), Table 4.3-4 (fauna), and Table 4.3-5 (ecological and economically important shellfish). The depth ranges within the NYS portion of the SFEC route are shallower than along the SFEC - OCS, and differences in species distributions related to these depths and wave energy exposure in nearshore areas are discussed in the SFEC habitat distribution section.

It is important to note that most of the macroalgae species identified in Table 4.3-3 are found in shallow intertidal and subtidal waters that are not present within the SFWF or along most of the SFEC route; the only living macroalgae observed was coralline algae at two stations within the SFWF (Appendix N1). Similarly, the depth ranges and habitats found at the SFWF and along most of the SFEC route preclude the possibility of SAV (e.g., eelgrass, widgeon grass), which are found in quiescent habitats shallower than 20 feet (6.1 m); none were observed during the benthic survey (Appendix N1). Additionally, no known invasive species (i.e., those listed by the Northeastern Aquatic Nuisance Species Panel) were observed during the benthic survey (Appendix N1). Demersal (bottom-dwelling) fish species and commercially harvested shellfish and invertebrates associated with hard bottom habitats are described further in Section 4.3.3 and Appendix O.

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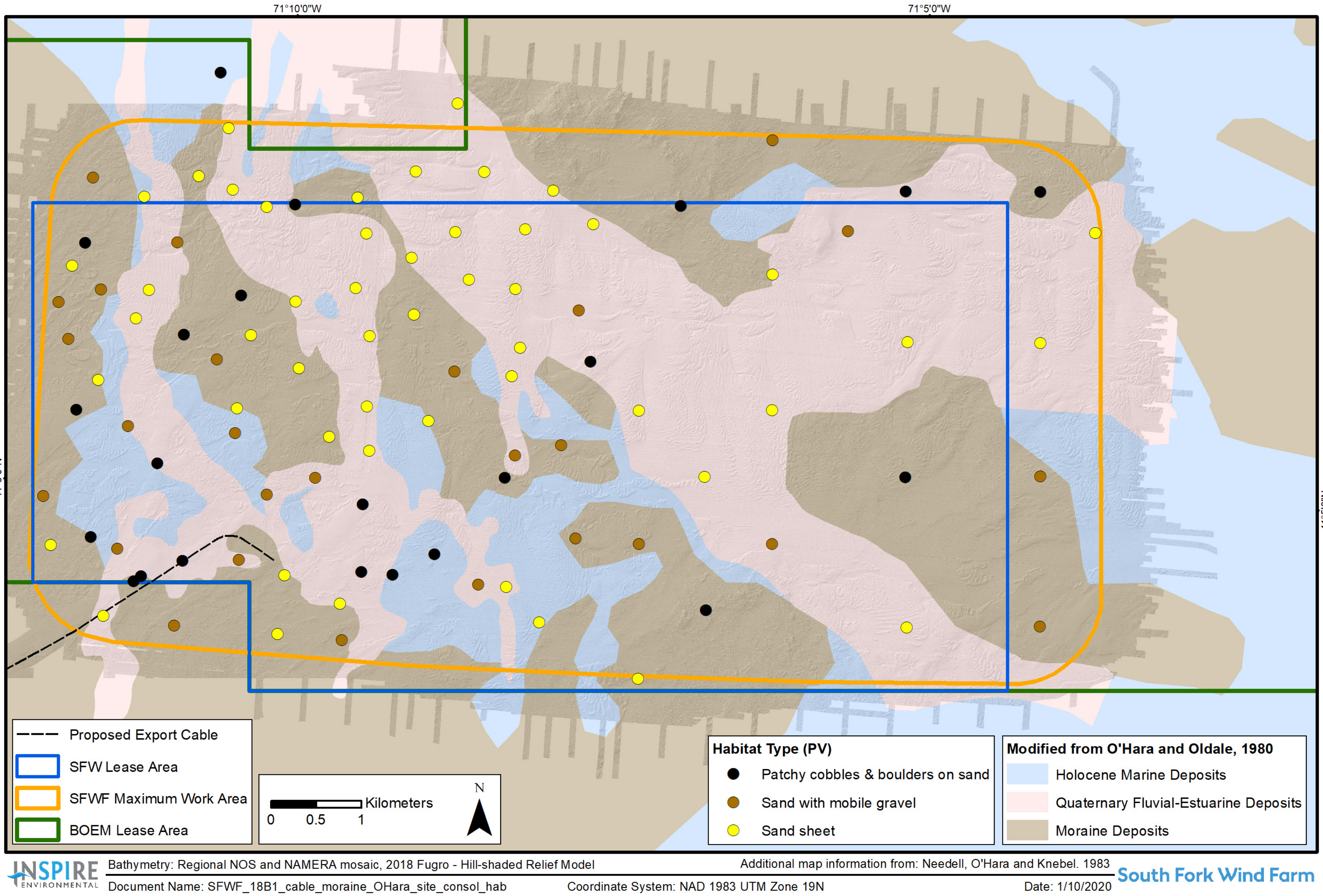

Figure 4.3-5. Interpreted Habitat Types Based on MBES and Shallow Seismic Data
Habitat types identified in plan-view images (PV) collected and interpreted by INSPIRE (Appendix N1).

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Benthic habitat types are used here as a construct to describe repeatable physical-biological associations found within the SFWF, SFEC, and reference area. These were derived from CMECS classifiers, and specific classification data for the Substrate and Biotic Component are provided in Appendices H and N. Three unique benthic habitat types were observed: patchy cobbles and boulders on sand; sand with mobile gravel, and sand sheets (Figure 4.3-6 and Appendix N1). On Figure 4.3-6, images (A) and (B) represent patchy cobbles and boulders on sand with associated fauna annotated. Figure 4.3-6 image (C) represents sand with mobile gravel and image (D) represents sand sheet habitats, shown here with infaunal tubes annotated in the SPI image and sand dollars in the PV image. The species found in these types of habitats are typically described as infaunal species, those living in the sediments (e.g., polychaetes, amphipods, mollusks), and epifaunal species, those living on the seafloor surface (mobile, e.g., sea stars, sand dollars) or attached to substrates (sessile, e.g., barnacles, anemones).

(A) and (B) represent patchy cobbles and boulders on sand with associated fauna annotated. (C) represents sand with mobile gravel; (D) represents sand sheet habitats, shown here with infaunal tubes annotated in the SPI image and sand dollars in the PV image. Note: PV image width is approximately 3.2 feet (1 m), and SPI image height is approximately 7.9 inches (20 centimeters [cm]).

Sand, generally fine to coarse sand grain sizes, was the predominant surface sediment across all three habitat types. These sands are mobile, influenced by bottom currents that form ripples on the seafloor surface; which, in turn, influence sediment resuspension, deposition, and sorting. For example, deposition of fine sediment grains and organic material in ripple troughs is promoted by the structure of the ripple. The sand with mobile gravel habitat type has small-sized gravels (granules, pebbles, and small cobbles) that are also influenced by bottom currents (tides, storms) and are transported often enough, appearing “washed clean,” that biota are not able to attach and grow on their surfaces. In these habitats, gravel tends to gather in the troughs between sand ripples (Figure 4.3-6 and Appendix N1).

The frequent hydrodynamic forcing and subsequent sediment mobility in sand sheet and sand with mobile gravel habitats creates a dynamic environment for biota. Therefore, these habitats do not include more than occasional sparse presence of attached flora or sessile attached epifauna and are, instead, inhabited by mobile epifauna, such as sand dollars, Jonah crabs, American lobster, and small tube-building and burrowing infauna (Tables 4.3-3 and 4.3-4). The dynamic nature of these environments results in high turnover of infauna, and, combined with the very low organic loads found in medium and coarse sands, limits the development of infaunal successional stages to Stage 1 and Stage 2 taxa; Stage 3 head-down deposit feeders would not be expected in these habitats (Appendix N1). Because they are accustomed to a certain degree of natural disturbance, the benthic biological communities associated with these habitat types are considered generally resilient to change and quick to recover.

In CMECS terms, the dominant Biotic Subclass of these habitats is Soft Sediment Fauna; and the dominant Biotic Groups include Small Surface-Burrowing Fauna, Small Tube-Building Fauna, and Sand Dollar Beds (Appendix N1). However, there is still potential that hydrozoans, anemones, and encrusting sponges will be present in low densities in sand with mobile gravel habitat, particularly when in close proximity to boulders and cobbles. Economically important species, including sea scallops, horseshoe crabs, surf clams, and the ocean quahog, are associated with these sandy habitats (Table 4.3-5).

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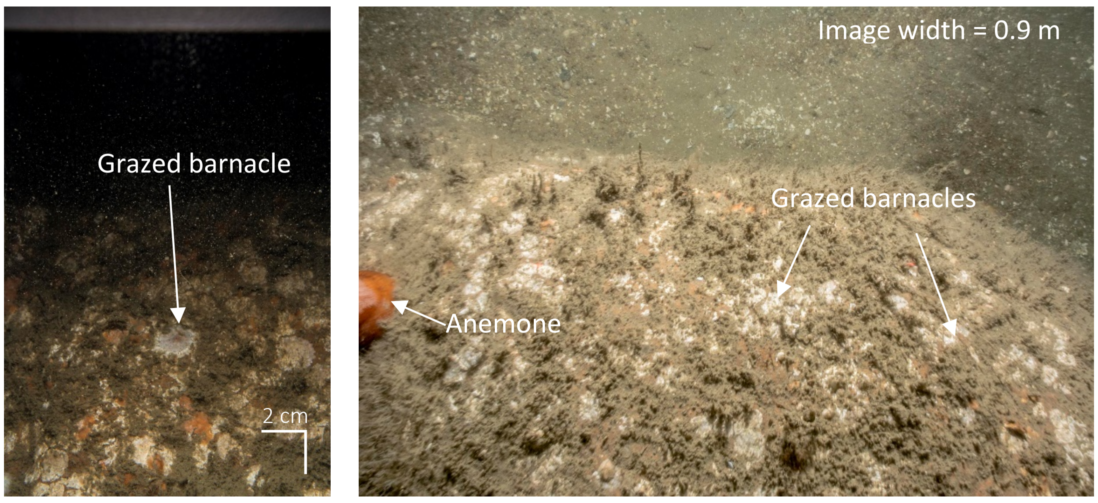
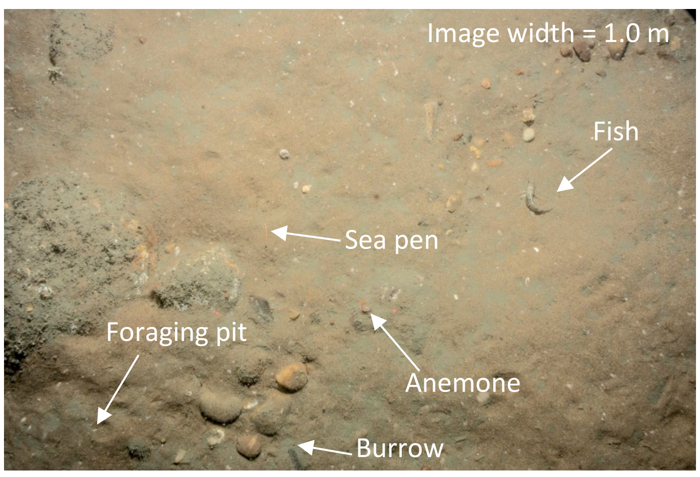
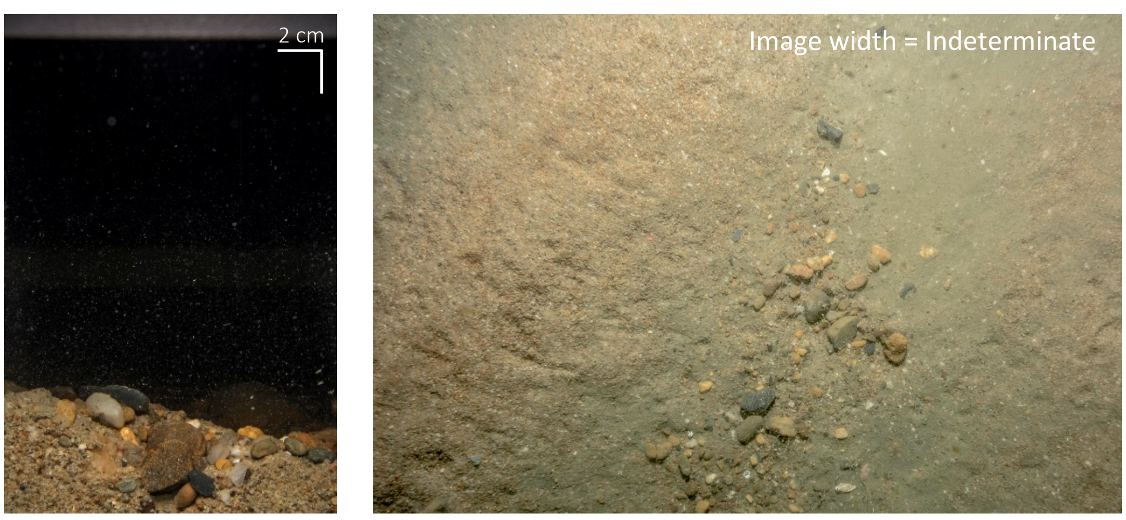


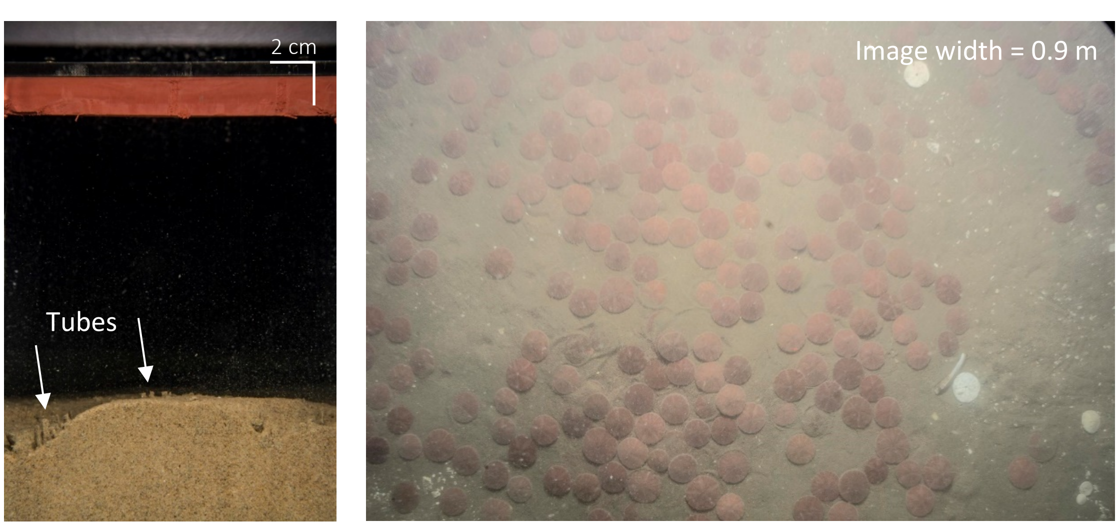
(A) The boulder is colonized by hydroids and barnacles, many of which have been grazed. A large orange anemone is attached to the boulder on the far left of the PV image.



(B) Hydroids and grazed barnacles are visible on the large cobbles and boulder. A sea pen and anemone are near the center of the image. A small unidentified fish is visible on the right side of the image. Infaunal burrows are present in the bottom center of the PV image and fish foraging pits in lower right and lower left.



(C) Small gravels washed clean by frequent water motion gather in throughs beneath ripples of mobile sand.



(D) Sand sheet habitats characterized by tube-building infauna and mobile epifauna, in this case sand dollars (*Echinorachnius parma*).

Figure 4.3-6. Representative Sediment Profile Imaging and Plan View Images for Each Habitat Type

SPI images of three unique benthic habitat types observed: patchy cobbles and boulders on sand with associated fauna (A and B); sand with mobile gravel (C), and sand sheets (D)

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The third benthic habitat type observed was patchy cobble and boulder on sand. These hard substrates generally support increasingly diverse epifaunal assemblages as grain sizes increase. The cobbles and boulders in these habitats provide substrate and stability on which biota can attach and grow; additionally, these habitats provide variable topography that creates complexity and additional niches for fauna to occupy. Where present, these large gravels were colonized by attached epifauna, predominantly hydroids, barnacles, and occasional anemones (Appendix N1). Other attached epifauna that have the potential to be found in this habitat type include encrusting sponges, serpulid polychaetes, sea pens, and mussels, among others (Table 4.3-3). Because presence of cobbles and boulders is patchy, these areas are interspersed with sandy habitats, further increasing diversity within these areas.

Because dominant CMECS Biotic Subclasses and Biotic Groups are strongly correlated with surficial sediments, the classifications of these habitats were a mix of Soft Sediment Fauna and Attached Fauna; biota associated with sand was found in the patches of sand between the cobbles and boulders, on which the attached fauna were found (Appendix N1). Within the Attached Fauna Subclass, dominant CMECS Biotic Groups included Attached Hydroids, Barnacles, Diverse Colonizers, Egg Masses, and Pennatulid Bed (Appendix N1). Mobile epifauna are often associated with the Attached Fauna Subclass and include taxa such as crabs, sea stars, moon snails, and lobster (FGDC, 2012; Table 4.3-4). Macroalgae, such as foliose red algae and coralline algae, also have the potential to grow attached to cobbles and boulders in these habitats, and coralline algae was observed at two stations within the SFWF (Table 4.3-3). Economically important species, notably lobster and squid, are associated with these hard bottom habitats (Table 4.3-4).

The structure provided by the cobbles and boulders in these habitats can also serve as nursery habitat for juvenile lobster, feeding ground for fish such as cod and black sea bass, and substrate upon which squid (including longfin squid, *Doryteuthis (Amerigo) pealeii*) lay their eggs (Table 4.3-4 and Figure 4.3-7). Further, the presence of boulders in mixed bottom types has been noted as an important feature for understanding the distribution of lobsters (*Homarus americanus*) and Jonah crab (*Cancer borealis*) in the region of the SFWF (Collie and King, 2016; Table 4.3-5).

The distribution of habitat types within the SFWF and along the SFEC as it travels from the SFWF along the OCS south of Block Island and Montauk to the nearshore areas within NYS waters are variable and are discussed in the following sections. The likelihood of encountering the taxa listed in the tables within the SFWF or along any particular segment of the SFEC - OCS is directly related to the distribution of habitat types found in each area. Because the depths and exposure to wave energy in the nearshore portion of the SFEC in New York State waters differs from the SFWF and SFEC - OCS, there are some differences in taxa expected; these are discussed in the SFEC habitat distribution section.

Figure 4.3-7. PV Image from the SFWF Showing Extensive Coverage of Polymastia sp. Sponge Indicating Cobbles and/or Boulders Covered with a Thin Layer of Sand
PV image indicating area with cobbles and/or boulders covered in a thin layer of sand from the SFWF

Table 4.3-3. Common Macroalgal Species Known from the Vicinity of the SFWF and SFEC and Their Potential to Occur

Species	Preferred Habitat	Depth Range	Growth Type	Potential for Presence at the SFWF and SFEC
Agarum cribrosum	Rocks, cobble	Subtidal to approximately 131 feet (40 m)	Single blade up to 59 inches (150 cm) with stipe attached to a holdfast	Limited potential for occurrence on boulders at the SFWF because of the depth at the site. Limited potential along the SFEC route segment near the SFWF where boulders and cobble are present.[a, b]
Coral weed (*Corallina officinalis*)	Rocks, cobble, large gravel, shells	Lower intertidal and subtidal	Coralline red algae that can encrust on rocks and shells; grows to about 4 inches (10 cm)	No potential at the SFWF and SFEC - OCS because of depth, and no potential at the SFEC - NYS because no cobble and boulder were present in the surveyed area. [c]

Table 4.3-3. Common Macroalgal Species Known from the Vicinity of the SFWF and SFEC and Their Potential to Occur

Species	Preferred Habitat	Depth Range	Growth Type	Potential for Presence at the SFWF and SFEC
Coralline red algae (Order Corallinales)	Rocks, cobble, large gravel, or epiphytic on shells or algae	Subtidal	Algal crusts	Coralline algae observed at two stations within the SFWF and may be present at other locations within the SFWF and along the SFEC where boulders and cobble are present. [a, b]
Foliose red algae (Phylum Rhodophyta)	Rocks, cobble, large gravel, or epiphytic on shells or algae	Subtidal	Low-growing, foliose red algae	Potential presence at both the SFWF and SFEC. Known to occur in the region within depth ranges for both the SFWF and SFEC and potentially suitable habitat is present in the SFWF and the portions of the SFEC near the SFWF. [a, b]
Green Thread (*Chaetomorpha linum*)	Free floating or drifting; often entangled with other algae	Upper Intertidal, and free-floating mats	Filamentous clumps and tangles	Potential for occasional presence at the SFWF and SFEC as free-floating mat. [c]
Gut weed (*Ulva intestinalis*)	Rocks, mud, sand, tide pools, epiphyte on other algae and shells	Intertidal-Upper Intertidal and free-floating mats	Unbranched, flattened, gas-filled tubes with undulating edges to approximately 16 inches (40 cm) long	Potential for occasional presence at the SFWF and SFEC as free-floating mat. [c, d]
Hooked red weed (*Bonnemaisonia hamifera*)	Rocks, cobble, large gravel, often epiphytic on shells and algae	Subtidal	Small, highly branched red foliose algae growing to 4 inches (10 cm)	Potential presence at both the SFWF and SFEC. Known to occur in the region within depth ranges for both the SFWF and SFEC, and potentially suitable habitat is present in the SFWF and the portions of the SFEC near the SFWF.[c]
Horsetail kelp (*Laminaria digitata*)	Rocks, large cobble	Subtidal in wave exposed areas	Large, wide, brown blade with central holdfast; grows to 39 inches (1 m)	Very limited potential for occurrence on boulders at the SFWF and portions of the SFEC near the SFWF because of depth, habitat, and offshore location.[c]

Table 4.3-3. Common Macroalgal Species Known from the Vicinity of the SFWF and SFEC and Their Potential to Occur

Species	Preferred Habitat	Depth Range	Growth Type	Potential for Presence at the SFWF and SFEC
Irish moss (*Chondrus crispus*)	Rocks	Lower intertidal and shallow subtidal	Shrub-like, densely branched; grows to 6 inches (15 cm)	No potential at the SFWF and most of the SFEC route because they are located in waters too deep for this species. Limited potential in nearshore intertidal areas along the SFEC - NYS route if rocks or boulders are present.[c]
Kelp (*Saccharina latissimi, S. longicruris*)	Rocks, large cobble, rocky reef	Subtidal to approximately 115 feet (35 m)	Single blades with stipe that grow to 36 feet (11 m) (S. longicruris)	Very limited potential for occurrence on boulders at the SFWF and portions of the SFEC near the SFWF because of depth, habitat, and offshore location. [a, c]
Lacy red weed (*Callophyllis cristata*)	Rocks, cobble, large gravel, or epiphytic on shells or algae	Subtidal, deeper waters	Small, highly branched red foliose algae growing to 2 inches (5 cm)	Potential presence at both the SFWF and SFEC. Known to occur in the region within depth ranges for both the SFWF and SFEC, and potentially suitable habitat is present at the SFWF and portion of the SFEC near the SFWF.[c]
Sargasso weed (*Sargassum filipendula*)	Free floating	Open water and embayments	Multibranched with small, gas-filled nodules	Potential for occasional presence at the SFWF and SFEC as free-floating mat.[c]
Sea lettuce (*Ulva lactuca*)	Rocks and rocky reefs, epiphyte on other algae and shells	Intertidal-Upper Intertidal and free-floating mats	Attached via holdfast; grows to approximately 7.1 inches (18 cm) in length	Very limited potential for species to occur as free-floating mat at the SFWF and SFEC because of the distance to nearshore habitat where this species occurs. More likely to occur along the SFEC - NYS. [c, d]
Wire weed (*Ahnfeltia plicata*)	Rocks and drift	Subtidal	Branched algae attached to bottom substrate or drifting	Limited potential for species to occur as drift algae at the SFWF and SFEC because of the distance to nearshore habitat where this species occurs. More likely to occur along the SFEC - NYS. [c]

Table 4.3-3. Common Macroalgal Species Known from the Vicinity of the SFWF and SFEC and Their Potential to Occur

Species	Preferred Habitat	Depth Range	Growth Type	Potential for Presence at the SFWF and SFEC

Note: Coralline algae was the only living macroalgae observed during the SPI and PV survey (Appendix N1).

[a] Vadas and Steneck, 1988

[b] McGonigle et al., 2011

[c] Van Patten and Yarish, 2009

[d] Shimada et al., 2003

Table 4.3-4. Common Species by Benthic Habitat Type

Habitat Type	Phylum or Class	Species (With Common Name if Available)	References
Sand substrates	Asteroidea	Blood star	Deepwater Wind, 2012
	Bivalvia	Atlantic sea scallop (*Plactopecten magellanicus*) *,, ocean quahog (*Artica islandica*), *Nucula proxima*, Waved astarte (*Astarte undata*), chestnut astarte (*A. castanea*), Atlantic surf clam (*Spisula solidissima*)	Steimle, 1982; Zajac, 1998; Fay et al., 1983; Meyer et al., 1981; Cargnelli et al., 1999a; Appendix N1
	Cephalopoda	Squid egg masses and newly hatched larvae	Macy and Brodziak, 2001; NEFSC, 2005
	Crustacea	Tube forming amphipods *: including *Ampelisca agassizi* and *A. vadorum* American lobster, Atlantic rock crab, sand shrimp (*Crangon septemspinosis*), hermit crabs *, Genus *Haustorid, Phoxocephalid, Leptocuma, Chiridotea, and Cancer* spp. Jonah crab (*Cancer borealis*)	Steimle, 1982; Wigley, 1968; Deepwater Wind, 2012; Robichaud et al., 2000; Williams and Wigley, 1977; Appendix N1
	Echinoidea	Sand dollar *, (*Echinarachnius parma)*	Wigley, 1968; Deepwater Wind, 2012; Appendix N1
	Gastropoda	Northern moon snail (*Lunatia heros*), *Nassarius* spp., channeled whelk (*Busycotypus canaliculatus*), common slipper shell *	Wigley, 1968; Deepwater Wind, 2012; Peemoeller and Stevens, 2013; Appendix N1
	Ophiuroidea	Not listed	Poppe et al., 2014b
	Polychaeta	Surface feeding: *Exogone verugera, Prionospio steenstrupi, Anobothrus gracilis,* and *Paraonis gracilis* Tube forming *: *Spirorbis borealis, Ophelia bicornis,* and *Travisia carnea*	Steimle, 1982; Wigley, 1968; Appendix N1
	Xiphosura	Horseshoe crab	ASMFC, 2010; NJDEP, 2016
Gravel/granule substrates	Asteroidea	Sea star *, blood star, common sea star	Collie et al., 1997; Redmond and Scott, 1989; Dickinson et al., 1980; Appendix N1
	Bivalvia	Waved astarte, chestnut astarte, genus *Placopecten,* including Atlantic sea scallop *, eastern oyster (*Crassostera virginica*), ocean quahog	Collie et al., 1997; Redmond and Scott, 1989; Dickinson et al., 1980; Wigley, 1968; Jenkins et al.,

Table 4.3-4. Common Species by Benthic Habitat Type

Habitat Type	Phylum or Class	Species (With Common Name if Available)	References
			1997; Hargis and Haven; 1999; Appendix N1
	Cephalopoda	Squid egg masses·, including longfin squid and newly hatched larvae	Macy and Brodziak, 2001; NEFSC, 2005
	Crustacea	Tube-forming Amphipods *·: *Ampelisca agassizi* and *A. vadorum* American lobster, sand shrimp *·, hermit crabs, Genus *Haustorid, Phoxocephalid, Leptocuma, Chiridotea*, and *Cancer* spp., Jonah crab (*Cancer borealis*), Atlantic rock crab	Collie et al., 1997; Redmond and Scott, 1989; Dickinson et al., 1980; Cobb and Wahle, 1994; Appendix N1
	Gastropoda	Northern moon snail, *Nassarius* spp., channeled whelk, common slipper shell	Collie et al., 1997; Redmond and Scott, 1989; Dickinson et al., 1980
	Ophiuroidea	Genus *Ophiopholis* and *Ophiacantha*	Collie et al., 1997; Wigley, 1968
	Polychaeta	Tube-forming *·: *Phyllochaetopterus socialis, Filograna implexa, Chone infundibuliformis, Protula tubalaria* Carnivorous and omnivorous: *Nephtys incisa, Eunice norvegica* Deposit feeding: *Thelephus cincinnatus*	Collie et al., 1997; Redmond and Scott, 1989; Dickinson et al., 1980; Appendix N1
Cobbles, boulders, rocky reef, rock outcrop	Anthozoa	Sea anemones *·, Order Alcyonacea (both gorgonians and non-gorgonians) tulacea[b].	Poppe et al., 2011; Northeast Ocean Data, 2017; Deepwater Wind, 2012; Appendix N1
	Asteroidea	Blood star, common sea star, genus *Solaster* and *Crossaster*	Deepwater Wind, 2012; Wigley, 1968; Collie et al., 1997
	Bivalvia	Horse mussel (*Modiolus modiolus*), eastern oyster, Atlantic sea scallop *·, waved astarte, chestnut astarte, genus *Brachiopoda, Placopecten, Anomia,* and *Musculus*	Deepwater Wind, 2012; Wigley, 1968; Jenkins et al., 1997; Hargis and Haven; 1999; Appendix N1
	Bryozoa	Not listed *·	Deepwater Wind, 2012
	Cephalopoda	Squid egg masses· and newly hatched larvae including longfin squid	Macy and Brodziak, 2001; NEFSC, 2005
	Chordata	Tunicates (*Boltenia* spp.)	Wigley, 1968
	Crustacea	Tube-forming Amphipods *·: *Ampelisca agassizi* and *A. vadorum* Barnacles *·(Infraclass Cirripedia and genus *Balanus*), America lobster, sand shrimp*·, hermit crabs*·, Genus *Cancer* and *Hyas**·, Jonah crab, Atlantic rock crab	Deepwater Wind, 2012; Wigley, 1968; Appendix N1
	Echinoidea	Green sea urchin (*Strongylocentrotus droebachiensis*)	Collie et al., 1997; Wigley, 1968
	Gastropoda	Northern moon snail, *Nassarius* spp., limpet *, channeled whelk, knobbed whelk (*Busycon carica*), whelk	Poppe et al., 2014b; Wigley, 1968, Appendix N1

Table 4.3-4. Common Species by Benthic Habitat Type

Habitat Type	Phylum or Class	Species (With Common Name if Available)	References
		(*Sinistrofulgur sinistrum*), common slipper shell, genus *Neptunea, Dendronotus*, and *Doris*	
	Hydrozoa	Hydroids[b.], including genuses *Eudendrium, Sertularia,* and *Bougainvilia*	Poppe et al., 2011; Deepwater Wind, 2012; Appendix N1
	Ophiuroidea	*Ophiopholis aculeate* and *Ophiacantha* spp.	Collie et al., 1997; Wigley, 1968
	Polychaeta	Tube-forming and suspension feeding*: *Phyllochaetopterus socialis*, *Filograna implexa, Chone infundibuliformis, Protula tubalaria,* genus *Serpula* and *Spiorbis* Carnivorous and omnivorous: *Nephtys incisa, Eunice norvegica*	Wigley, 1968; Deepwater Wind, 2012; Appendix N1
	Porifera	Encrusting sponges of genus's *Halichondria, Clathria, Polymastia, Clionia, and Myxilla*	Poppe et al., 2011; Deepwater Wind, 2012; Wigley, 1968

Note: The potential for each species to occur at the SFWF and along the SFEC - OCS and SFEC - NYS is related to the distribution of benthic habitat types within each area

* Indicates taxa were observed in SPI/PV imagery for the SFWF or SFEC (Appendix N1).

Table 4.3-5. Ecologically and Economically Important Shellfish Species and Potential for Occurrence at the SFWF and SFEC

Species	Life Stage Present	Preferred Habitat	Potential Time of Year in Region	Potential Presence at the SFWF and SFEC	References
American lobster (*Homarus americanus*)	All	Prefers rocky habitat, including mixed bottom types, but may burrow in featureless sand or mud habitat.	Year-round	Potential presence in the vicinity of rocky areas within the SFWF and along the SFEC near the SFWF; may seasonally pass through the SFWF, SFEC - OCS, and SFEC - NYS, including nearshore waters during migratory movements.	Collie and King 2016; ASMFC, 2015; Cobb and Wahle, 1994

Table 4.3-5. Ecologically and Economically Important Shellfish Species and Potential for Occurrence at the SFWF and SFEC

Species	Life Stage Present	Preferred Habitat	Potential Time of Year in Region	Potential Presence at the SFWF and SFEC	References
Atlantic rock crab (*Cancer irroratus*)	All	Prefers depths ranging from 20 to 1,496 feet (6 to 456 m), but most common in waters less than 65 feet (20 m) deep. Prefers rocky and gravely substrate but also occurs in sand.	Year-round	Limited potential for presence within the SFWF and along the SFEC near the SFWF because species prefers areas that are shallower than the SFWF. Potential presence in the SFEC - NYS and in nearshore waters.	Krouse, 1980; Robichaud et al., 2000; Williams and Wigley, 1977
Atlantic sea scallop (*Plactopecten magellanicus*)	All	Found on sand, gravel, shells, and other rocky habitat. Larvae settle out on gravel and rocky substrate. Found from mean low water to depths of 656 feet (200 m). This species also has designated EFH in the SFWF, SFEC-OCS, and SFEC-NYS (see Appendix O).	Year-round	Potential for presence throughout the SFWF and SFEC route.	NEFSC, 2004; Mullen and Moring, 1986
Atlantic surf clam (*Spisula solidissima*)	All	Prefers depths ranging from 26 to 216 feet (8 to 66 m) in medium-grained sand but may also occur in finer-grained sediments. Burrows up to 3 feet (0.9 m) below the sediment-water interface. This species also has designated EFH along part of the SFEC-OCS and SFEC-NYS (see Appendix O).	Year-round	Potential for presence in sandy substrates within the SFWF and along the SFEC route.	Fay et al., 1983; Meyer et al., 1981; Cargnelli et al., 1999a
Channeled whelk (*Busycotypus canaliculatus*)	All	Commonly found in nearshore and offshore environments, but preferred depth range is not known. Occurs in sandy and fine-grained sediments where they can bury themselves. Eggs are laid on sand in intertidal and subtidal areas.	Year-round	Potential for presence in sandy substrates within the SFWF and along the SFEC route. Potential for eggs to be laid in nearshore portions of the SFEC route.	Fisher, 2009; Peemoeller and Stevens, 2013

Table 4.3-5. Ecologically and Economically Important Shellfish Species and Potential for Occurrence at the SFWF and SFEC

Species	Life Stage Present	Preferred Habitat	Potential Time of Year in Region	Potential Presence at the SFWF and SFEC	References
Eastern oyster (*Crassostera virginica*)	All	Larvae and adults can be found on hard bottom substrate or shell substrate to a depth of 36 feet (11 m) but is most common between 8 to 18 feet (2.5 to 5.5 m) deep.	Year-round	Not expected to occur at the SFWF or SFEC, as no shellfish beds are known from the vicinity.	Jenkins et al., 1997; Hargis and Haven, 1999
Horseshoe crab (*Limulus polyphemus*)	All	Prefer depths shallower than 98 feet (30 m) but known to occur in depths greater than 656 feet (200 m). Occurs commonly on sandy substrate but is a habitat generalist and may be found on gravel and cobbles as adult. During full moon tides in spring and summer, migrates inshore to shallow bays and sandy beaches to spawn. Juveniles use shallow nearshore areas as nurseries before moving into deeper waters.	Year-round	Potential presence throughout the SFWF and SFEC route. Juveniles may be present in higher densities in the vicinity of nearshore portions of the SFEC route.	NJDEP, 2016; ASMFC, 2010
Jonah crab (*Cancer borealis*)[a.]	Adults	Prefers depths ranging from 164 to 984 feet (50 to 300 m), but also occurs in shallower waters, perhaps associated with circadian rhythms. Found across sediment types, from sand, to small gravel, to rocky areas.	Year-round	Presence at the SFWF and potential presence along the SFEC route. Studies found higher abundances in fine sand, followed by coarse sand, and boulders on sand.	Appendix N; Collie and King 2016; Robichaud and Frail, 2006; Jeffries, 1966
Longfin squid (*Doryteuthis (Amerigo) pealeii*)[a.]	All	May-November found in inshore waters, and adults are demersal during the day. Eggs are laid on a variety of substrates, including sand and hard bottom. Newly hatched squid become demersal then migrate to offshore waters. December-April: Offshore waters between 328 and 550 feet (100 and 168 m) deep. This species also	May-November	Potential presence within the SFWF and potential presence along the SFEC route where rocky and gravelly areas are found between May-November; eggs have been observed at the SFWF and may be laid along the SFEC. Not expected to be present between	Macy and Brodziak, 2001; NEFSC, 2004

Table 4.3-5. Ecologically and Economically Important Shellfish Species and Potential for Occurrence at the SFWF and SFEC

Species	Life Stage Present	Preferred Habitat	Potential Time of Year in Region	Potential Presence at the SFWF and SFEC	References
		has designated EFH in portions of the SFWF, SFEC-OCS, and SFEC-NYS, including EFH for eggs (see Appendix O).		December and April.	
Northern quahog clam (*Mercinaria mercinaria*)	All	Mud and sandy habitats to depths up to 50 feet (15 m). Burrow into the sediments to a depth of 2 to 4 inches (5 to 10 cm).	Year-round	No potential to occur at the SFWF, may occur in nearshore portions of the SFEC route, but species prefers finer sediments than those found along the SFEC route.	Hill, 2004; DFO, 1996
Northern shortfin squid (*Illex illecebrosus)*	Adults	Prefers depths ranging from 328 to 656 feet (100 to 200 m) but is also known to occur in waters shallower than 60 feet (18 m). Egg masses are thought to be neutrally buoyant.	Year-round	Preferred depth range is deeper than the SFWF and SFEC but may occasionally be present within the SFWF and along the SFEC route. Neutrally buoyant egg masses may occasionally be present throughout both the SFWF and SFEC routes.	Black et al., 1987; Grinkov and Rikhter, 1981; O'Dor and Balch, 1985
Ocean quahog clam (*Artica islandica*)	Juveniles and Adults	Prefers depths ranging from 82 and 200 feet (25 and 61 m) in medium to fine grain sand. This species also has designated EFH in the SFWF and in portions of the SFEC-OCS and SFEC-NYS (see Appendix O).	Year-round	Potential presence within the SFWF and deeper portions of the SFEC route. Nearshore portions of the SFEC route are outside of the preferred depth range of the species.	Cargnelli et al., 1999b

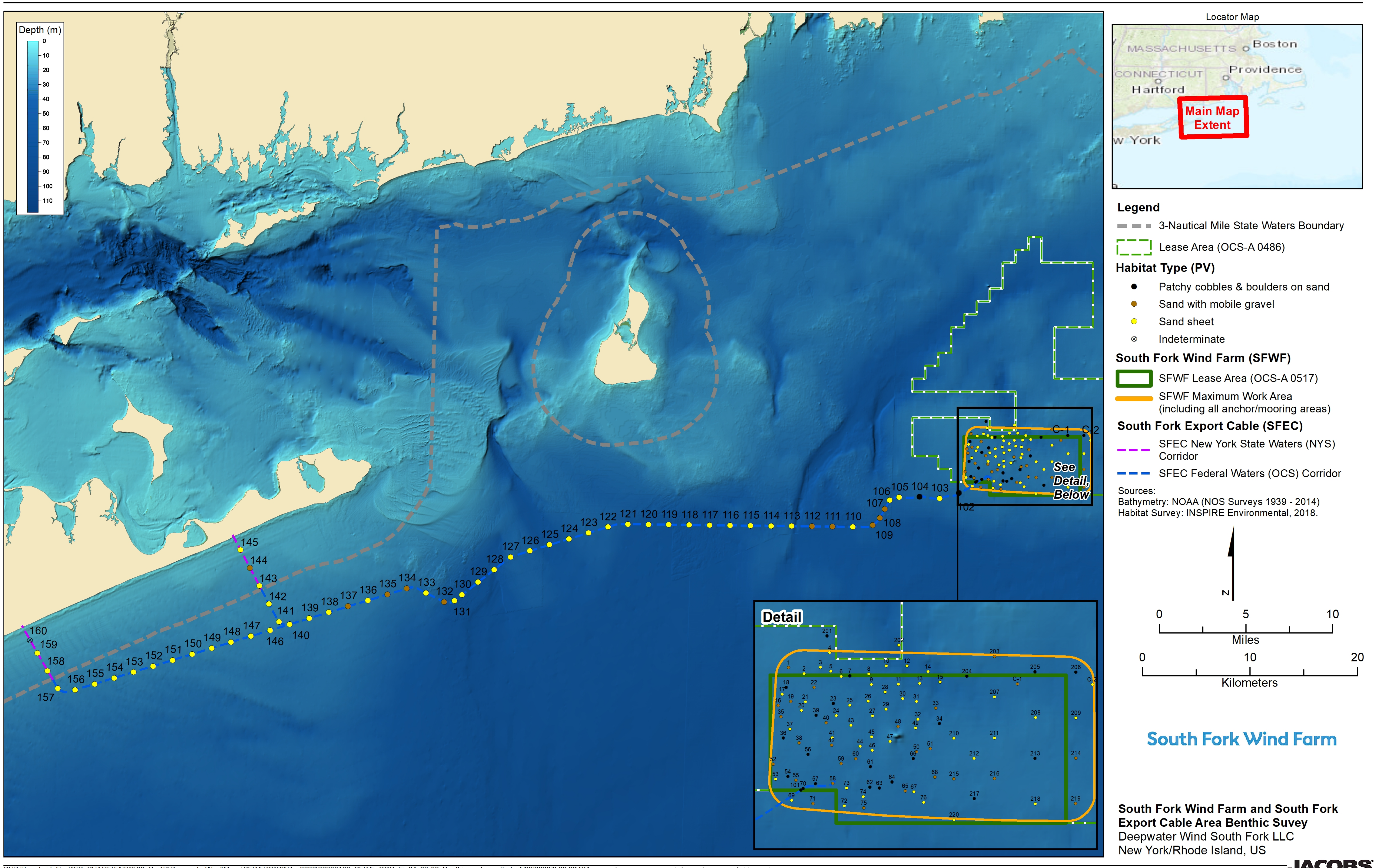
Note: Indicates taxa were observed in SPI/PV imagery for the SFWF or SFEC (Appendix N1).

Shellfish Resources

Ecologically and economically important shellfish species in the vicinity of the SFWF and SFEC are presented in Table 4.3-5. The economic and fisheries importance of these species is discussed further in Section 4.6.5. The patchy cobble and boulder habitat type is considered suitable, and potentially important regionally (Collie and King, 2016), for the American lobster. Sand sheet and sand with mobile gravel habitat types appear to be suitable for the following species: Atlantic sea scallop, Jonah crab, Atlantic rock crab, channeled whelk, ocean quahog clam, Atlantic surf clam, and horseshoe crab (Table 4.3-5). Longfin squid are expected to seasonally be present in the vicinity; they are demersal during the day and lay their eggs on the bottom substrate in patchy cobble and boulder on sand and sand with mobile gravel habitats. Table 4.3-5 includes a summary of these species, likelihood of presence, and the potential time of year that they could be present in the region.

South Fork Wind Farm Benthic Habitat Distribution

Based on data from these surveys, the SFWF has a highly variable and patchy distribution of benthic habitats, including sand sheets, sand with mobile gravel, and patchy cobbles and boulders on sand (Figure 4.3-8, Appendix N1, Appendix N2). Although sand sheets were the most common habitat type encountered during the benthic surveys, the heterogeneity of sediment types on small scales was high, with variable presence of gravel (i.e., granules, pebbles, cobbles, boulders) on sandy substrates characterizing much of the SFWF (Appendix H). The presence of cobbles and boulders at the SFWF was patchy at both the sub-square meter scale of the SPI/PV images and at a larger landscape scale (Appendix H). Patchy presence of cobbles and boulders with attached fauna within and near the SFWF indicate that there is likely greater relative areal coverage of these features than was captured in SPI/PV images. Further, landscape scale data collected during the G&G survey show that boulders are present throughout the site with a much higher frequency than could be captured with SPI/PV (Appendix H). These data show that the highest density of boulders was found in the western and central portion of the SFWF (Appendix H). Site-specific sidescan sonar surveys revealed boulder density in relation to project components and show that greatest boulder density occurs in the western, southern, and northeastern parts of the MWA, with three higher density boulder areas near the center of the MWA (Figures 3.1-1 and 3.1-2, Appendix H). Areas of low boulder density correspond to quaternary fluvial-estuarine deposits identified in shallow seismic data (glacial meltwater channels; Figure 4.3-5 and Appendix H).



Note: Inset map is zoomed-in view of the SFWF.

Figure 4.3-8. Dominant Benthic Habitat Types Observed Across the Surveyed Area

Illustration of dominant benthic habitat types in relation to Project components

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The dominant CMECS Biotic Subclass across the SFWF was Soft Sediment Fauna. Attached Fauna were present as the CMECS Biotic Subclass or Co-occurring Biotic Subclass at approximately one-third of the stations sampled within the SFWF. The attached fauna were associated with presence of hard bottom substrate; for example, extensive coverage of sponges captured at one station indicates the presence of hard bottom buried by a thin layer of sand (Figure 4.3-7). Sensitive taxa were not observed in SPI/PV images at the SFWF, although they have the potential to occur in areas with cobble and boulder presence. Because only a small portion of the boulders that exist at the SFWF were captured by SPI/PV images, data on the prevalence of attached and potentially sensitive fauna associated with these features (Appendix N1) should be considered an underrepresentation of their presence at the SFWF, and data should be extrapolated over the boulder presence density noted in the geophysical data (Appendix H).

South Fork Export Cable Benthic Habitat Distribution

All three benthic habitats were observed along the SFEC route; however, their distribution varied with distance from the SFWF and as the SFEC routes near land in NYS waters, where waters are shallower than 25 feet (7 m) (Figure 4.3-8 and Appendix N1). The SFEC route was dominated by sand sheet habitats except for the following SFEC segments, where this habitat type was interspersed with other habitat types. Areas of the SFEC - OCS immediately adjacent to the SFWF were more heterogenous than the remainder of the SFEC, with patchy cobble and boulder on sand habitats observed within 19-25 miles (30-40 km) of the SFWF. Sand with mobile gravel habitats were observed along the SFEC - OCS route between the SFWF and for about half the distance along the SFEC - OCS to due south of Block Island. These habitats were also present in the section of the SFEC - NYS south of Montauk Point and near the Hither Hills landing point within NYS waters (Figure 4.3-8 and Appendix N1). Within New York State waters, sand sheets were the predominant benthic habitat type, with mobile gravel present at one station (Appendix N1), and sediment grain size was largely homogeneous (Appendix H). Sediment grain size was moderately variable on small scales along the SFEC - OCS, but most of the variability was between grain size classes within the overall sand category. Deposits of very fine silt, on the order of 6 inches (15 cm) thick, were observed overlying sand at two locations offshore of the Beach Lane SFEC landing location; one of these locations fell within New York State waters (Appendix H).

The dominant CMECS Biotic Subclass along the SFEC route was Soft Sediment Fauna at all stations where Biotic Subclass could be determined. Attached Fauna was present as the CMECS Co-occurring Biotic Subclass at a handful of locations along the SFEC, on patchy boulders close to the SFWF and on small pebbles or cobbles in sand sheet and sand with mobile gravel habitats. The Attached Fauna Biotic Subclass was not observed along the SFEC - NYS. No sensitive taxa were observed along either the SFEC - OCS or SFEC - NYS (Appendix N1).

The nearshore portion of the SFEC - NYS passes through areas that are shallow enough for SAV to be present; however, all known SAV beds identified in the vicinity are on the northern side of Long Island. No eelgrass beds were identified near the routes during a review of historical aerial imagery from the vicinity of the routes (Tiner et al., 2003; NYSDOS Seagrass Taskforce, 2009; Stephenson, 2009). In addition, because these portions of the route are open to wave activity and are not located in shallow, sheltered, estuarine habitat, it is unlikely that SAV occurs along these routes. Similarly, depth and wave energy are anticipated to limit macroalgae that may be present in the nearshore areas of the SFEC - NYS; floating algal masses and drifting algae composed of species such as sea lettuce and wire weed are the most likely to occur (Table 4.3-3). Neither eelgrass beds nor macroalgae were observed in the nearshore areas of the SFEC - NYS (Appendix N).

As the majority of the SFEC is located at a similar depth as the SFWF, the macrobenthic communities associated with each benthic habitat type present are expected to be similar (Table 4.3-4). In shallower areas with greater exposure to waves and shifting sands in New York State waters, benthic communities and organisms are expected to be less prevalent than in deeper areas because of higher wave energy and more frequent disturbance patterns, preventing large populations of epifauna and infauna from becoming established. There is also expected to be a shift in dominant ecologically and economically important species in the shallower nearshore waters of the SFEC - NYS, with increased densities of Northern quahog clam, Atlantic rock crab, Atlantic surf clam, horseshoe crab, and a limited potential for eastern oyster if shell beds are present. These shallower nearshore areas of the SFEC - NYS are also less suitable for lobster, Atlantic sea scallop, Jonah crab, and as egg-laying sites for longfin squid than benthic habitats within the SFWF and along the SFEC - OCS.

Reference Area Benthic Habitat Distribution

The physical and biological characteristics of the reference area were within the range observed across the SFWF and SFEC. Therefore, the area can serve as a valid reference area for the SFWF project. The potential presence of macroalgae (Table 4.3-3), macrofauna (Table 4.3-4), and ecologically and economically important shellfish species (Table 4.3-5) in the reference area is expected to be similar to that predicted for the SFWF and the SFEC-OCS in direct relation to the complement of habitat types present.

All three benthic habitat types were observed in the reference area (Figure 4.3-8 and Appendix N1). Sediments exhibited low to medium heterogeneity and were composed of mostly coarse and medium sands, with pebbles and cobbles present at the western and eastern ends of the area and a boulder observed at the eastern end (Appendix H). The dominant CMECS Biotic Subclass in the reference area was Soft Sediment Fauna, and Attached Fauna was the Co-occurring Biotic Subclass at the eastern edge of the reference area where sea pens and hydroids were observed attached to cobbles (Appendix N1). Sensitive taxa were not observed within the reference area.

4.3.2.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to cause both direct and indirect impacts on benthic resources and shellfish, as discussed in the following sections. IPFs associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are described in Section 4.1.

An overview of the IPFs for benthic and shellfish resources associated with the SFWF and SFEC is presented on Figure 4.3-9. IPFs not expected to impact benthic resources are depicted with slashes through the circle. For the IPFs that could impact benthic resources but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. The IPFs with potential to impact benthic resources are indicated by gray shading.

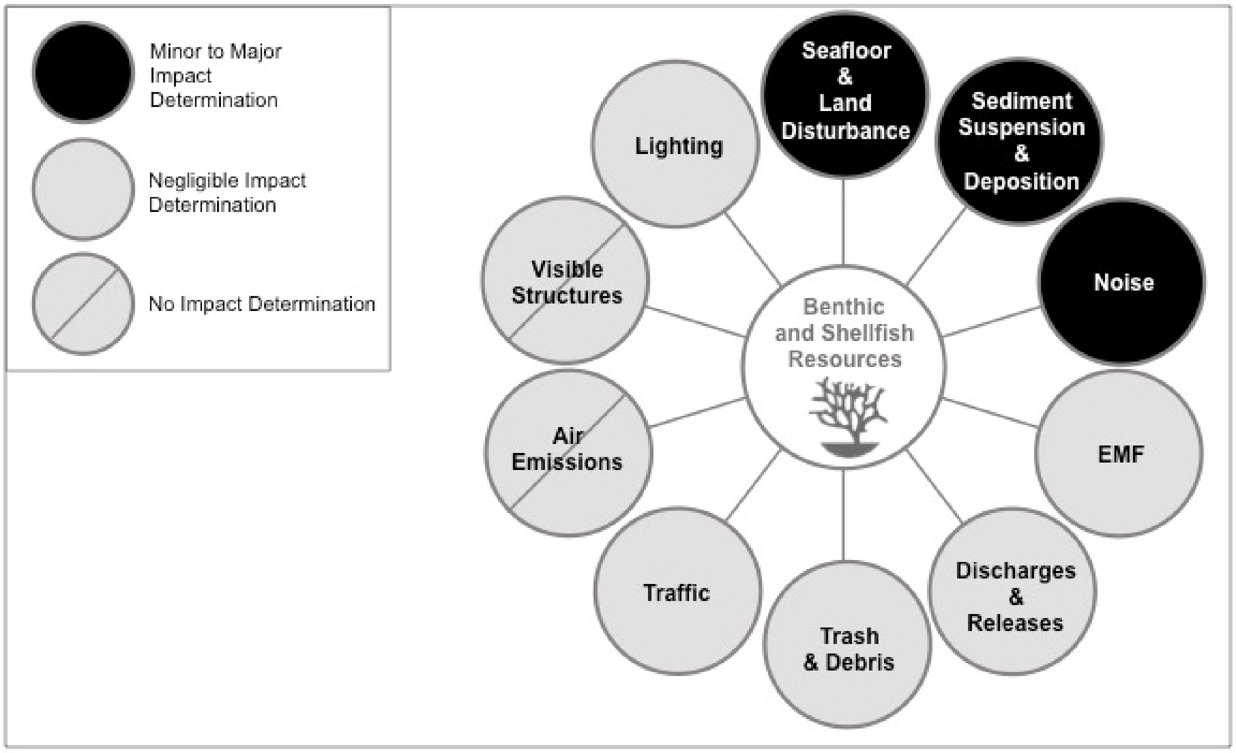

Figure 4.3-9. IPFs on Benthic and Shellfish Resources

Illustration of potential impacts to benthic and shellfish resources resulting from SFWF and SFEC activities.

South Fork Wind Farm

Impacts associated with the construction, O&M, and decommissioning of the SFWF to benthic species overall are expected to be ***negligible to minor, localized, and short-term***. Impacts to sessile species and species with limited mobility are more likely to experience ***minor impacts***, while more mobile species are more likely to experience ***negligible impacts***. See Section 4.1 for the acreage range of benthic habitat that is expected to be affected by construction.

Following completion of construction and during O&M of the SFWF, the majority of the substrates at the SFWF will return to pre-project conditions and allow for continued use by benthic species. Boulders relocated during construction will be in new locations and may be in new physical configurations in relation to other boulders. Short-term loss of attached fauna is expected during relocation. Concerning these spatial and physical attributes, the boulders are not expected to return to pre-project conditions. However, relatively rapid (< 1 year) recolonization of these boulders is expected (Guarinello et al., 2017) and will return these boulders to their pre-project habitat function. Additionally, if relocation results in aggregations of boulders, these new features could serve as high value refuge habitat for juvenile lobster and fish as they may provide more complexity and opportunity for refuge than surrounding patchy habitat. Benthic infauna and epifauna are expected to recolonize the area after sediment disturbance, allowing these areas to continue to serve as habitat. The exception is the conversion of soft substrate to hard substrate associated with the WTGs, scour protection, and protective armoring. The acreage of benthic habitat that is expected to be affected by construction (Section 4.1) is small relative to the total area of available surrounding habitat and EFH. Impacts to EFH for shellfish are discussed in Appendix O.

<u>Construction</u>

Table 4.3-6 summarizes the level of impacts expected to occur to benthic and shellfish resources during the construction and decommissioning phases of the SFWF. Decommissioning of the SFWF is included in Table 4.3-6 because the structures are expected to be removed, and their removal will be accomplished by similar methods or result in similar impact areas as their installation. Additional details on potential impacts to benthic and shellfish resources from the various IPFs of the SFWF during construction are described in the following sections.

Table 4.3-6. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources at the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Seafloor Disturbance	Seafloor preparation	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
	Pile driving and foundation installation	Minor short-term direct	Minor short-term direct
	OSS platform installation	Minor short-term direct	Minor short-term direct
	SFWF Inter-array Cable installation	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible long-term indirect
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible long-term indirect
Noise	Pile driving	Minor short-term direct Minor short-term indirect	Minor short-term direct Minor short-term indirect
	Vessel noise, trenching noise, aircraft noise	Negligible short-term direct	Negligible short-term direct
Traffic		Negligible short-term direct	
Lighting		Negligible short-term direct	Negligible short-term direct
Discharges and releases [c]		Negligible	Negligible
Trash and debris [c]		Negligible	Negligible

[a] Maximum level of impact is the highest impact level for direct or indirect impacts. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category. For further information on potential impacts associated with the IPFs, see the following sections.

[b] Including eggs and larvae of mobile species.

[c] Supporting information on the negligible level of impact for the Discharges and Releases and Trash and Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

Seafloor disturbance during construction of the SFWF occurs during the following activities: seafloor preparation, pile driving and foundation installation, OSS platform installation, the SFWF Inter-array Cable installation, and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce ***minor direct impacts*** to species, depending on the mobility of the benthic species and shellfish species. See Section 4.1 for the impact area associated with the Inter-array Cable and impact areas associated with the monopile foundation that is planned to be installed for the WTGs and OSS.

Seafloor Preparation

Seafloor preparation activities at the SFWF during construction include removal of obstructions and debris within a 100-foot radius of the WTG installation location and along the route of the Inter-array Cable. A PLGR will be used to clear debris from the area prior to laying the Inter-array Cable. In addition, boulder relocation may be required within the foundation work area for some of the foundations and within 49 feet (15 m) of each side of the Inter-array Cable centerline where boulders are present. Temporary seabed disturbance from boulder relocation related to preparation for foundation placement could be up to 14.8 acres (6 ha) and temporary seabed disturbance from boulder relocation related to Inter-array Cable installation could be up to 61.1 acres (24.7 ha).

These activities are expected to result in ***minor, short-term direct impacts,*** including mortality to benthic species within the area of impact. Benthic species are expected to recolonize the impact area following construction activities, and this may occur within months or 1 to 3 years of disturbance (BERR, 2008; BOEM, 2012; Guarinello et al., 2017). In a study of particular regional relevance, boulders that were moved by anchoring activity during construction at the Block Island Wind Farm (BIWF) were recolonized to pre-construction coverage levels within 1 year of seafloor disturbance (Guarinello et al., 2017). Recolonization rates of benthic habitats are driven by the benthic communities inhabiting the area surrounding the impacted region. Communities well adapted to disturbance within their habitats (e.g., sand sheets) are expected to quickly recolonize a disturbed area, while communities not well adapted to frequent disturbance (e.g., deep boulder communities) may take upwards of a year to begin recolonization, resulting in ***minor, long-term, indirect impacts***. Impacts to benthic resources will be limited to the area of direct disturbance. ***Minor, short-term, direct impacts*** may also include disruption of feeding during seafloor preparation; however, post-seafloor preparation predatory infaunal and epifaunal species may be attracted to the area to prey upon dislodged or injured organisms.

Pile Driving and Foundation Installation

In disturbed areas where no structures are placed, benthic species are expected to recolonize following the disturbance. In areas where foundations and associated scour protection are placed ***minor, short-term, direct impacts*** to benthic species through crushing and displacement of all life stages of species, including eggs and larvae are anticipated. Long-term impacts to benthic species because of the presence of the foundations and scour protection are discussed in the O&M section for the SFWF.

Offshore Substation Platform Installation

Impacts associated with the installation of the OSS platform are expected to be similar to those described for seafloor preparation and pile driving and foundation installation.

SFWF Inter-Array Cable Installation

Installation of the Inter-array Cable is expected to result in impacts similar to these described for seafloor preparation, pile driving and installation of foundations resulting in ***minor, short-term, direct impacts*** to benthic species. Sessile and slow-moving benthic species, including infaunal species that cannot get out of the way of the cable installation equipment, may be subject to mortality and injury to individuals. Because of the slow speed of equipment and limited size of the impact area, it is expected that most mobile benthic species, such as American lobster, crabs, Atlantic sea scallops, and juvenile and adult squid, will be able to move out of the way and not be subject to mortality, but may still experience ***minor, short-term, direct impacts***. Sessile and slower moving species, such as clams, oysters, whelks, and egg masses for a variety of species, including squid, may be subject to mortality or injury if within the impact area. The Inter-array Cable may also require armoring, and the installation of this armoring is expected to result in ***minor, short-term, direct impacts***.

Similar to seafloor preparation, ***minor to negligible, long- and short-term, direct impacts*** may include longer-term recolonization of the affected area, and short-term disruption of feeding of benthic species.

Vessel Anchoring (Including Spuds)

Impacts associated with vessel anchoring are similar to those discussed for seafloor preparation and pile driving and foundation installation. ***Minor, short-term, direct impacts***, including mortality or injury of slow-moving or sessile species within the impact area of the spuds, anchor, or area swept by the anchor chain, may occur. The extent of the impacts will vary, depending on the vessel type, number of vessels, and duration onsite; as these numbers increase, the associated impact areas will also increase. ***Minor, long-term, direct impacts*** will be associated with habitat disturbance and associated recovery time from the areas impacted by the vessel anchors, spuds, and areas swept by anchor chains.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during construction can result from seafloor disturbance associated with foundation placement and Inter-array Cable installation, as well as vessel traffic and anchoring. These activities have the potential to cause localized increases in sediment suspension and deposition in adjacent areas as the suspended sediment settles out of the water column. ***Direct impacts*** associated with increased sediment suspension and deposition are expected to be ***minor*** and ***short-term*** for sessile species and species with limited mobility, and ***negligible*** and ***short-term*** for mobile species. ***Minor, long-term, direct impacts*** associated with habitat loss through sediment deposition in surrounding areas would be anticipated. Vessel mooring or anchoring activity resulting in sediment suspension and deposition is expected to be limited to areas of the seafloor immediately adjacent to the spuds or anchors. For cable installation activities, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the Inter-array Cable, one of three potential types of equipment to be used for cable installation (Appendix I).

To estimate the extent of potential impacts from sediment suspension and deposition generated by jet plow installation, one of three potential types of equipment to be used for cable installation, a modeling simulation was conducted on a representative section of the Inter-array Cable, which indicated that the maximum modeled TSS concentration from the SFWF Inter-array Cable installation using a jet plow is 100 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) from the jet plow, and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) within 18 minutes (0.3 hour) from the conclusion of jet plow trenching. The model predicted that sediment deposition resulting from the installation of the Inter-array Cable using a jet plow will be limited to the area immediately adjacent to the burial route, typically extending no more than 196 feet (60 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.4 inch (10 mm) and limited to within 26 feet (8 m) of the burial route, covering an estimated cumulative area of 0.1 acre (0.04 ha) (Appendix I).

Increased deposition could result in mortality of benthic organisms through smothering and irritation to respiratory structures; however, mobile benthic organisms are expected to temporarily vacate the area and move out of the way of incoming sediments (DOI-MMS, 2007). Eggs and larval organisms are especially susceptible to smothering through sedimentation, and smaller organisms are likely more affected than larger organisms, as larger organisms may be able to extend feeding tubes and respiratory structures above the sediment (BERR, 2008). Maurer et al. (1986) found that several species of marine benthic infauna (the clam *Mercenaria mercenaria*, the amphipod *Parahaustorius longimerus*, and the polychaetes *Scoloplos fragilis* and *Nereis succinea*) exhibited little to no mortality when buried under up to 3 inches (8 cm) of various types of sediment (from predominantly silt-clay to pure sand). This suggests that burial with 0.4 inch (10 mm) of sediment will have little impact on some species of benthos if they are present near the trench.

Recolonization of areas covered in sediment may take months to years to occur, and studies associated with cable laying found that benthic infauna were still recovering 2 years after the cable-laying activity had ceased (Gill, 2005; DONG Energy et al., 2006).

Increased sediment suspension and deposition could also result in a reduction in feeding success of benthic species because prey species may be covered or temporarily vacate the area. Levels of TSS could also reach lethal or sublethal levels for benthic species; however, given the limited extent and duration of the elevated project-related TSS concentrations, this would be considered a minor impact to the benthic population. Indirect impacts may also include mobilization of contaminants within the sediments; however, the Inter-array Cable is not located near a known disposal site or area of contamination, so this is unlikely.

Sand sheet and mobile sand with gravel habitats as found near the SFWF are often more dynamic in nature; therefore, they are quicker to recover than more stable environments, such as fine-grained (e.g., silt) habitats and rocky reefs (Dernie et al., 2003). Species found in these more dynamic areas are often adapted to deal with more dynamic habitats and handle increases in sedimentation associated with wind and waves.

Noise

Direct impacts associated with noise during construction of the SFWF may occur during pile driving and installation of the Inter-array Cable. Noise associated with vessels and aircrafts may also cause impacts during construction. Pile driving is expected to cause ***minor, short-term, direct impacts***, while the other sources of noise are expected to have ***negligible impacts***. Expected impacts from these activities are discussed separately in the following sections. Criteria for assessing injury to invertebrates associated with sound levels and sound exposure levels have not been established.

Pile Driving Noise

Little scientific research has been conducted on noise impacts on benthic species and shellfish; however, because benthic species and shellfish lack gas-filled organs, they are likely to be less sensitive than finfish and marine mammals to pressure waves. Few marine invertebrates have the sensory organs to perceive sound pressure, but many can perceive particle motion (Vella et al., 2001). ***Minor, short-term, direct impacts*** are expected for benthic resources and shellfish from pile driving noise. Increased underwater noise may result in short-term behavioral changes, including area avoidance by mobile species. ***Minor, short-term, direct impacts*** may be associated with increased underwater noise, resulting in an increased potential for predation, and potential interruption of communication leading to behavioral changes.

Vessel Noise, Trenching Noise, Aircraft Noise

Little research has been conducted on how benthic resources and shellfish are affected by underwater noise from vessels, trenching, or aircraft noise. Vessel noise may cause short-term behavioral changes; however, this is not expected to be different than what currently occurs when vessels transit the area. Similarly, trenching noise levels are not expected to result in adverse impacts to benthic resources. As a result, ***short-term, negligible, direct impacts from*** trenching, vessel noise, and aircraft noise could be anticipated

Traffic

Impacts associated with vessel traffic during the SFWF construction are expected to be ***negligible*** and ***short-term*** related to benthic resources.

Lighting

BOEM does not identify potential impacts to benthic or shellfish species from lighting at offshore facilities (Orr et al., 2013). There is the potential that lighting associated with construction of the OSS may serve to attract species such as squid to the area at night; however, because of the limited size of the lit area during construction and the depth of the water at the SFWF, potential impacts are expected to be ***short-term*** and ***negligible***.

Operations and Maintenance

Table 4.3-7 summarizes the level of impacts expected to occur to benthic and shellfish resources during the O&M phases of the SFWF. ***Minor, long-term, indirect impacts*** during O&M are largely associated with the presence of the SFWF. Additional details on potential impacts to benthic and shellfish resources from the various IPFs during O&M are described in the following sections.

Table 4.3-7. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources at the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact[a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Seafloor Disturbance	Foundation	Minor long-term indirect	Minor long-term indirect
	OSS platform	Minor long-term indirect	Minor long-term indirect
	SFWF Inter-array Cable	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
	Vessel Anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible long-term indirect
Noise	Vessel Noise and Aircraft Noise	Negligible short-term direct	Negligible short-term direct
	WTG Operational Noise	Negligible long-term direct	Negligible long-term direct
EMF		Negligible	Negligible
Traffic		Negligible short-term direct	
Lighting		Negligible long-term direct	Negligible long-term direct
Discharges and Releases [c]		Negligible	Negligible
Trash and Debris [c]		Negligible	Negligible

[a] Maximum level of impact is the highest impact level for direct or indirect impacts. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category. For further information on potential impacts associated with the IPFs, see the following sections.

[b] Including eggs and larvae of mobile species.

[c] Supporting information on the negligible level of impact for the Discharges and Releases and Trash and Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

During O&M of the SFWF, the presence of the foundations, Inter-array Cable, and vessel anchoring may result in seafloor disturbance. See Sections 3.1.2.2 and 4.1 for the expected impact areas associated with the monopile foundation that is planned to be used to support the WTGs and OSS, and the impact area associated with the Inter-array Cable and vessel anchoring.

Foundations

The presence of the foundations and associated scour protection is expected to result in ***minor, long-term, direct impacts*** to benthic organisms because of the conversion of existing sand sheet or sand with mobile gravel habitat to hard bottom habitat. This conversion to hard-bottom habitat would result in ***long-term, minor direct impacts*** to species that occur in soft-bottom because of loss of habitat. Species that are associated with hard bottom habitat are expected to experience ***long-term benefits*** due to an increase of hard bottom habitat.

Habitat conversion is expected to cause a ***long-term, minor, indirect impact*** resulting in a potential shift in species assemblages towards those found in rocky reef and rock outcrop habitat; this is known as the "reef effect" (Wilhelmsson et al., 2006; Wilhelmsson and Malm, 2008; Maar et al., 2009; Reubens et al., 2013). This effect is also well known from other anthropogenic structures in the sea, such as oil platforms, artificial reefs piers, and shipwrecks (Claudet and Pelletier, 2004; Wilhelmsson et al., 2006; Seaman, 2007; Langhamer and Wilhelmsson, 2009; Langhamer et al., 2009). The impact is expected to be minor because both soft and hard bottom habitats are already present in and around the SFWF. Data collected as part of the G&G survey at the SFWF (Appendix H) indicate that sand sheet habitat is not a limiting habitat in the region, and that numerous hard bottom boulder habitats are also present within the area. As a result, the conversion of a small area of sand sheet habitat to hard bottom habitat is unlikely to result in perceptible changes to the benthic community outside of the immediate area impacted.

These converted hard bottom habitat areas may serve as artificial reefs and are expected to be colonized by fouling organisms, including macroalgae, shellfish, barnacles, tunicates, and bryozoans (Gill and Kimber, 2005). Recruitment of marine organisms to new structures such as foundations primarily occurs in two different ways: by migration of adults from the surrounding substrate or by settling of larvae and juveniles. This recruitment will be influenced by the local hydrodynamic regime that will be carrying the larvae to the area (Jonsson et al., 2004), the material and texture of the foundations and structures (Glasby, 2000), the location of the foundations and structures with respect to water depth (Relini et al., 1994), and temperature (Anil et al., 1995; Verween et al., 2007). Design components may influence the specific species that settle and colonize scour protection structures, as structural complexity of exposed surfaces is an important factor (Petersen and Malm, 2006; Langhamer and Wilhelmsson, 2009; Langhamer, 2012).

The use of gravel or boulders for scour protection around the foundations will create new hard substrate, and this substrate is expected to be initially colonized by barnacles, tube-forming species, hydroids, and other fouling species found on existing hard bottom habitat in the region. Mobile organisms, such as lobsters and crabs, may also be attracted to and occur in and around the foundation in higher numbers than surrounding areas. Hard substrate generally has a higher biodiversity and species abundance than surrounding soft bottoms (Linnane et al., 2000).

Monopiles, if treated with anti-fouling paint, may deter some species, but still attract barnacles and filamentous algae (Petersen and Malm, 2006). As these foundations extend from below the seafloor to above the surface of the water, there is expected to be a zonation of macroalgae from deeper growing red foliose algae and coralline algae, to kelps and other species, including those that may grow in subtidal, intertidal, and splash zone areas. Foundations typically also have crevices that increase structural complexity of the area and attract finfish and invertebrate species seeking shelter, including crabs and American lobster. Other species that may be beneficially affected include sea anemones and other anthozoans, bivalves such as horse mussel, green sea urchin, barnacles, hydrozoans, sponges, and other fouling organisms. There is expected to be a similar zonation of these species with depth, as well. Species that prefer softer bottom habitat may be adversely affected, and these include ocean quahog, waved and chestnut astarte clam, Atlantic surf clam, sand shrimp, channeled whelk, and horseshoe crab. For further information on preferred habitat of benthic species, see Table 4.3-3.

Hard bottom habitat is present but limited in the area and conversion of soft bottom habitat to hard bottom habitat is expected to provide ***long-term benefits*** that may increase diversity and biomass of benthic and shellfish species in the vicinity of the SFWF, including those species discussed in the cobbles, boulders, rocky reef, and rock outcrop portion of Table 4.3-3. The conversion to hard bottom associated with the WTGs is expected to have a ***minor, long-term,***

impact on species associated with sandy bottom habitats. Because of the amount of surrounding sand sheet soft bottom habitat in the area, sand sheet habitat is not expected to be a limiting factor on benthic resources and shellfish. In addition, because of the dispersed nature and small spatial footprint of the WTGs and other locations that may be converted to hard bottom, any reef effect observed will be limited to the immediate vicinity of that structure and will not cover the entire area where the SFWF is located.

Offshore Substation Platform

Impacts associated with the presence of the OSS platform during operation are expected to be similar to those described for the foundation.

SFWF Inter-Array Cable

Some portions of the Inter-array Cable may require armoring, which will result in conversion of existing habitat to hard bottom, as described in the Foundation section. Areas that require armoring are expected to result in ***minor, long-term impacts*** to benthic organisms and their habitat, as described in the Foundation section.

Benthic organisms are expected to experience ***minor, short-term, direct impacts*** if the Inter-array Cable requires maintenance that will expose the Inter-array Cable. Maintenance of the Inter-array Cable is considered a nonroutine event and is not expected to occur regularly. Impacts associated with exposing the Inter-array Cable will be similar but less frequent to those described for the SFWF Inter-array Cable installation during the construction and decommissioning stage.

Vessel Traffic - Anchoring (Including Spuds)

Vessels are not expected to anchor during O&M activities unless the Inter-array Cable or WTGs require maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to but less frequent than those discussed for vessel anchoring during the construction phase. ***Minor, short-term, direct impacts***, including mortality or injury of slow-moving or sessile species within in the impact area of the spuds, anchor, or area swept by the anchor chain, may occur. The extent of the impacts will vary depending on the vessel type, number of vessels, and duration onsite; as these numbers increase, the associated impact areas will also increase. ***Minor, long-term, indirect impacts*** will be associated with habitat disturbance and associated recovery time from the areas impacted by the vessel anchors, spuds, and areas swept by anchor chains.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M will primarily result from vessel anchoring and any maintenance activities that require unburying or reburying the Inter-array Cable. Both activities are expected to be nonroutine events and not expected to occur with regularity. Sediment suspension and deposition impacts resulting from vessel activity during the SFWF O&M are expected to be similar to vessel-related sediment suspension and deposition impacts described for the construction phase.

Noise

Noise associated with O&M activities is expected to have ***negligible impacts*** on the benthic resources at the SFWF.

Vessel and Aircraft Noise

Vessel and aircraft noise during the SFWF O&M are expected to have ***negligible, short-term, direct impacts*** and will be similar to or less than those impacts described in the construction phase.

WTG Operational Noise

The WTGs will produce low-level continuous underwater noise (infrasound) during operation; however, there are no conclusive studies associating WTG operational noise with impacts on benthic resources and shellfish. Because of this, direct impacts are expected to be ***long-term*** and ***negligible*** for WTG operational noise. No indirect impacts are expected.

Electromagnetic Field

Operation of the WTG does not generate EMF; however, once the Inter-array Cable becomes energized, the cable will produce a magnetic field, both perpendicularly and in a lateral direction around the cable. The Inter-array Cable will be shielded and buried beneath the seafloor. Shielded electrical transmission cables do not directly emit electrical fields into surrounding areas but are surrounded by magnetic fields that can cause induced electrical fields in moving water (Gill et al., 2012). Exposure to EMF could be short- or long-term, depending on the mobility of the species. Mobile species are likely to pass through the area and be exposed for a short duration. Sessile species, which are unable to move, will be exposed for the entire duration that the Inter-array Cable is energized (BERR, 2008; Woodruff et al., 2012; Love et al., 2015, 2016).

Compared to fish and elasmobranchs, relatively little is known about the response of marine invertebrates to AC EMF, and how this might impact migration, orientation, or prey identification. Aquatic crustaceans, a group that includes commercially important crab and lobster species, have been observed to use geomagnetic fields to guide orientation and migration, which suggests that this group of organisms is capable of detecting static magnetic fields (Ugolini and Pezzani, 1995; Cain et al., 2005; Boles and Lohmann, 2003; Lohmann et al. 1995). The ability to detect geomagnetic fields, however, is likely integrated with other environmental cues, including slope, light, currents, and water temperature. Furthermore, Project cables will produce AC magnetic fields, which differ from the static geomagnetic fields to which magnetosensitive marine invertebrates are attuned; therefore, operation of the Inter-array Cable is not expected to adversely impact benthic invertebrate orientation or migration.

As described in Appendix K, data from field studies constitute the best source of evidence to assess population-level impacts to benthic invertebrates. These demonstrate that impacts on benthic invertebrate behavior or distribution are not expected due to the presence of energized cables. Field surveys on the behavior of large crab species at 60-Hz AC submarine cable sites indicate that the project's calculated magnetic-field levels are not likely to impact the distribution and movement of large epibenthic crustaceans. Ancillary data and observations from these field studies also suggest that cephalopod predation is similarly unaffected by the presence of 60-Hz AC cables (Appendix K).

Appendix K provides more detail on field study evidence that supports the conclusion that large benthic and epibenthic invertebrates will not be affected by the installation of the SFWF Inter-array Cable. Impacts on sea urchin embryonic development observed in laboratory studies were minor and were only documented to occur after exposure to magnetic fields between 500 and 34,000 mG (Appendix K). These levels are much higher than magnetic fields expected to be produced by the SFWF and SFEC cables. Based on these studies, negligible impacts to benthic invertebrates are expected from the EMF associated with operation of the SFWF Inter-array Cable.

Traffic

Impacts associated with vessel traffic during the SFWF construction are expected to be negligible and short-term related to benthic resources.

Lighting

Impacts associated with lighting are expected to be similar to impacts described in the construction phase. Because of the limited size of lit area during O&M at the OSS and individual WTGs, the depth of the water at the SFWF, the limited area associated with artificial lighting, and the height of the lights above the water, these potential impacts are expected to be ***negligible*** but would occur over the duration of the O&M of the SFWF.

Decommissioning

Decommissioning of the SFWF is expected to have similar impacts as those described for construction of the WTGs, OSS, and Inter-array Cable, and. the SFWF area is expected to return to pre-project conditions after completion of decommissioning.

South Fork Export Cable

Similar to the SFWF Inter-array Cable, the construction, installation, and decommissioning of the SFEC is not expected to have more than minor long-term impacts on benthic or shellfish resources. Impacts are largely expected to be ***negligible to minor, localized,*** and ***short-term*** in nature. See Section 4.1 for the acreage of benthic habitat that is expected to be affected by construction.

Following completion of construction and during O&M of the SFEC, the substrates along the SFEC are expected to fundamentally remain the same as pre-project conditions, since the SFEC will be buried below the seafloor. This will allow for benthic species to recolonize the disturbed areas. The exception is the conversion of sand sheet and sand with mobile gravel habitats to hard bottom habitat associated with the protective armoring for discrete portions of the SFEC. This acreage is small relative to the total area of available surrounding benthic habitat, and such adverse impacts to benthic species are expected to be ***localized*** and ***minor at the short- and long-term***.

SFEC – OCS and SFEC - NYS

Construction and Decommissioning

Table 4.3-8 summarizes the level of impacts expected to occur to benthic and shellfish resources during the construction and decommissioning phases of the SFEC. Decommissioning of the SFEC is included in Table 4.3-8 because decommissioning of the structures will be accomplished by similar methods or result in similar impact areas as their installation. Additional details on potential impacts to benthic and shellfish resources from the various IPFs during construction are described in the following sections. Impacts to EFH for shellfish are discussed in Appendix O.

Table 4.3-8. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources for the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Seafloor Disturbance	Seafloor preparation	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
	Pile driving and cofferdam installation	Minor short-term direct	Minor short-term direct
	SFEC installation	Minor short-term direct	Minor short-term direct
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible long-term indirect
Noise	Pile driving	Minor short-term direct	Minor short-term direct
	Vessel noise, trenching noise, aircraft noise	Negligible short-term direct	Negligible short-term direct
Traffic		Negligible short-term direct	

Table 4.3-8. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources for the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Lighting		Negligible short-term direct	Negligible short-term direct
Discharges [c]		Negligible	Negligible
Trash and Debris [c]		Negligible	Negligible

[a] Maximum level of impact is the highest impact level for direct or indirect impacts. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Including eggs and larvae of mobile species.

[c] Supporting information on the negligible level of impact for the Discharges and Trash and Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

Seafloor disturbance, associated with construction of the SFEC, results from the following activities: seafloor preparation, cofferdam installation, cable installation, and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce ***minor direct*** and ***indirect impacts*** to species depending on the mobility of the benthic species and shellfish species. See Section 4.1 for the expected impact areas associated with the SFEC cable and HDD cofferdam.

Seafloor Preparation

Seafloor preparation activities at the SFEC during construction include removal of obstructions and installation trials prior to installing the SFEC. A PLGR will be used to clear debris from the area prior to laying the SFEC. Up to five installation trials may be conducted, resulting in a temporary seabed disturbance of up to 9.3 acres (3.75 ha). In addition, boulder relocation may be required within 49 feet (15 m) of each side of the cable centerline where boulders are present. Temporary seabed disturbance from boulder relocation related to preparation for SFEC-OCS installation could include a total temporary disturbance of up to 124.9 acres (50.5 ha). Boulder relocation will not be required along the SFEC-NYS.

Impacts associated with seafloor preparation are expected to be similar to those described for the SFWF Inter-array Cable, with the one difference that shallower areas will be affected as the SFEC nears shore. These shallower areas are expected to have slightly different species assemblages than the deeper offshore areas near the SFWF. See Tables 4.3-3 and 4.3-4 for species that may occur in these areas and be affected by seafloor preparation.

Pile Driving and Cofferdam Installation

Vibratory pile driving will be used to install the temporary cofferdam at the HDD exit point. Direct impacts will be primarily associated with the placement of the piles and the potential to crush benthic species. This is expected to be a ***minor, short-term impact*** for sessile and slow-moving species, while mobile species are expected to have a reduced potential for direct impacts because they are expected to temporarily vacate the area where the piles will be placed. These impacts are expected to be similar to those described for pile driving at the SFWF; however, at a much smaller spatial and temporal scale.

SFEC Installation

Installation of the SFEC is expected to result in direct impacts similar to those described for the SFWF Inter-array Cable. Nearshore portions of the SFEC and the HDD to transition the onshore cable to the submarine cable will take place in shallower waters than the SFWF. During the HDD event, fluids are pumped into the borehole to lubricate it and aid in the return of drilled sediments. These fluids typically consist of bentonite clay and water with some stabilizing compounds (i.e., drilling mud).

During the HDD event, the bentonite-sediment slurry is managed landside at the entry pit through a recycling system. However, the bentonite slurry can be released to the seafloor into the water column. The pressure from boring causes an upward rupture of the seafloor or at the terminus of the borehole. When an unexpected rupture occurs followed by a release of drilling mud, this is known as a frac-out.

In the event of a frac-out, a series of containment and cleanup procedures are implemented. These procedures are typically described in an HDD inadvertent release control plan. The bentonite slurry is viscous and tends to easily coagulate. These properties allow for cleanup of releases, if necessary, through a vacuum or suction dredge system designed for that purpose.

In the event of drilling mud release out of the end of the completed borehole, the cofferdam (steel sheet piles or gravity) contains the material in a confined space. Any significant volume of the material within the confined space can be recovered as described. In either case, drilling mud will not be purposely released into the marine environment. If it does, it is expected to be confined and cleaned up so that a plume will not move through and about the water column.

If a drilling mud release occurs, it is expected to result in a ***minor, short-term impacts*** due to seafloor disturbance at the frac-out location. If any benthic organisms are in the vicinity of the release, impacts to those few individuals will occur. Species such as Atlantic rock crab and horseshoe crab are mobile and expected to vacate the impact area associated with the installation of the SFEC and any areas requiring cable armoring. Northern quahog clam, eastern oyster, and Atlantic surf clam may be subject to mortality or injury if they are present in the impact areas.

Vessel Anchoring (Including Spuds)

Impacts associated with vessel anchoring and the use of spuds during construction of the SFEC are expected to be similar to those described for the SFWF. ***Minor, short-term, direct impacts***, including mortality or injury of slow-moving or sessile species within in the impact area of the spuds, anchor, or area swept by the anchor chain, may occur. The extent of the impacts will vary depending on the vessel type, number of vessels, and duration onsite; as these numbers increase, the associated impact areas will also increase. ***Minor, long-term, indirect impacts*** will be associated with habitat disturbance and associated recovery time from the areas impacted by the vessel anchors, spuds, and areas swept by anchor chains.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during construction of the SFEC will result from seafloor disturbance caused by vessel anchoring, installation of the SFEC, and limited excavation required at the cofferdam. Direct impacts associated with increased sediment suspension and deposition are expected to be ***minor*** and ***short-term*** for sessile species and species with limited mobility, and ***negligible*** and ***short-term*** for mobile species. Indirect impacts to benthic and shellfish resources from increases in sediment suspension and deposition are expected to be ***minor*** and ***long-term*** for sessile species, and ***negligible*** and ***long-term*** for mobile species, as described for the SFWF. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For cable installation at the SFEC - OCS and SFEC - NYS, and excavation at the cofferdam, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation, one of three potential types of equipment to be used for cable installation (Appendix I). A summary of the modeling results for these three project components is provided in the following subsections.

SFEC - OCS Installation

The modeling results indicate that the maximum modeled TSS concentration from SFEC - OCS installation using a jet plow is 1,347 mg/L. The highest TSS concentrations using this type of cable installation equipment are predicted to occur in locations where the jet plow passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route – see Appendix H), but concentrations exceeding 30 mg/L otherwise remain within approximately 328 feet (100 m) of the source during the simulation. Water column concentrations of 100 mg/L or greater are predicted to extend up to 1,115 feet (340 m) from the jet plow, and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.4 hours after the conclusion of jet plow trenching.

The model predicted that sediment deposition resulting from installation of the SFEC - OCS using a jet plow will be limited to the area immediately adjacent to the burial route, typically, extending no more than 328 feet (100 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.45 inch (11.4 mm). Sedimentation at or above 0.4 inch (10 mm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.74 ha) of the seabed (Appendix I).

SFEC - NYS Installation

The modeling results indicate that the maximum modeled TSS concentration from SFEC - NYS installation using a jet plow is 578 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 394 feet (120 m) from the jet plow, and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.3 hours after the conclusion of jet plow trenching. A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore transition was also conducted. The maximum predicted TSS concentration from suction dredging at the HDD site is 562 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 476 feet (145 m) from the source, and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.1 hours after the conclusion of suction dredging (Appendix I).

The model predicted that sediment deposition resulting from installation of the SFEC - NYS using a jet plow will also be limited to the area immediately adjacent to the burial route, as described. The maximum predicted deposition thickness is estimated to be 0.39 inch (9.9 mm). Sedimentation at or above 0.4 inch (10 mm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.72 ha) of the seabed (Appendix I).

Cofferdam Installation

A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore transition was also conducted. The model predicted that sedimentation will be limited to the area immediately adjacent to the exit pit (within 656 feet [200 m] of the source). Unlike previous scenarios where sediment is resuspended along a linear path, the dredge and side-cast operation occur from a single point within the model domain. For this reason, the deposit is thicker, but is far more limited in extent. The maximum predicted deposition thickness is 12.5 inches (318 mm). Sedimentation at or above 10 mm extends a maximum of 177 feet (54 m) from the side-cast point and covers a cumulative area of only 1.38 acres (0.56 ha) of the seabed (Appendix I).

Potential impacts to benthic organisms from increase in sediment suspension and sediment deposition are similar to those described for the SFWF. Given the limited extent and duration of the elevated TSS and sedimentation based on the predictive modeling described, direct impacts are expected to be ***minor*** and ***short-term*** for sessile species and species with limited mobility, and ***negligible*** and ***short-term*** for mobile species; indirect impacts are expected to be ***minor*** and ***long-term*** and associated with short-term habitat loss through sediment deposition in surrounding areas.

Noise

Pile Driving Noise and Vibration

Direct impacts associated with noise and vibration during construction of the SFEC may occur during vibratory hammer pile driving for the cofferdam and cable installation of the SFEC. Pile driving is expected to cause ***minor, short-term, direct impacts*** on benthic organisms in the proximity of the SFEC – NYS cofferdam installation. Project-related underwater sounds were modeled as a part of the broader acoustic modeling effort presented in Appendix J. Vibratory hammer pile driving in water causes sound energy to radiate directly into the water by vibrating the pile between the surface of the water and the bottom and causes ground-borne vibration at the bottom substrate. Direct impacts will be experienced by those organisms close enough to the vibratory hammer pile driving to be exposed to injurious or disturbing sounds and vibrations. Indirect impacts are expected to be similar to those discussed in the Pile Driving section for the SFWF. In general, because of the shorter duration (12 to 24 hours) expected for vibratory hammer pile driving associated with the SFEC cofferdam and the continuous, nonimpulsive sounds, as opposed to impulse sounds from pile driving for the foundations, noise impacts to benthic organisms are expected to be less than those described for the SFWF pile driving.

Vessel Noise, Trenching Noise, Aircraft Noise

Impacts associated with vessel noise, trenching noise, and aircraft noise are expected to be similar to those described for the SFWF and include ***negligible, short-term, direct impacts***.

Traffic

Impacts associated with vessel traffic during the SFWF construction are expected to be negligible and short-term related to benthic resources.

Lighting

Lighting will be associated with the vessels that will be conducting the work and installing the SFEC. Potential impacts associated with vessel lighting are expected to be ***negligible*** and similar to those discussed for the SFWF construction phase. These impacts will be ***short-term*** and localized, as the vessels installing the SFEC are expected to pass quickly through each location during laying of the cable. They will be similar to impacts that currently occur in the vicinity when vessels pass through the area. As such, impacts associated with lighting are expected to be ***negligible***.

Operations and Maintenance

Table 4.3-9 summarizes the level of impacts expected to occur to benthic and shellfish resources during the O&M phases of the SFEC. ***Minor, long-term impacts*** during O&M are associated with the presence of the SFEC and associated cable armoring. Additional details on potential impacts to benthic and shellfish resources during O&M are described in the following sections.

Table 4.3-9. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources at the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact [a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Seafloor Disturbance	SFEC	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
	Vessel Anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible long-term indirect

Table 4.3-9. IPFs and Potential Levels of Impact on Benthic and Shellfish Resources at the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact [a]	
		Sessile Species and Species with Limited Mobility [b]	Mobile Species and Life Stages
Vessel and Aircraft Noise		Negligible short-term direct	Negligible short-term direct
Electromagnetic Field		Negligible	Negligible
Traffic		Negligible short-term direct	
Lighting		Negligible short-term direct	Negligible short-term direct
Discharges [c]		Negligible	Negligible
Trash and Debris [c]		Negligible	Negligible

[a] Maximum level of impact is the highest impact level for direct or indirect impacts. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Including eggs and larvae of mobile species.

[c] Supporting information on the negligible level of impact for the Discharges and Trash and Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

Seafloor disturbance during O&M of the SFEC may result from maintenance to the SFEC and vessel anchoring (including spuds). See Section 4.1 for the expected impact areas associated with the SFEC and HDD cofferdam.

Benthic organisms are expected to experience ***minor, short-term, direct impacts*** if the SFEC requires maintenance that will expose it. Similar to the maintenance of the SFWF Inter-array Cable, maintenance of the SFEC is considered a nonroutine event and is not expected to occur with regularity. Impacts associated with exposing the SFEC are expected to be similar but less frequent to those described for the construction phase. Benthic organisms are expected to experience ***negligible, short-term, direct impacts*** from the presence of the SFEC because it will be buried beneath the seabed. However, some areas of the SFEC may require armoring, which will result in conversion to hard bottom, as described for the SFWF Inter-array Cable. Areas that require armoring are expected to result in ***minor, long-term impacts*** to benthic organisms and their habitat.

Vessel Anchoring (Including Spuds)

Vessels are not expected to anchor during O&M activities unless the SFEC requires maintenance. Impacts associated with potential vessel anchoring during O&M of the SFEC are expected to be similar to those described for the SFWF. ***Minor, short-term, direct impacts***, including mortality or injury of slow-moving or sessile species within in the impact area of the spuds, anchor, or area swept by the anchor chain, may occur. The extent of the impacts will vary depending on the vessel type, number of vessels, and duration onsite; as these numbers increase, the associated impact areas will also increase. ***Minor, long-term, indirect impacts*** will be associated with habitat disturbance and associated recovery time from the areas impacted by the vessel anchors, spuds, and areas swept by anchor chains.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M of the SFEC will primarily result from vessel anchoring and maintenance activities that will require exposing the SFEC. Both activities are expected to be nonroutine events and not expected to occur with regularity. Sediment suspension and deposition impacts resulting from vessel activity during O&M of the SFEC are expected to be similar to vessel-related sediment suspension and deposition impacts described for the SFEC construction phase, but less frequent and at a smaller scale. Direct impacts associated with increased sediment suspension and deposition are expected to be ***minor*** and ***short-term*** for sessile species and species with limited mobility, and ***negligible*** and ***short-term*** for mobile species. Indirect impacts to benthic and shellfish resources from increases in sediment suspension and deposition are expected to be ***minor*** and ***long-term*** for sessile species, and ***negligible*** and ***long-term*** for mobile species, as described for the SFWF.

Noise

Direct impacts to benthic organisms associated with noise during O&M of the SFEC may occur associated with vessels and aircraft. Impacts associated with vessel noise and aircraft noise are expected to be similar to those described for the SFWF and include ***negligible, short-term, direct impacts***.

Electromagnetic Field

Negligible impacts to benthic organisms from the EMF associated with the SFEC are expected and impacts are expected to be similar to those described for the Inter-array Cable at the SFWF. Appendix K1 provides an assessment of potential effects on marine life from submarine cables.

Traffic

Impacts associated with vessel traffic during the SFWF construction are expected to be negligible and short-term related to benthic resources.

Lighting

There will be no artificial lighting associated with the SFEC in nearshore and aquatic areas during O&M. As such, ***negligible*** direct and indirect impacts associated with lighting will only occur from vessels during maintenance activities on the SFEC. These activities are expected to be ***short-term*** and ***localized,*** and similar to those discussed for the construction phase of the SFEC.

<u>Decommissioning</u>

Decommissioning of the SFEC is expected to have similar impacts as construction. The SFEC area is expected to return to pre-project conditions after decommissioning.

4.3.2.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to benthic resources.

- The SFWF and SFEC - Offshore will minimize impacts to harder and rockier bottom habitats to the extent practicable. Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize long-term impacts to the benthic habitat.
- Use of monopiles with associated scour protection will minimize impacts to benthic habitat, compared to other foundation types.
- The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
- Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to benthic and shellfish resources, as compared to use of a vessel relying on multiple-anchors.
- The sea-to-shore transition will be installed with HDD to avoid impacts to the dunes, beach, and near-shore zone, including benthic and shellfish resources.
- A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.

4.3.3 Finfish and Essential Fish Habitat

The description of the affected environment and assessment of potential impacts for finfish and EFH was evaluated by reviewing current public data sources related to finfish and EFH, including state and federal agency-published papers and databases, published journal articles, online data portals and mapping databases, and correspondence and consultation with federal and state agencies. SFW has completed a benthic habitat assessment as described in Section 4.3.2. Finfish and EFH within the potentially affected environment are described below, followed by an evaluation of potential project-related impacts.

4.3.3.1 Affected Environment

Regional Overview

The regional waters off the coast of Rhode Island, Massachusetts, and Long Island, New York are transitional waters that separate Narragansett Bay and Long Island Sound from the OCS (BOEM, 2013). These waters straddle the Mid-Atlantic and New England regions and serve as the northern boundary for some Mid-Atlantic species and the southern boundary for some New England species. The species evaluated as possibly present in the SFWF and SFEC areas reflect the transitional nature of this regional area.

Habitat and spatial factors (temperature, salinity, pH, current, etc.) affect the distribution of fish within the oceans. Major habitat types expected to be found within the SFWF and SFEC are described in Section 4.3.3. As summarized in BOEM's Revised Environmental Assessment (BOEM, 2013), finfish off the coasts of Rhode Island and Massachusetts include demersal, pelagic, and shark finfish assemblages. In addition, there are important shellfish (Section 4.3.2) and migratory pelagic finfish throughout the Southern New England-New York Bight.

BOEM (2013) states that demersal species (groundfish) spend at least their adult life stage on or close to the ocean bottom. They are generally considered to be high-value fish and are sought by both commercial and recreational anglers. Pelagic fishes are generally schooling fish that occupy the mid- to upper water column as juveniles and adults and are distributed from the nearshore to the continental slope. Some species are highly migratory and are reported to be present in the near-coastal and shelf surface waters of the Southern New England-New York Bight in the summer, taking advantage of the abundant prey in the warm surface waters. Coastal migratory pelagics include fast-swimming schooling fishes that range from shore to the continental shelf edge and are sought by both recreational and commercial anglers. These fish use the highly productive coastal waters of the more expansive Mid-Atlantic Bight during the summer months and migrate to deeper and/or distant waters during the remainder of the year (BOEM, 2013). Pelagic sharks, large coastal sharks, and small coastal sharks also occupy this region. The sections below identify these groups of finfish species and their associated habitats that may be found within the SFWF and SFEC.

South Fork Wind Farm

This section describes finfish resources (demersal and pelagic) within and surrounding the areas of the SFWF. Also, outlined in this section are the finfish species and their habitats that may be affected by the SFWF project activities. Benthic resources, including shellfish and habitat types, are described in Section 4.3.2. A thorough EFH Assessment for designated species in the SFWF and SFEC is provided as Appendix O.

Table 4.3-10 summarizes species of economic or ecological importance potentially present within the region of the SFWF and SFEC, generally characterized by their life stage and location in the water column. The species listed in Table 4.3-10 were selected based on literature review, agency correspondence, fish sampling results from the BIWF, and EFH source document review. This table does not include every species that has the potential to occur in the SFWF or SFEC, but focuses on those that are abundant, commercially or recreationally important, important prey species, or have designated EFH within the areas of the SFWF or SFEC. The table delineates species characteristics, including: habitat preference (demersal versus pelagic), early life stage presence, EFH designation, commercial/recreational importance, potential prey species, and seasonality in the region. The type or types of potential impact(s) of the SFWF on each species is related to these characteristics.

Demersal species occur near the bottom of the water column in benthic habitats, and pelagic species occupy space near the surface and within the water column. Benthic and pelagic invertebrates are discussed in Section 4.3.2. Each species type that is ecologically or economically important is described in more detail in relation to proposed SFWF activities in the following sections.

Demersal Finfish in the South Fork Wind Farm

Demersal habitat includes the bottom substrate within continental shelf and shallow areas (Scotti et al., 2010). Demersal species interact with and consume benthic organisms. Because of this interaction, demersal species are reliant on the complex relationship between benthic habitats and species. More diverse fish communities occupy more complex habitats (Malek, 2015 and Malek et al., 2016). Some demersal species are present year-round; however, there are distinct variations in local populations because of seasonal migrations and inter-annual population dynamics (declines and increases) (Malek, 2015). Within nearby Narragansett Sound, demersal fish community structure has been changing over the past six decades with some demersal species declining (winter flounder, whiting, and red hake), while others have increased (Atlantic butterfish, scup, and squid) (Collie et al., 2008). These population changes are related to overfishing, fishery closures, changes in food sources, and changes in habitat (ASMFC, 2018).

Many of the members of the New England groundfish complex (cod, haddock, pollock, and various species of hake and flounders, monkfish, whiting, scup, and black sea bass), have been collected in local surveys (Petruny-Parker et al., 2015). Groundfish are an important part of the ecosystem within the SFWF and have an important economic role for the region.

Some demersal fish species migrate seasonally to the SFWF area. These migrations are often correlated with seasonal variation in water temperature. Most demersal species are abundant nearshore and offshore, extending along the continental shelf in winter and spring, (the cold season), and decline as they migrate out of the area during the summer and fall months, (the warm season) (Scotti et al., 2010).

Anadromous species are those which migrate between ocean and riverine environments. These types of fish spend their lives in both freshwater and marine environments. Juveniles from anadromous species leave coastal rivers and estuaries in the spring to enter the ocean. During this period, they grow and mature prior to returning to estuarine habitat to spawn, generally during fall months. There are two demersal species of anadromous fish that are potentially present within the SFWF area: striped bass and Atlantic sturgeon (BOEM, 2013; Scotti et al., 2010).

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
DEMERSAL/BENTHIC								
Atlantic Cod (*Gadus morhua*)[b]			▪	▪	X	X		Year-round, peak in winter and spring
Atlantic Halibut (*Hippoglossus hippoglossus*)[b]			▪	▪		X		Year-round
Atlantic Herring (*Clupea harengus*)[b]	▪					X	X	Winter
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)			▪	▪				October to May
Barndoor skate (*Dipturus laevis*)			SFEC*	SFEC*	X			Year-round
Black Sea Bass (*Centropristis striata*)[b]			▪	▪	X	X		Spring to summer; summer to fall
Cunner (*Tautogolabrus adspersus*)			▪	▪			X	Year-round, hibernate in mud over winter
Haddock (*Melanogrammus aeglefinus*)[b]			▪	SFEC*	X	X		Winter and spring
Little Skate (*Leucoraja erinacea)*			▪	▪	X	X		Year-round
Monkfish (*Lophius americanus*)[b]			SFEC*	▪	X	X		Summer to fall
Northern sea robin (*Prionotus carolinus*)[b]			▪	▪		X		Spring through fall
Ocean Pout (*Macrozoarces americanus*)	▪		▪	▪	X	X	X	Late summer to winter
Pollock (*Pollachius virens*)[b]			▪	▪	J	X		Collected in November at BIWF
Red Hake (*Urophycis chuss*)[b]			▪	SFEC*	X	X	X	Shallow waters in spring and summer; offshore waters in the fall and winter. Collected from April to July at BIWF
Sand Lance (*Ammodytes americanus*)	▪	▪	▪	▪			X	Year-round
Sand Tiger Shark (*Carcharias taurus*) [d]		▪	▪		X			May to September

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
Sandbar Shark (*Carcharhinus plumbeus*) [b,d]		SFEC*	▪	▪	X			May to September
Scup (*Stenotomus chrysops*)			▪	▪	X	X	X	Juveniles: offshore in winter and spring, inshore in summer, near-coastal waters in fall; Adults: Fall, spring, and summer
Sea Raven (*Hemitripterus americanus*)	▪	▪	▪	▪				Collected Year-Round at BIWF
Smooth Dogfish (*Mustelus canis*)[d]		▪	▪	▪	X			Fall to winter Collected spring through fall at BIWF
Spiny Dogfish (*Squalus acanthias*)[b]				▪	X	X		Fall, winter, and summer Collected summer and fall at BIWF
Striped Bass (*Morone saxatilis*)			▪	▪		X		April to September
Summer Flounder (*Paralichthys dentatus*)[b]			SFEC*	▪	X	X		Winter to spring Collected year-round at BIWF
Tautog (*Tautoga onitis*)			▪	▪		X	X	Winter
Tilefish (*Lopholatilus chamaeleonticeps*)		▪	▪			X		Larvae: July to September; Juveniles: April to July
White hake (*Urophycis tenuis*) [b]			SFEC*		X			Migrate inshore in warmer months; disperse into deeper waters in colder months
Whiting (*Merluccius bilinearis*)[b]			SFEC*	▪	J	X		Winter to spring
Windowpane Flounder (*Scophthalmus aquosus*)[b]			▪	▪	X	X	X	Summer to fall Collected year-round at BIWF
Winter Flounder (*Pseudopleuronectes americanus*)[b]	▪	▪	▪	▪	X	X	X	Eggs/Larvae: winter to early spring; Juveniles and Adults: year-round

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
Winter Skate (*Leucoraja ocellate*)			■	■	X	X		Summer and fall Collected year-round at BIWF
Wolffish (*Anarhichas lupus*)			■	■				November to June
Yellowtail Flounder (*Limanda ferruginea*)[b]			■	■	X	X	X	Year-round
PELAGIC								
Albacore Tuna (*Thunnus alalunga*)			■	■	X	X		Summer to fall
Alewife (*Alosa pseudoharengus*)			■	■		X	X	Mid July to October Collected January to May at BIWF
American Eel (*Anguilla rostrata*)		■	■	■		X		Juveniles or Adults: March through December. One adult collected in April at BIWF
American Plaice (*Hippoglossoides platessoides*)		■	■	■		X		Year-round Collected April to May at BIWF
American Shad (*Alosa sapidissima*)			■	■		X		Spring to summer
Atlantic Bonito (*Sarda sarda*)			■	■		X		Summer to fall
Atlantic Butterfish (*Peprilus triacanthus*)	■	■	■	SFEC*	X	X	X	Eggs/Larvae: July to September; Juveniles/Adults: spring Adults: Collected in summer and fall at BIWF
Atlantic Cod[c]	■	■			X	X	X	Winter and spring
Atlantic Halibut[c]	■	■				X	X	Winter and spring
Atlantic Herring[c]		■	■	■	X	X	X	Larvae: August to December; Juveniles/Adults: spring and fall Juveniles/Adults: Collected January to March at BIWF

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
Atlantic Mackerel (*Scomber scombrus)*	■	■	SFEC*	■	E,L,J	X	X	Eggs/Larvae: April to June; Juveniles/Adults: late summer to fall Juveniles/Adults: Collected January through February at BIWF
Atlantic Menhaden (*Brevoortia tyrannus*)			■	■		X	X	Spring to summer
Atlantic silverside (*Menidia menidia*)			■	■			X	Late fall to early spring
Basking Shark (*Cetorhinus maximus*)[d]		■	■	■	X			Summer to fall
Bay anchovy (*Anchoa mitchilli*)	SFEC	SFEC	SFEC	SFEC			X	Eggs and Larvae: spring, summer, fall Juveniles and Adults: year-round Populations expected to be low and more evident in the SFEC - NYS than the SFEC - OCS.
Black Sea Bass[c]	■	■				X	X	July to September
Blueback Herring (*Alosa aestivalis*)			■	■		X	X	Summer to winter Collected in the winter at BIWF
Bluefin Tuna (*Thunnus thynnus*)			■	■	X	X		Spring to winter
Bluefish (*Pomatomus saltatrix*)	■	■	SFEC*	■	X	X	X	Eggs: March to May; Larvae: June to August; Juveniles collected in September, October, and December at BIWF Adults: August to September; Adults collected in September, October, November, and May at BIWF
Blue shark (*Prionace glauca*) [d]		■	■	■	X			June to November
Common Thresher Shark (*Alopias vulpinus*) [d]		■	■	■	X			June to December

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
Conger Eel (*Conger oceanicus*)			▪	▪				Collected November to June at BIWF
Dusky Shark (*Carcharhinus obscurus*) [d]		▪	▪	▪	X			June to November
Haddock[c]	▪	▪			L	X	X	Winter and spring
Monkfish[c]	▪	▪			X	X	X	Summer to fall
Northern sea robin[c]	▪	▪				X		Summer to fall
Pollock[c]	▪	▪			X	X		Eggs: October to June Larvae: September to July
Red Hake[c]	▪	▪			X	X	X	May to December
Sandbar Shark (*Carcharhinus plumbeus*) [c,d]		SFEC*	▪	▪	X			May to September
Shortfin Mako Shark (*Isurus oxyrinchus*) [d]		▪	▪	▪	X			June to December
Skipjack Tuna (*Katsuwonus pelamis*)			▪	▪	X	X		Year-round
Spiny Dogfish (*Squalus acanthias*)[c]				▪	X	X		Fall, winter, and summer Collected summer and fall at BIWF
Spot (*Leiostomus xanthurus*)			▪	▪		X		October to May
Summer Flounder[c]	▪	▪			X	X	X	Fall
Tiger Shark (*Galeocerdo cuvieri*)			SFEC*	SFEC*	X			May to September
Weakfish (*Cynoscion regalis*)			▪	▪		X	X	Adults: June
White Shark (*Carcharodon carcharias*) [d]		▪	▪	▪	X			Summer to fall
White hake (*Urophycis tenuis*) [c]			SFEC*		X			Migrate inshore in warmer months; disperse into deeper waters in colder months

Table 4.3-10. Economically and Ecologically Important Finfish Species in the SFWF and SFEC

Species	Eggs	Larvae	Juveniles	Adults	EFH	Commercial/ Recreational Importance	Prey Species	Potential Time of Year in Region [a]
Whiting[c]	■	■			X	X	X	Year-round
Windowpane Flounder[c]	■	■			X	X	X	Spring
Winter Flounder[c]		■			X	X	X	Winter to spring
Witch Flounder	■	■			X	X	X	Year-round
Yellowfin Tuna (*Thunnus albacares*)			■	■	X	X		Year-round
Yellowtail Flounder[c]	■	■			X	X	X	March to August

Sources:

Bohaboy et al., 2010; Cargnelli et al., 1999c; Cargnelli et al., 1999d; Cargnelli et al., 1999e; Chang et al., 1999; Collette and Klein-MacPhee, 2002; Collie et al., 2008; Collie and King, 2016; Cross et al., 1999; Curtice et al., 2016; Demarest, 2009; Fahay et al., 1999a; Fahay et al., 1999b; Fairchild, 2017; Fisheries Hydroacoustic Working Group, 2008; Florida Fish and Wildlife Conservation Commission, 2017; Florida Museum of Natural History, 2017; GARFO, 2016; Hasbrouck et al., 2011; Johnson et al., 1999a; Johnson et al., 1999b; Knickel, 2017; Lipsky, 2014; Malek, 2015; Malek et al., 2010; Malek et al., 2014; Massachusetts Department of Energy and Environmental Affairs, 2017; MA EOEEA, 2015; McBride et al., 2002; McGuire et al., 2016; Morse et al., 1999; Morton, 1989; NOAA, 2010, 2015, 2016a, 2017a, 2017b, and 2017c; North Carolina Department of Environment and Natural Resources: Division of Marine Fisheries, 2017; NEFSC, 2017; Northeast Ocean Data, 2017; Packer et al., 1999, 2003a, 2003b, and 2003c; Pereira et al., 1999; Petruny-Parker et al., 2015; Popper et al., 2014; Reid et al., 1999; Rooker et al., 2007; Scotti et al., 2010; Siemann and Smolowitz, 2017; Steimle et al., 1999a, 1999b, 1999c, 1999d, and 1999e; Studholme et al., 1999; USFWS, 2017; URI EDC, 1998a and 1998b; Wilber et al., 2017.

[a] Time of year information obtained from sources listed in the reference section. When available, species presence based on survey information from the BIWF was provided from Wilber et al., 2017.

[b] This species also has life stages that are pelagic.

[c] This species also has life stages that are demersal.

[d] For sharks, if larvae stage is checked, it refers to the neonate stage. Neonate sharks are considered more similar to the juvenile life stage of other finfish.

Notes:

■ - denotes that the life stage is potentially present in both the SFWF and SFEC.

SFWF* – denotes that the life stage is potentially present only in the SFWF, according to EFH designations.

SFEC* – denotes that the life stage is potentially present only in the SFEC, according to EFH designations.

EFH column – X indicates EFH is designated for all life stages checked in that row. E, L, J, A indicates that only certain life stages have EFH. E=eggs, L=larvae, J=juveniles, A=adults.

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Many species listed in Table 4.3-10 have demersal life stages that are considered commercially or recreationally important in New England regional waters and have the potential to occur in the SFWF. Management for each species is dictated by state regulations for waters within 3 miles (4.8 km) of the coast and by federal regulations beyond 3 miles (4.8 km). Federal waters like those of the SFWF are managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). Species such as Atlantic cod, black sea bass, scup, whiting, summer flounder, winter flounder, yellowtail founder, and winter skate are demersal species that are important to both the stability and resiliency of the local marine community and have a large impact on federal fisheries (RI CRMC, 2010). For more information about the commercial and recreational fishing activity within the SFWF (Section 4.6.5).

The Atlantic sturgeon, a federally listed demersal species, has a possible presence within the SFWF from October to May, when juveniles and adults return to the oceans after spawning occurs in estuarine and riverine environments, including the Hudson River. Atlantic sturgeon are discussed in further detail in the Threatened/Endangered Finfish section that follows.

Atlantic cod is a demersal species potentially present within the SFWF that is known to have spawning habitat within localized regions near the SFWF. Cod spawn in the winter and may demonstrate strong spawning site fidelity, returning to the same fine-scale bathymetric locations year after year (Hernandez et al., 2013; Siceloff and Howell, 2013). An active Atlantic cod spawning ground is identified in a broad geographical area that includes Cox Ledge (Zemeckis et al., 2014). Kovach et al. (2010) collected cod with an otter trawl on Cox Ledge and the majority collected were in spawning condition. These collections included 158 individuals in January 2007 and 118 individuals in April 2007.

In other studies, Atlantic cod was not among the consistently prevalent (top 25) species collected during multi-year sampling by otter trawl and beam trawl in areas that included Cox Ledge (Malek et al., 2014). Cod were collected in the SFWF area during fall sampling by Northeast Fisheries Science Center (NEFSC) from 1989 to 2002 and in the spring from 2003 to 2016. Groundfish distributions (including Atlantic cod) were assessed as low to medium densities by the vessel monitoring system (VMS; NOAA NMFS) within the SFWF (Section 4.6.5).

SFW is conducting a hook and line survey to assess the potential for Atlantic cod spawning activity at the SFWF and at nearby designated areas during winter and spring of 2018. The hook and line survey will assess site-specific spawning activity by determining the maturation stage of collected adult Atlantic cod. Reports from this study will be compiled and presented as part of an overarching SFWF and SFEC fisheries survey and monitoring plan.

Nineteen of the species that have demersal life stages listed in Table 4.3-10 have designated EFH in the SFWF. Additional information regarding EFH is described in Appendix O.

<u>Pelagic Finfish in the South Fork Wind Farm</u>

Pelagic species occupy the surface to midwater depths (0 to 3,281 feet [0 to 1,000 m] depth) from the shoreline to the continental shelf and beyond. There are 33 ecologically or commercially important finfish species that have pelagic life stages listed in Table 4.3-10 potentially present within the regional area that contains the proposed SFWF. Some pelagic species potentially present within the region include Atlantic sea herring, blueback herring, alewife, and Atlantic mackerel (Petruny-Parker et al., 2015). Pelagic finfish species are characterized as estuarine, marine, and anadromous species. Estuarine species tend to reside nearshore, whereas marine species are found offshore in deeper waters. Anadromous species prefer both nearshore and offshore areas but migrate up rivers to lower salinity environments for spawning. There are five pelagic species of anadromous fish that are potentially present within the region: American shad, alewife, blueback herring, Atlantic menhaden, and the Atlantic sea herring (BOEM, 2013; Scotti et al., 2010).

Some pelagic fish species migrate seasonally to the SFWF area. These migrations are often correlated with seasonal variation in water temperature. Seasonal variations in temperature and finfish migrations directly affect abundance of food and species of fish present (Bohaboy et al., 2010). Pelagic species are present nearshore and offshore in the warm season, and decline during the cold season (Scotti et al., 2010).

Certain pelagic species in federal waters are managed under the Atlantic Highly Migratory Species Fishery Management Plan (FMP). NMFS consults with and considers the comments of the Highly Migratory Species Advisory Panel when preparing and implementing FMPs or FMP amendments for Atlantic tuna, swordfish, billfish, and sharks. Species in Table 4.3-10 potentially present within the regional area that contains the proposed SFWF that are classified as highly migratory include: blue shark, common thresher shark, shortfin mako shark, and yellowfin tuna (NOAA, 2004).

Many species of finfish that have pelagic life stages within the regional area that contains the SFWF are considered commercially or recreationally important in federal waters. Twenty-seven of the finfish species with pelagic life stages listed in Table 4.3-10 have designated EFH within the SFWF. For more information regarding designated EFH within the SFWF (Appendix O).

Common Habitat Types of Species within the South Fork Wind Farm

New England waters have diverse habitats that are defined by their temperature, salinity, pH, physical structure, biotic structure, depth, and currents. The unique combination of habitat characteristics shapes the community of finfish species that inhabit the area. Habitat varieties determine species, distribution, and predator/prey dynamics. Each habitat structure supports a community of finfish species that rely on the habitat to survive. Multiple factors directly affect spatial and temporal patterns of fish species. A summary of common habitat types for the finfish species that could potentially occur in the SFWF or SFEC is provided in Table 4.3-11.

As described in Section 4.3.2, the SFWF has a highly variable and patchy distribution of benthic habitats including sand sheets, sand with mobile gravel, and patchy cobbles and boulders on sand (Appendix N1, Appendix N2). Although sand sheets were the most common habitat type encountered during the benthic surveys, the heterogeneity of sediment types on small scales was high, with variable presence of gravel (i.e., granules, pebbles, cobbles, boulders) on sandy substrates characterizing much of the SFWF (Appendix H). The presence of cobbles and boulders at the SFWF was patchy; interpretation of sidescan sonar survey data show detail of boulder density in relation to project components and show that greatest boulder density occurs in the western, southern, and northeastern parts of the MWA, with three higher density boulder areas near the center of the MWA (Figures 3.1-1 and 3.1-2 and Appendix H).

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage
DEMERSAL/BENTHIC	
Atlantic Cod	Juveniles: Cobble substrates both nearshore and offshore; wide temperature ranges. Adults: On or near the bottom along rocky slopes of ledges; depths between 131 and 426 feet (40 and 130 m) but also midwater.
Atlantic Halibut	Juveniles: Coastal areas 65 to 196 feet (20 to 60 m) deep; sandy bottom. Adults: Areas at depths of 328 to 2,296 feet (100 to 700 m) over sand, gravel, or clay bottoms.
Atlantic sea herring	Eggs: Spawned at depths of 131 to 262 feet (40 to 80 m) on George's Bank on gravel (preferred); sand, rocks, shell fragments, aquatic macrophytes, and lobster pot structures.
Atlantic Sturgeon	Juveniles: In the wintertime, juveniles congregate in a deep-water habitat in estuaries. Most are found over clay, sand, and silt substrates. Adults: Primarily a marine species that is found close to shore; however, it does migrate long distances.

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage
Black Sea Bass	Juveniles: Collected at depths of 65 to 787 feet (20 to 240 m) in channel environments. Adults: At depths of 98 to 787 feet (30 to 240 m) in shipwrecks, rocky and artificial reefs, mussel beds, and other structures along the bottom.
Cunner	All Life Stages: Coastwise fish that prefers eel grass, rock pools, or pilings at depths 13 to 23 feet (4 to 7 m).
Haddock	Adults: Pebble gravel bottom at depths of 131 to 492 feet (40 to 150 m).
Little Skate	All Life Stages: Sandy/gravely bottoms at a depth range of less than 233 to 298 feet (71 to 91 m).
Monkfish	Juveniles/Adults: Bottom habitat, sand/shell mix, gravel or mud along the continental shelf, depths 82 to 656 feet (25 to 200 m).
Northern sea robin	Juveniles and Adults: Smooth, hard-packed bottom.
Ocean Pout	All Life Stages: Bottom habitats with rocky shelter from the intertidal continental shelf to 656 feet (200 m) deep.
Pollock	All Life Stages: Schooling fish living at various depths from near the surface to at least 600 feet (182 m) deep.
Red Hake	Juveniles: Use of shells and substrate as shelter; found less than 393 feet (120 m) to low tide line.
Sand Lance	All Life Stages: Throughout water column over sandy substrates
Sand Tiger Shark	All Life Stages: Nearshore ranging in depths from 6 to 626 feet (2 to 191 m); inhabit surf zone, shallow bays, and rocky reefs, and deeper areas around the OCS. Generally found near bottom in sand, mud, and rocky substrates.
Sandbar Shark	All Life Stages: Prefer bottom habitats. Sand, mud, shell, and rock sediments/benthic habitat. Also, pelagic (see pelagic section).
Scup	Juveniles: Nearshore in sandy, silty-sand, mud, mussel beds, and eel grass at depths of 16 to 55 feet (5 to 17 m). Adults: Soft, sandy bottom, near structures (ledges, artificial reefs, mussel beds) at a depth range less than 98 feet (30 m).
Sea Raven	All Life Stages: Prefer rocky ground; hard clay, pebbles, or sand from 300 to 630 feet (91 to 192 m) deep.
Smooth Dogfish	All Life Stages: Mostly nearshore but some have a depth range of 870 to 990 feet (145 to 165 m); prefer bottom habitats.
Spiny Dogfish	All Life Stages: Collected over sand, mud, and mud-sand transitions at depths ranging from 3 to 1,640 feet (1 to 500 m); do not travel to maximum depths in the fall. Also, pelagic (see pelagic section).
Striped Bass	All Life Stages: Open waters along rocky shores and sandy beaches.
Summer Flounder	Adults: Prefer sandy habitats; captured from shoreline to 82 feet (25 m) deep.
Tautog	All Life Stages: Require complex, structured habitats with a hard bottom substrate; depths of 82 to 989 feet (25 to 30 m).

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage
Tilefish	All Life Stages: 262- to 590-foot (80- to 180-m) depth along the outer part of the continental shelf to upper part of continental shelf.
White hake	Juveniles: Benthic phase juveniles occur on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats.
Whiting	Juveniles: Bottom habitats; all substrate types; depths of 65 to 885 feet (20 to 270 m). Adults: Bottom habitats; all substrate types; depths of 98 to 1,066 feet (30 to 325 m).
Windowpane Flounder	Juveniles and Adults: Fine, sandy sediment; nearshore less than 246 feet (75 m) deep.
Winter Flounder	Eggs: Nearshore; mud to sand or gravel. Emerging evidence that spawning occurs offshore. Larvae: Nearshore; fine sand to gravel. Juveniles: 59 to 88 feet (18 to 27 m) deep; mud or sand-shell. Adults: Mostly nearshore up to 98 feet (30 m) deep; mud, sand, cobble, rocks, or boulders substrate.
Winter Skate	All Life Stages: Prefer sandy or gravelly substrates; spring depths from 3 to 984 feet (1 to 300 m); fall depths from 3 to 1,312 feet (1 to 400 m).
Wolffish	All Life Stages: Occupy complex habitats with large stones or rocks at a depth range of 131 to 787 feet (40 to 240 m).
Yellowtail Flounder	Juveniles: Sand or sand and mud; depth range of 16 to 410 feet (5 to 125 m). Adults: Sand or sand and mud; depth range of 32 to 1,181 feet (10 to 360 m).
Pelagic	
Albacore Tuna	All Life Stages: Deepwater habitats; depth range of 0 to 1,968 feet (0 to 600 m).
Alewife	Adults: Shorelines; shallower waters near estuaries.
American Eel	Larvae: Drift with Gulf Stream toward Atlantic Coast. Juveniles: Glass eels and elvers migrate to brackish waters; some remain in marine waters. Adults: Freshwater, coastal, and marine waters.
American Plaice	Eggs and Larvae: Open waters; depth maximum 328 feet (100 m). Juveniles and Adults: High concentrations around 328-feet (100-m) deep; prefer sand and gravel substrates.
American Shad	Juveniles: Nearshore open waters Adults: Open ocean.
Atlantic Bonito	All Life Stages: Open waters both nearshore and offshore.
Atlantic Butterfish	Eggs: Surface waters along the edge of the continental shelf to estuaries and bays. Larvae and Juveniles: Surface waters from continental shelf to bays. Adults: Surface waters from depths of 885 to 1,377 feet (270 to 420 m).

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage
Atlantic Cod	Eggs: Bays, harbors, offshore banks; float near water surface. Larvae: Open ocean and continental shelf area.
Atlantic Halibut	Eggs: Offshore drift suspended in the water column. Larvae: Nearshore areas near the water surface.
Atlantic Mackerel	Eggs: Shoreward side of the continental shelf; 32 to 1,066.27 feet (10 to 325 m) deep. Larvae: Offshore waters and open bays; 32 to 426 feet (10 to 130 m) deep. Juveniles: Nearshore areas; 164 to 229 feet (50 to 70 m) deep. Adults: Offshore, 32 to 1,115 feet (10 to 340 m) deep.
Atlantic Menhaden	All Life Stages: Nearshore and offshore.
Atlantic sea herring	All Life Stages: High energy environments; gravel seafloors.
Atlantic silverside	Juveniles and Adults: Found at great depths offshore from late fall through early spring. In the summer, they are found along the shore, within a few feet of the shoreline along sandy or gravel shores.
Basking Shark	All Life Stages: Coastal and offshore; sometimes enters inshore bays.
Bay anchovy	Eggs/Larvae: Eggs are found throughout the water column but tend to be concentrated near the surface. Larvae move upstream to lower salinity waters in the spring and then move to more saline waters in the fall. Juveniles and Adults: shallow and moderately deep offshore waters, nearshore waters off sand beaches, open bays, and muddy coves.
Black Sea Bass	Eggs: Coastal, upper water column. Larvae: Nearshore, mouths of estuaries, upper water column.
Blueback Herring	Adults: High energy environments; gravel seafloors.
Bluefin Tuna	All Life Stages: Nearshore and offshore.
Bluefish	Eggs: Across continental shelf; transported further offshore. Larvae: Near edge of continental shelf; associated with surface. Juveniles: Nearshore; associated with surface. Adults: Nearshore to offshore.
Blue Shark	All Life Stages: Nearshore and offshore, surface dwelling, concentrated near fishing activity.
Common Thresher Shark	Juveniles: Shallower waters over the continental shelf (less than 656 feet [200 m] deep) in areas of upwelling or mixing. Adults: Present near and offshore, but more common nearshore, in areas of upwelling or mixing.
Conger Eel	All Life Stages: Near the coast line to the edge of the continental shelf, 50 to 142 fathoms deep
Dusky Shark	All Life Stages: Near and offshore.
Haddock	Eggs: Near the surface of water column. Larvae: Depths of 32 to 164 feet (10 to 50 m) with a maximum depth of 492 feet (150 m).

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage
Monkfish	Eggs: Surface waters in areas that have depths of 49 to 3,280 feet (15 to 1000 m). Larvae: Pelagic waters in areas that have depths of 49 to 3,280 feet (15 to 1000 m).
Northern sea robin	Eggs and Larvae: Pelagic waters of the continental shelf.
Pollock	Eggs and Larvae: Pelagic inshore and offshore habitats, including bays and estuaries.
Red Hake	Eggs: Water column within the inner shelf. Larvae: Coastal waters less than 656 feet (200 m) in depth.
Sandbar Shark	All Life Stages: Waters on continental shelves, oceanic banks, and island terraces, but also found in harbors, estuaries, at the mouths of bays and rivers, and shallow turbid water. Mostly at 65 to 213 feet (20 to 65 m) deep. Also, benthic/demersal.
Shortfin Mako Shark	All Life Stages: Various areas of the water column; ranging depths, maximum depth 2,427 feet (740 m).
Skipjack Tuna	All Life Stages: Epipelagic, oceanic species.
Spiny dogfish	All Life Stages: Pelagic and epibenthic habitats.
Spot	All Life Stages: Coastal, nearshore, and offshore continental shelf areas.
Summer Flounder	Eggs and Larvae: Nearshore areas within eel grass beds and pilings.
Tiger Shark	All Life Stages: Coastal, nearshore, and offshore continental shelf areas.
Weakfish	All Life Stages: Nearshore, shallow waters along open sandy shores and estuaries.
White hake	Juveniles: Mixed and high salinity zones to a maximum depth of 984 feet (300 m). Pelagic phase juveniles remain in the water column for about 2 months.
White Shark	All Life Stages: Nearshore and offshore, mostly spotted near the surface.
Whiting	Eggs: Surface waters over continental shelf at depths of 164 to 492 feet (50 to 150 m). Larvae: Surface waters over the continental shelf at depths of 164 to 426 feet (50 to 130 m).
Windowpane Flounder	Eggs and Larvae: Occupy multiple areas in water column less than 229-foot (70-m) depths.
Winter Flounder	Larvae: Both nearshore and offshore.
Witch Flounder	Eggs: Deep; pelagic waters 164- to 278-foot (50- to 85-m) depths. Larvae: 0- to 820-foot (0- to 250-m) depths.
Yellowfin Tuna	All Life Stages: epipelagic, oceanic fish found in the upper 328 feet (100 m) of the water column.
Yellowtail Flounder	Eggs: Pelagic – near-surface continental shelf waters. Larvae: Pelagic – mid-water column; movement limited to currents.

Table 4.3-11. Common Habitat Types for Finfish Species known to occur in the Region

Species	Habitat Type by Lifestage

Sources:

Auster and Stuart, 1986

Collette and Klein-MacPhee, 2002

Malek et al., 2016

Common Prey Species in the South Fork Wind Farm

Finfish species depend on a system of multiple trophic levels. Both demersal/benthic and pelagic fish species consume fish, shellfish, planktonic organisms, and detritus. Shellfish, worms, copepods, and other invertebrates are predominant types of prey for finfish in New England. The most common vertebrate finfish prey include alewife, Atlantic menhaden, northern sand lance, and whiting. Common prey of juvenile and adult finfish species that could potentially occur in the SFWF or SFEC are summarized in Table 4.3-12. Invertebrate and shellfish prey species and their relationships with habitat are described further in Section 4.3.2.

Table 4.3-12. Common Prey Species of Juvenile and Adult Finfish Species

Species	Prey Species
Demersal/Benthic	
Atlantic Cod	Benthic invertebrates
Atlantic Halibut	Whiting, sand lance, ocean pout, and alewife
Atlantic Sturgeon	Benthic invertebrates
Black Sea Bass	Invertebrates and zooplankton
Cunner	Pipefish, mummichog, and invertebrates
Haddock	Amphipods
Little Skate	Sand lance, alewife, herring, cunner, silversides, tomcod, and whiting
Monkfish	Sand lance and monkfish
Northern sea robin	Shrimp, crabs, amphipods, squid, bivalve mollusks, and segmented worms
Ocean Pout	Sand dollars
Pollock	Herring and crustacea
Red Hake	Crustaceans
Sand Lance	Plankton
Sand Tiger Shark	Small sharks, rays, squid, and lobster
Sandbar Shark	Menhaden and crustaceans
Scup	Fish eggs and invertebrates
Sea Raven	Herring, lance, sculpins, tautog, whiting, and both sculpin and sea-raven eggs
Smooth Dogfish	Crustaceans, particularly lobsters
Spiny Dogfish	Squid and fish

Table 4.3-12. Common Prey Species of Juvenile and Adult Finfish Species

Species	Prey Species
Striped Bass	Menhaden, anchovy, spot, amphipods, and sand lance
Summer Flounder	Windowpane, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, whiting, scup, Atlantic silverside, American sand lance, bluefish, weakfish, mummichog, rock crabs, squids, and shrimp
Tautog	Copepods and shellfish
Tilefish	Crabs, squid, shrimp, shelled mollusks, annelid worms, sea urchins, sea cucumbers, and sea anemones
White hake	Polychaetes, shrimp, and other crustaceans
Whiting	Crustaceans
Windowpane Flounder	Invertebrates
Winter Flounder	Clams
Winter Skate	Smaller skates, eels, alewife, blueback herring, menhaden, smelt, sand lance, chub mackerel, butterfish, cunner, sculpins, whiting, and tomcod.
Wolffish	Mollusks and shellfish
Yellowtail Flounder	Invertebrates
PELAGIC	
Albacore Tuna	Longfin and shortfin squid and crustaceans
Alewife	Herring, eels, sand lance, cunners, and alewife
American Eel	Small fish of many varieties, shrimp, crabs, lobsters, and smaller crustacea
American Plaice	Sand dollars
American Shad	Various fish
Atlantic Bonito	Mackerels, menhaden, and sand lance
Atlantic Butterfish	Small fish, squid, and crustaceans
Atlantic Mackerel	Copepods and crustaceans
Atlantic Menhaden	Diatoms and crustaceans
Atlantic sea herring	Copepods
Atlantic silverside	Zooplankton, copepods, shrimp, amphipods, young squid, worms, insects, and algae
Basking Shark	Small crustaceans
Bay anchovy	Mysid shrimp, copepods, small crustaceans and mollusks, and larval fish
Blueback Herring	Zooplankton
Bluefin Tuna	Herring and eels
Bluefish	Invertebrates and crustaceans
Blue Shark	Herring, mackerel, spiny dogfish, and various others

Table 4.3-12. Common Prey Species of Juvenile and Adult Finfish Species

Species	Prey Species
Common Thresher Shark	Pelagic fish and squid
Conger Eel	Butterfish, herring, eels, and invertebrates
Dusky Shark	Various pelagic fish
Sandbar Shark	Menhaden and crustaceans
Shortfin Mako Shark	Mackerels, tuna, and bonito
Skipjack Tuna	Pelagic fish and invertebrates
Spiny Dogfish	Squid and fish
Spot	Bristle worms, mollusks, crustaceans, and plant and animal detritus
Tiger Shark	Fish and squids
Weakfish	Crabs, amphipods, mysid and decapod shrimps, squid, shelled mollusks, and annelid worms, menhaden, butterfish, herring, scup, anchovies, silversides, and mummichog
White Shark	Fish, rays, squid, other sharks, and marine mammals
White hake	No documentation of prey species for pelagic phase.
Yellowfin Tuna	Large pelagic fish and squids

Sources:
Auster and Stuart, 1986
Collette and Klein-MacPhee, 2002
Florida Fish and Wildlife Conservation Commission, 2017
Florida Museum of Natural History, 2017
Knickel, 2017
NOAA, 2010
USFWS, 2017
URI EDC, 2017

Threatened and Endangered Fish

There are two sturgeon species that could potentially occur within the SFWF area, the Atlantic sturgeon and the shortnose sturgeon; however, as indicated below, the shortnose sturgeon is extremely unlikely to be present in the SFWF area.

Atlantic Sturgeon

The Atlantic sturgeon is listed as endangered under the ESA and is the more common sturgeon species in the SFWF area. Within the United States, five distinct population segments (DPSs) of Atlantic sturgeon are identified by NMFS. The population of concern associated with the SFWF is the New York Bight DPS. Atlantic sturgeon is a large anadromous species that utilize rivers, bays, estuaries, coastal, and continental shelf waters during their life cycle. They can grow up to 14 feet (4.3 m) long and 800 pounds (370 kilograms) (Vladykov and Greely, 1963). Declines in stock began with intensive fisheries for caviar in the late 1800s, and further declines are attributed to damming of spawning rivers and degradation of water quality (see review in Hilton et al., 2016).

Estimated the abundance of age 0-1 Atlantic sturgeon in the Delaware River in 2014 was 3,656 individuals (Hale et al., 2016), which is similar in magnitude to age-1 estimates in the Hudson River for 1995 (Petersen et al., 2000). The Atlantic Sturgeon stock assessment (ASMFC, 2017) indicate that the all DPS stocks are depleted but recovering. It is estimated that biomass and abundance are currently higher than in 1998 (last year of available survey data) for the New York Bight DPS (75% average probability).

Adult Atlantic sturgeon in the New York Bight DPS travel upstream in spawning rivers along southern New England (e.g., Connecticut River), New York (e.g., Hudson River), and in the Delaware River in the spring and early summer (ASMFC, 1990, 2017). Historically, Atlantic sturgeon also spawned in the Taunton River (Massachusetts), however, their current status in this river is unknown (ASMFC, 2017). During this period, most spawning age adults will be found in natal rivers.

Adult Atlantic sturgeon travel upstream in spawning rivers along southern New England (e.g., Connecticut River) and New York (e.g., Hudson River) in the spring and early summer (ASMFC, 1990). During this period, most spawning age adults will be found in natal rivers. Adult Atlantic sturgeon live in coastal and offshore waters during the remainder of the year. Juvenile and sub-adult Atlantic sturgeon undergo yearly coastal foraging migrations after leaving their natal estuaries (Hilton et al., 2016). Within the SFWF area, many juvenile and adult Atlantic sturgeon have been captured in otter trawls and sink gill nets (Stein et al., 2004). Through an aggregation of commercial bycatch data, Stein et al. (2004) found the greatest occurrence of offshore Atlantic sturgeon in Massachusetts and Rhode Island waters to occur from November through May. Data from this study indicate that adult Atlantic sturgeon are found within the SFWF area. See Appendix P1 for additional species information.

Sturgeon are believed to be low-frequency hearing specialists (Popper et al., 2014). ANSI-accredited hearing thresholds, derived from Popper et al. (2014), categorize sturgeon as a fish species that has a swim bladder, but the swim bladder is not thought to play a role in hearing. For this category of fish, peak sound pressure levels ($L_{P,PK}$) greater than 207 dB re 1μPa^2 have the potential to cause injury.

Shortnose Sturgeon

Like the Atlantic sturgeon, the shortnose sturgeon is listed as endangered under the ESA and much of the distribution information is the same for the two species which co-occur in habitats along the Atlantic coast. In a 2010 Biological Assessment (Shortnose Sturgeon Status Review Team, 2010), shortnose sturgeon were described as spending less time in open ocean habitats and spawning farther upriver than Atlantic sturgeon. The Northeast shortnose sturgeon population uses freshwater habitat more than any of the other shortnose sturgeon populations (Kynard et al., 2016). They are considered more of an amphidromous species (defined as a species that spawns and remains in freshwater for most of its lifecycle but spends some time in saline water) rather than fully anadromous. Marine migrations do occur, and individuals have been recorded traveling 87 miles (140 km) in 6 days when moving between rivers (Kynard et al., 2016). Because the shortnose sturgeon prefer freshwater and estuarine habitats, the potential for shortnose sturgeon to be present in the SFWF area is considered extremely unlikely. See Appendix P1 for additional species information.

Giant Manta Ray

The giant manta ray (*Manta birostris*) is listed as threatened under the ESA. The giant manta ray occurs in tropical, sub-tropical, and temperate waters (IUCN, 2018, NOAA, 2018). Their distribution in the Atlantic ranges from the Carolinas to Brazil and they are very rarely found in colder waters of the northwest Atlantic. Giant manta rays may reach disc widths of over 7 m (reviewed by IUCN [2018]).

Commercial fishing is the primary threat to the giant manta ray (NOAA, 2018). The species is targeted and caught as bycatch in several global fisheries throughout its range. Additionally, they are slow-growing, highly migratory animals with sparsely distributed and fragmented populations throughout the world. Regional population sizes are small (between 100 to 1,500 individuals) (IUCN, 2018; NOAA, 2018).

Giant manta rays undergo seasonal migrations, timing their visits to productive coastlines with regular upwelling, oceanic island groups, and offshore pinnacles and seamounts. They are generally found at depths below 10 m, although tagging studies indicate dives of up to 200 to 450 m (NOAA, 2018). They are often observed in estuarine waters, near oceanic inlets, potentially using these habitats as nursery grounds. The giant manta ray is commonly encountered on shallow reefs and is also occasionally observed in sandy bottom areas and seagrass beds (IUCN, 2018). Mantas have been reported as far north as Canada in the northeast Atlantic; however, its propensity for warmer waters makes its presence is unlikely in the SFWF.

Essential Fish Habitat

EFH is an important part of the MSFCMA regulations and is defined as: "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)). Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities. Necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers a species' full life cycle. EFH is described by the regional fishery management councils in amendments to FMPs and is approved by the Secretary of Commerce acting through NOAA Fisheries" (50 CFR 600.10).

EFH has been designated for a total of 34 finfish species that occur within the SFWF. These species and their EFH are further described in the EFH Assessment (Appendix O).

South Fork Export Cable

SFEC – OCS and SFEC – NYS

This section describes finfish resources (demersal and pelagic) within and surrounding the areas of the SFEC - OCS and SFEC - NYS. The affected environment in the SFEC for finfish is generally the same as described for the SFWF. Some differences in resources occur at lower water depths nearshore as described in more detail in the following sections. Benthic resources, including shellfish and habitat types, are described in Section 4.3.2. A thorough EFH Assessment for designated species in the SFWF and SFEC is provided as Appendix O.

Species of economic or ecological importance potentially present within the region of the SFEC are summarized in Table 4.3-10. As described for the SFWF, this table does not include every species that has the potential to occur in the SFEC, but focuses on those that are abundant, commercially or recreationally important, important prey species, or have designated EFH within the area of the SFEC.

Demersal and pelagic species that are ecologically and economically important are described in more detail in relation to proposed SFEC activities in the following sections.

Demersal Finfish along the South Fork Export Cable Route

Table 4.3-10 summarizes ecologically or commercially important finfish with demersal life stages potentially present within the regional area that contains the proposed SFEC. The species with demersal life stages that may reside within the areas of the SFEC may also reside in the SFWF area (see previous SFWF section).

Some demersal fish are seasonal visitors to the SFEC area, which spans both federal and state waters. Most demersal species are abundant in the cold season nearshore and offshore extending along the continental shelf, which is associated with the eastern portions of the SFEC and decline in the region during the warmer months (Scotti et al., 2010). Two demersal species of anadromous fish are potentially present within the SFEC area: striped bass and Atlantic sturgeon (BOEM, 2013; Scotti et al., 2010).

Many finfish that have demersal life stages in Table 4.3-10 are considered commercially or recreationally important in New England and New York State waters. Fisheries in federal waters are managed under the MSFCMA. Portions of the SFEC route are within the boundaries of New York State waters. Fisheries in New York State waters are primarily managed by NYSDEC.

Black sea bass, bluefish, scup, and summer flounder are each individually managed under respective New York State Quota Distribution Programs. There is additional management for Atlantic cod, haddock, yellowtail flounder, American plaice, witch flounder, redfish, white hake, and pollock under the Groundfish Disaster Program (NYSDEC and NYSDOS, 2017). The Groundfish Disaster Program was put into effect because NYSDEC determined in 2013 that these fish stocks were headed towards collapse and needed to have drastic reductions to their fishing quotas. The Groundfish Disaster Program proposed protection to their habitats to continue to sustainably fish those species. Summer flounder and scup were the top two finfish species landed by pounds by commercial fishermen in New York State waters from the years 2008 to 2010 of all demersal species listed in Table 4.3-10 (Scotti et al., 2010). Species summarized in Table 4.3-10 as potentially occurring in the SFEC may be present within the areas of the SFEC and have a regional presence in New York State waters. More information about commercial and recreational fishing and their socioeconomics is described in Section 4.6.5.

Of the species that have demersal life stages listed in Table 4.3-10, 21 species have designated EFH in the SFEC. Additional information regarding EFH is described in Appendix O.

Pelagic Finfish along the South Fork Export Cable Route

Table 4.3-10 summarizes ecologically or commercially important finfish species with pelagic life stages that are potentially present within the regional area containing the proposed SFEC. Pelagic species are potentially abundant nearshore and offshore along the proposed SFEC route in the warm season, and decline during the cold season (Scotti et al., 2010).

There are five pelagic species of anadromous fish that are potentially present within the SFEC: American shad, alewife, blueback herring, Atlantic menhaden, and the Atlantic sea herring (BOEM, 2013; Scotti et al., 2010). Of the species with pelagic life stages potentially present in the SFEC, many are considered commercially or recreationally important within federal and New York State waters. The top two commercially fished finfish in 2010 in New York State waters by abundance were: Atlantic menhaden and American shad (Scotti et al., 2010). More detailed information regarding recreational and commercial important finfish species is described in Section 4.6.5. The following pelagic species listed in Table 4.3-10 are managed under the Atlantic Highly Migratory Species FMP: blue shark, common thresher shark, shortfin mako shark, and yellowfin tuna (NOAA, 2004). Additionally, 29 species in Table 4.3-10 with pelagic life stages have designated EFH within the region of the SFEC area. For more information regarding designated EFH within the SFEC (Appendix O).

Common Habitat Types of South Fork Export Cable Species

Much of the habitat characteristics along the SFEC route are as described in the SFWF section. As described in Section 4.3.2, all three benthic habitats (sand sheets, sand with mobile gravel, and patchy cobbles and boulders on sand) were observed along the SFEC route; however, their distribution varied with distance from the SFWF and as the SFEC route nears land in New York State waters, where waters are shallower than 25 feet (7 m). The SFEC route was dominated by sand sheet habitats with a few exceptions where this habitat type was interspersed with other habitat types.

The SFEC - OCS in areas immediately adjacent to the SFWF were more heterogenous than the remainder of the SFEC, with patchy cobble and boulder on sand habitats observed within 18.6 to 24.9 miles (30 to 40 km) of the SFWF. Sand with mobile gravel habitats were observed along the SFEC - OCS route between the SFWF and for about half the distance along the SFEC - OCS to due south of Block Island. These habitats were also present in the section of the SFEC - NYS south of Montauk Point and near the Hither Hills landing point within New York State waters. Within New York State waters, sand sheets were the predominant benthic habitat type, with mobile gravel present at one station, and sediment grain size was largely homogeneous. Sediment grain size was moderately variable on small scales along the SFEC - OCS, but most of the variability was between grain size classes within the overall sand category. Deposits of very fine silt, on the order of 6 inches (15 cm) thick, were observed overlying sand at two locations offshore of the Beach

Lane SFEC - NYS landing location; one of these locations fell within New York State waters (see Section 4.3.2 for more detail).

A summary of common habitat types for finfish species that may occur in the SFWF and SFEC is provided in Table 4.3-11.

Common Prey Species along the South Fork Export Cable Route

Common prey of juvenile and adult species that potentially occur within the SFEC route options are described in Table 4.3-12.

Threatened and Endangered Fish

There are two sturgeon species that could potentially occur within the SFEC area, the Atlantic sturgeon and the shortnose sturgeon; however, as indicated below, the shortnose sturgeon is extremely unlikely to be present in the SFEC area. The giant manta ray is not expected at the SFEC.

Atlantic Sturgeon

General information regarding the life history and conservation status of Atlantic sturgeon can be found in the SFWF section. While information is sparse regarding the offshore habitat use of Atlantic sturgeon, there has been more extensive research conducted in recent years on coastal and estuarine movements of the species. A trawl study conducted by Dunton et al. (2015) along the south coast of Long Island, New York found that Atlantic sturgeon use the coastal areas along the entire region, with most individuals caught at depths less than 49 feet (15 m) and in areas of previously known aggregations. Data analyzed within this study also indicated that adult and juvenile Atlantic sturgeon are found further offshore as seen in commercial otter trawl and sink gill net bycatch databases. Spring was identified as the time of year with the greatest bycatch rates along the eastern end of Long Island. Data from the Dunton et al. (2015) trawl survey and the Northeast Fisheries Observer Program bycatch database indicate that Atlantic sturgeon are present along the SFEC. See Appendix P1 for additional species information.

Shortnose Sturgeon

General information regarding the life history and conservation status of shortnose sturgeon can be found in the SFWF section. Because the shortnose sturgeon prefers freshwater and estuarine habitats, the potential for shortnose sturgeon to be present in the SFEC area is considered extremely unlikely. See Appendix P1 for additional species information.

Essential Fish Habitat

Waters within the SFEC route have been designated as EFH for a total of 37 finfish species that are further described in the EFH Assessment (Appendix O).

4.3.3.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the project have the potential to impact finfish species and EFH through both direct and indirect impacts, as discussed in the following sections. Neither the SFWF nor the SFEC is expected to have major long-term impacts to finfish or EFH resources during any of the project phases. An overview of the potential impacts to finfish and EFH associated with the Project is presented in Figure 4.3-10.

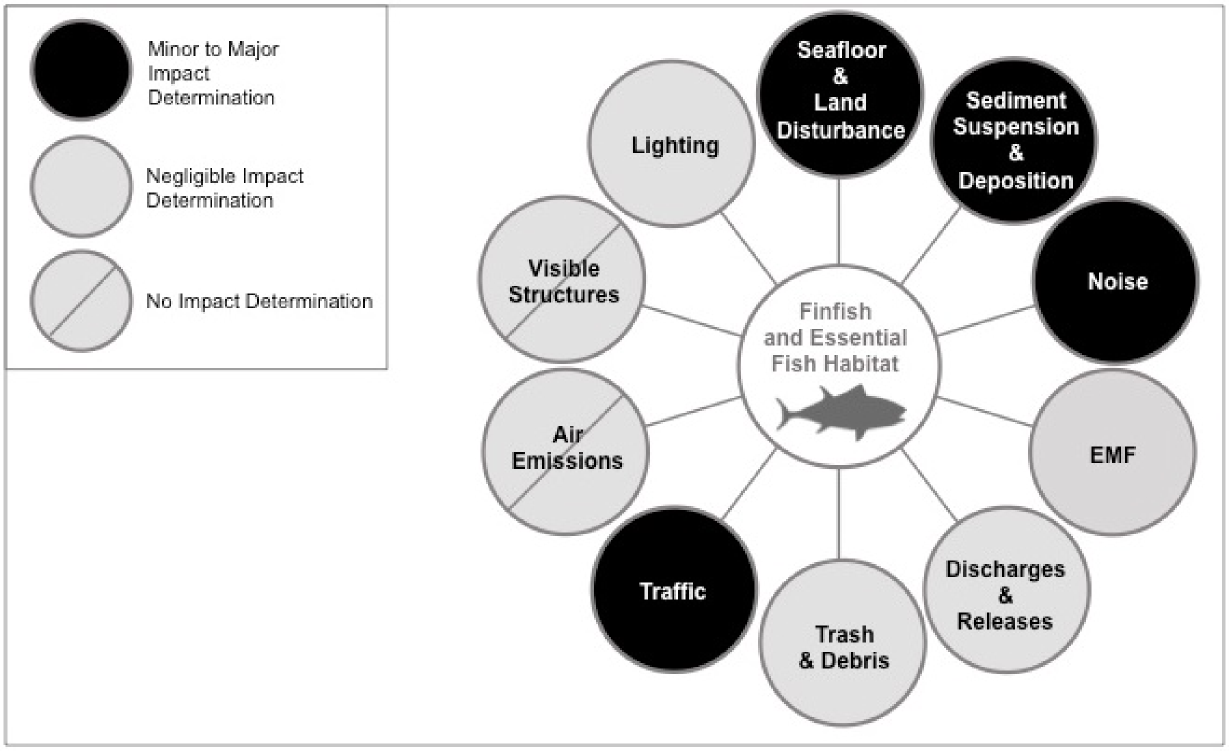

Figure 4.3-10. IPFs on Finfish and Essential Fish Habitat

Illustration of potential impacts to finfish and EFH resources resulting from SFWF and SFEC activities.

IPFs associated with the construction, O&M, and decommissioning phases for the Project are described in Section 4.1. The phase of the project during which these IPFs will occur is also described in Section 4.1.

South Fork Wind Farm

Construction

Table 4.3-13 summarizes the level of impacts expected to occur to finfish and EFH during the construction and decommissioning phases of the SFWF. Decommissioning of the SFWF is included in Table 4.3-13 because the structures are expected to be removed and their removal will be accomplished by similar methods or result in similar impact areas as their installation. Additional details on potential impacts to finfish and EFH from the various IPFs during construction of the SFWF are described in the following sections.

Table 4.3-13. IPFs and Potential Levels of Impact on Finfish and EFH for the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/Demersal Early Life Stages[b]	Pelagic Early Life Stages[b]	Benthic/Demersal Later Life Stages[b]	Pelagic Later Life Stages[b]
Seafloor/Land Disturbance	Seafloor Preparation	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect

Table 4.3-13. IPFs and Potential Levels of Impact on Finfish and EFH for the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/Demersal Early Life Stages[b]	Pelagic Early Life Stages[b]	Benthic/Demersal Later Life Stages[b]	Pelagic Later Life Stages[b]
	Pile Driving/Foundation Installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct
	OSS platform installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct
	SFWF Inter-array Cable installation	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect
Noise	Pile Driving	Moderate short-term direct	Moderate short-term direct	Moderate short-term direct	Moderate short-term direct
	Ship Noise, Trenching Noise, Aircraft Noise	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct
Traffic		See Seafloor disturbance, noise (ship, trenching, aircraft), sediment suspension and deposition, and lighting IPFs.			
Lighting		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct
Discharges and Releases [c]		Negligible			
Trash and Debris [c]		Negligible			

[a] Maximum level of impact is the highest impact levels for direct or indirect effects. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Early life stages include eggs and larvae. Later life stages include juveniles and adults.

[c] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

IPFs associated with seafloor disturbance during construction of the SFWF has been split into seafloor preparation, pile driving/foundation installation, OSS platform installation, SFWF Inter-array Cable installation, and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce negligible to minor levels of direct and indirect impacts to species depending on the life stages present for each species. Other IPFs that are interrelated with seafloor disturbance such as pile driving noise and sediment suspension and deposition are discussed in subsequent sections. See Section 3.1.2.1 for the expected impact areas associated with the monopile foundation that will be used to support the WTGs and OSS and the impact area associated with the Inter-array Cable.

Of the species identified in Table 4.3-10 as possibly present at the SFWF, many have a completely pelagic life cycle, and many others have pelagic early life stages that are not dependent on benthic habitat. As such, modification or disturbance of the substrate is expected to have a ***negligible impact*** on the habitat or EFH of pelagic species, if present. There may be some impacts to finfish habitat and EFH of demersal/benthic species, including the federally endangered Atlantic sturgeon, resulting from the Project, but these are expected to be ***negligible to minor, localized, and short-term*** in nature.

Following completion of construction and during O&M of the SFWF, the substrates at the SFWF will fundamentally remain the same as pre-project conditions, and allow for the continued use by finfish species, including those with designated EFH. The exception is the conversion of soft substrate to hard substrate associated with the WTGs, scour protection, and protective armoring. As discussed in Section 4.3.2, benthic infauna and epifauna are expected to recolonize the area after sediment disturbance, allowing this area to continue to serve as foraging habitat for finfish species. The acreage range of benthic habitat that is expected to be affected by construction (Section 4.1) is small relative to the total area of available surrounding habitat and EFH and impacts to finfish habitat and EFH during O&M are expected to be ***minor and short-term to long-term***.

Seafloor Preparation

Seafloor preparation activities at the SFWF during construction include removal of obstructions and debris within a 100-foot radius of the WTG installation location and along the route of the Inter-array Cable. A PLGR will be used to clear debris from the area prior to laying the Inter-array Cable. In addition, boulder relocation may be required within the foundation work area for some of the foundations and within 49 feet (15 m) of each side of the Inter-array Cable centerline where boulders are present. Temporary seabed disturbance from boulder relocation related to preparation for foundation placement could be up to 14.8 acres (6 ha) and temporary seabed disturbance from boulder relocation related to Inter-array Cable installation could be up to 61.1 acres (24.7 ha).

Benthic/demersal early life stages of species that have suitable habitat at the SFWF are expected to experience ***minor, short-term, direct impacts*** from seafloor preparation and will most likely be subject to injury or mortality. While some mortality could occur to benthic/demersal early life stages, this impact is considered minor given the small area of impact in relation to the total area of surrounding habitat. Benthic/demersal later life stages, including Atlantic sturgeon, are expected to experience ***minor to negligible, short-term, direct impacts*** because older life stages are more mobile and more likely to leave the area during seafloor preparation. However, individuals of these species may also experience limited injury or mortality. These impacts are only expected for finfish species that have benthic/demersal life stages associated with sand sheets, sand with mobile gravel, or patchy cobble and boulder on sand habitats. Those that are associated with fine-grained sediments (silt and clay) are expected to have negligible impacts as these are not expected to occur or only occur occasionally in the area. Areas requiring boulder relocation will experience temporary disturbance to attached fauna and any species sheltering in the boulders or cobble will have to relocate to a nearby similar habitat. Relatively rapid (< 1 year) recolonization of these boulders is expected (Guarinello et al., 2017) and will return these boulders to their pre-project habitat function. Additionally, if relocation results in aggregation of boulders, these new features could serve as high value refuge habitat for juvenile lobster and fish as they may provide more complexity and opportunity for refuge than surrounding patchy habitat. See Table 4.3-11 for a summary of common habitat types for finfish species that may occur in the SFWF.

Pelagic early and later life stages are generally more mobile and reside higher in the water column, so direct impacts associated with seafloor preparation are expected to be ***negligible and short-term***. These species are expected to either temporarily vacate the area or may drift through the area with limited potential to be present in the direct impact area.

Finfish are expected to move back into the area following the disturbance, but, habitat recovery from the grapnel runs and seafloor leveling may take up to 1 to 3 years to occur, during which habitat quality for benthic/demersal species may be decreased, resulting in a ***minor, long-term, indirect impact*** for species that use those habitats (BERR, 2008; BOEM, 2012; Guarinello et al., 2017). Indirect impacts associated with feeding may also occur; however, this will be dependent upon species. Feeding by some species may be disrupted if they temporarily avoid the area; this will primarily affect benthic species but may also have some impact on pelagic species. Other species may be attracted to the disruption and prey on dislodged benthic species or other species injured or flushed during seafloor preparation. See Table 4.3-12 for common prey species for the identified ecologically and economically important finfish species. This is expected to be a short-term minor indirect impact. Potential presence of the various species and different life stages throughout the year are identified in Table 4.3-10.

Pile Driving/Foundation Installation

Similar to seafloor preparation, installation of the foundations, piles, and associated scour protection are expected to result in ***minor, short-term, direct impacts*** to benthic/demersal early life stages of finfish and ***minor to negligible, short-term, direct impacts*** to benthic/demersal later life stages, including Atlantic sturgeon, that have preferred habitat at the SFWF (Tables 4.3-10 and 4.3-11). Pile driving and foundation installation could crush benthic/demersal species, particularly eggs and larvae, but also less mobile older life stages that do not vacate the area. ***Negligible, short-term, direct impacts*** are expected for pelagic early and later life stages because they are not expected to be at the bottom during work activities or subject to crushing or injury through placement of the materials.

Offshore Substation Platform Installation

Impacts associated with the installation of the OSS platform are expected to be similar to those described for Seafloor Preparation and Pile Driving/Foundation Installation.

SFWF Inter-Array Cable Installation

Direct impacts to the seabed associated with installation of the SFWF Inter-array Cable will take place within the area that had already been disturbed during the PLGRs; those impacts were discussed in the Seafloor Preparation section. Installation of the Inter-array Cable is expected to result in ***minor to negligible, short-term, direct impacts*** to benthic/demersal early and later life stages.

It is also expected to produce ***negligible to minor, short-term, direct impacts*** to early life stages and later life stages of smaller species if using a jet plow because they may become impinged or entrained on the water pumps that will operate the jet plow. Although the circulated seawater is released back into the ocean, it is assumed that all entrained eggs, larvae, and zooplankton will be killed. To assess the potential loss of fish and zooplankton related to this activity, an ichthyoplankton and zooplankton assessment was conducted using data from NOAA's Marine Resource Monitoring, Assessment and Prediction Program and their subsequent Ecosystem Monitoring (EcoMon) plankton sampling programs (Appendix O, Attachment 1). The results indicate that total estimated losses of zooplankton and ichthyoplankton related to entrainment from installation of the Inter-array Cable using a jet plow were less than 0.001

percent of the total zooplankton and ichthyoplankton abundance present in the study region (Appendix O, Attachment 1). Therefore, impacts to early life stages of EFH species from entrainment caused by installation of the Inter-array Cable using a jet plow are expected to be ***negligible to minor and short-term***.

Because of the slow speed of the equipment and limited size of the impact area, it is expected that most mobile benthic/demersal and pelagic finfish will leave the area; however, eggs, larvae, and other slower moving species may be subject to injury or mortality. The Inter-array Cable may also require armoring, and the installation of this armoring is expected to result in ***minor, short-term, direct impacts***.

Similar to seafloor preparation, ***minor, long-term and short-term, indirect impacts*** for benthic/demersal species may include a longer period for prey species to recolonize the impact area resulting in reduced foraging habitat for finfish. ***Minor, short-term, direct impacts*** including a temporary feeding disruption during cable installation may occur; however, some species may also be attracted to the disturbance and increase feeding as Inter-array Cable installation may dislodge benthic prey species.

Vessel Anchoring (Including Spuds)

Impacts associated with vessel anchoring and the use of spuds during construction at the SFWF are expected to be similar to those discussed in the Seafloor Preparation and Pile Driving/ Foundation Installation section. Direct impacts are expected to be ***minor and short-term*** and associated with mortality and or injury of benthic/demersal early life stage species and benthic/demersal later life stage species with limited mobility. Faster moving benthic/demersal species, including Atlantic Sturgeon, and pelagic species are expected to temporarily vacate the impact area associated with the spuds, anchor, or area swept by the anchor chain. The extent of the impacts will vary depending on the vessel type, number of vessels, and duration onsite, and as these numbers increase, the associated impact areas will also increase. ***Long-term, indirect impacts*** will be associated with habitat disturbance and associated recovery time from the areas impacted by the vessel anchors, spuds, and areas swept by anchor chains.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during construction can result from seafloor disturbance associated with foundation placement and Inter-array Cable installation as well as vessel traffic. Direct impacts associated with increased sediment suspension and deposition are expected to be ***negligible or minor and short-term in nature***. Indirect impacts associated with increased suspended sediment and deposition include changes in habitat and species composition after sediments have settled out. These impacts are expected to result in ***negligible to minor long-term, indirect impacts*** for benthic early and later life stages and ***negligible, short-term indirect impacts*** for pelagic early and later life stages as described in more detail below. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For cable installation activities, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation of the Inter-array Cable, one of three potential types of equipment to be used for cable installation (Appendix I).

Temporary Increase in Total Suspended Solids

In order to estimate the extent of potential impacts from sediment suspension generated by jet plow installation, one of three potential types of equipment to be used for cable installation, a modeling simulation was conducted on a representative section of the Inter-array Cable which indicated that the maximum modeled TSS concentration from SFWF Inter-array Cable installation using a jet plow is 100 mg/L. Water column concentrations of 100 mg/L are predicted to extend up to 131 feet (40 m) from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) within 18 minutes (0.3 hour) from the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation (Appendix I).

Increases in sediment suspension could result in impacts to finfish including abrasion of gill membranes and respiration impairment, impairment of feeding, inhibition of migratory movements, and mortality of early life stages. Juvenile and adult life stages will likely temporarily avoid the area of increased TSS, resulting in behavioral changes such as changes in foraging behavior. However, given the limited extent and duration of the elevated TSS based on the predictive modeling described above, these impacts are expected to be ***negligible to minor*** to benthic/demersal species because they will be ***short-term*** and highly localized. Most marine species have some degree of tolerance to higher concentrations of suspended sediment because storms, currents, and other natural processes regularly result in increases in turbidity (DOI-MMS, 2009). Direct impacts to pelagic species are expected to be ***negligible*** as older life stages will likely leave the area and not be affected by increased suspended sediment and early life stages are expected to have tolerance for short-term increases in suspended sediment.

Sediments are expected to come out of suspension quickly after the impact occurs, returning pelagic habitat to pre-impact conditions in a short-time frame, resulting in a ***negligible, short-term, indirect impact*** for pelagic early and later life stages. Indirect impacts to benthic/demersal species from a potential change in habitat composition are described in the Sediment Deposition section below.

Sediment Deposition

A modeling simulation was also conducted on a representative section of the Inter-array Cable to predict sediment deposition extent and depth resulting from installation of the Inter-array Cable using a jet plow, one of three potential types of equipment to be used for cable installation. The model predicted that sediment deposition resulting from the installation of the Inter-array Cable using a jet plow will be limited to the area immediately adjacent to the burial route, typically, extending no more than 196 feet (60 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.4 inch (10 mm) and limited to within 26 feet (8 m) from the burial route, covering an estimated cumulative area of 0.1 acre (0.04 ha) (Appendix I). Direct sediment deposition impacts to finfish are considered to be ***short-term, localized,*** and ***minor*** because of the limited extent of sedimentation predicted by the model.

In the localized area of impact, these direct impacts could involve mortality through sediment deposition and smothering of early benthic/demersal life stages of finfish and limited injury or mortality of later benthic/demersal life stages. Sediment deposition on eggs or larvae may result in smothering, potentially resulting in mortality (DOI-MMS, 2007). However, most older stages of finfish, including Atlantic sturgeon, are expected to temporarily vacate the area to avoid the increased sedimentation.

Indirect impacts associated with increased sediment deposition include potential changes in habitat composition and species composition after sediments have settled out. This change is similar to what is described in the Seafloor Disturbance section above because habitat quality may be temporarily degraded, and recolonization may take 1 to 3 years, depending upon the extent of the effects (BOEM, 2012). Given the localized extent of sediment deposition predicted by the model, the resulting impacts on benthic communities and habitat quality are expected to be ***negligible to minor*** and ***long-term*** for benthic early and later life stages. Sediment deposition is expected to result in ***no impact*** to pelagic early of later life stages.

Noise

Underwater acoustic modeling was conducted to evaluate various project-related construction sounds including impulsive sounds (pile driving noise) and non-impulsive or continuous sounds (vibratory pile driving, thrusters on DPV). Based on the acoustic modeling, an impact assessment specific to marine protected species was performed (Appendix P) including an evaluation of potential impacts on ESA-listed Atlantic sturgeon. However, the results of these analyses are broadly applicable to fish and are discussed within the context of noise impacts in this section.

Direct impacts associated with noise during construction at the SFWF may occur during pile driving and DPV usage for installation of the Inter-array Cable or associated with vessels and aircraft. Pile driving is expected to cause ***minor to moderate, short-term, direct impacts***, while the other sources of noise are expected to have ***negligible impacts***. Expected impacts from these activities are discussed separately in the following sections.

Hearing among fish vary among species and auditory physiology. Fishes hear sounds using pressure and particle motion and detect the motion of surrounding water (Popper et al., 2008). Fish with swim bladders are generally sensitive to pressure waves, while those that lack swim bladders are more sensitive to particle motion. Generally pelagic species have swim bladders, while benthic/demersal species like halibut, flounders, and soles do not have swim bladders. In addition, different fish species vary greatly in their hearing structures and auditory capabilities, and this may change during different life stages. There is a lack of knowledge about hearing capabilities of most fish species. This applies to sturgeon, which are known to have primitive swim bladders that are not connected to their inner ears. Anatomical and physiological variation makes it difficult to generalize about the impacts of noise on individual species (Thomsen et al., 2006).

The short duration of potential impacts of noise during the construction, operation, and decommissioning of wind farms can be split into the following general categories (Thomsen et al., 2006):

1. Temporary or permanent hearing damage or other physical injury or mortality;
2. Behavioral responses; for example, the triggering of alarm reactions, causing fish to flee from interrupting activities necessary for survival and reproduction, and potentially inducing stress in the fish; or
3. Masking acoustic signals, which may serve as communication among individuals, or may provide information about predators or prey.

There is only limited data on mortality in response to anthropogenic noises and it is not clear whether death or injury only occurs in close proximity to a sound source (Hawkins et al., 2014). Overall, it is more likely that fish will experience sublethal impacts that increase the possibility for delayed mortality (Hawkins et al., 2014). Because most construction sound sources produce low frequency sounds that are within the sensitive hearing range of most fish, the potential for fish to experience temporary threshold shifts (TTS), masking, and behavioral impacts are a higher likelihood.

Behavioral responses (e.g., fleeing or avoidance) to active acoustic sound sources are the most likely direct effects for most fish resources exposed to noise during SFWF construction. Fewtrell and McCauley (2012) found that fish exhibited alarm responses to air gun noise at levels exceeding 147 to 151 dB re 1 micropascal (µP) sound exposure limit (SEL). The potential for masking or behavioral response may exist at a large and variable distance from a sound source, depending on the ambient background noise level and the frequency and amplitude characteristics of the propagated sound.

Pile Driving Noise

Noise generated by pile driving (both impulsive and non-impulsive) has the potential for direct impacts on finfish species, particularly those with swim bladders. While noise generated by both types has the potential to elicit behavioral responses, pile driving has the greatest potential to cause harassment or injury through the generation of intense underwater sound pressure waves and particle motion. For instance, in-water pile driving for bridge construction has resulted in high underwater sound pressures that have proved lethal to fishes, and sturgeon in particular (Thalheimer et al., 2014, Popper et al., 2016). Noise generated from pile-driving (vibratory and impact hammering) and vessel operations could affect finfish. Laboratory pile driving studies showed swim bladder damage in Chinook salmon and documented barotrauma injuries in other species (Halvorsen et al., 2012).

Direct impacts associated with these intense sound pressure waves and particle motion may include changes in fish behavior and injury or mortality caused by rupturing swim bladders or by internal hemorrhaging. Noise from pile driving can also cause fish to be temporarily stunned, which might make them more susceptible to predation. These noise-generating activities also have the potential to interrupt migration patterns of finfish through the area because they may avoid elevated noise levels. Impacts associated with pile driving noise are expected to be ***short-term and moderate*** with finfish returning to the area after the noise-generating activity has been completed as described in more detail below.

Two accepted sources for defining acoustic impact metrics and thresholds for fish were incorporated into the sound propagation analysis (Appendix J) supporting this COP. A technical report by an American National Standards Institute (ANSI)-registered committee (Popper et al. 2014) reviewed available data and suggested metrics and methods for estimating acoustic impacts for fish and sea turtles. The NOAA Greater Atlantic Regional Fisheries Office (GARFO; 2016) developed a pile driving acoustic tool, which compiled and listed criteria for fish injury from noise including metrics for the potential for injury to fish exposed to pile driving sounds (Stadler and Woodbury 2009). Both of these sources of acoustic metrics and thresholds address injurious noise levels from impulsive sounds but do not completely agree. They also offer different guidance on fish impacts from non-impulsive sounds and behavior impact thresholds from impulsive sounds. Both sources were included based on agency consultations during the development of this COP.

The Popper et al. (2014) report suggests the dual criteria of peak pressure and accumulated sound energy for evaluating potential injury. These acoustic criteria for fish injury from impulsive and non-impulsive sounds are provided in Table 4.3-14. The modeling presented in Appendix J provides the ranges (in meters) to potential injury and temporary threshold shifts for fish groups based on Popper et al. (2014). Appendix J also provides the results of the modeling against the GARFO (2016) criteria for both potential injury *and* behavioral impacts, as presented in Table 4.3-15 and discussed below.

Table 4.3-14. Acoustic Criteria and Thresholds for Injury for Fish

Group	Impulsive Sounds					Non-Impulsive Sounds	
	Mortality or Mortal Injury		*Recoverable Injury*		*TTS*	*Recoverable Injury*	*TTS*
	L_E (dB)	L_{pk} (dB)	L_E (dB)	L_{pk} (dB)	L_E (dB)	$L_{pk,\ 48h}$ (dB)	$L_{pk,\ 12h}$ (dB)
Fish without swim bladder	>219	> 213	>216	> 213	>186	--	--
Fish with swim bladder not involved in hearing	210	> 207	203	> 207	>186	--	--
Fish with swim bladder involved in hearing	207	> 207	203	> 207	186	170	158

Source: Popper et al., 2014

L_E = sound exposure level (dB re 1 µPa2·s); L_{pk} = peak sound pressure (dB re 1 µPa); $L_{p,12h}$ = root mean square sound pressure (dB re 1 µPa) for 12 hours continuous exposure; $L_{p,\ 48h}$ rms sound pressure (dB re 1 µPa) for 48 hours continuous exposure TTS = temporary threshold shift.

-- = not applicable

Peak levels are the sound levels in dB associated with a single pile strike - defined as the level assessed to cause injury with one strike. Cumulative levels are the total energy received through a pile driving event (generally the energy received over an entire day of pile driving). Of the two sets of criteria considered, the GARFO (2016) metrics are considered more conservative because the acoustic levels are lower than that those included in Popper et al. (2014). If fish are exposed to cumulative (over 12 hours) SEL at or above 187 dB or peak sound pressure at or above 206 dB, they may be injured, killed, or experience a permanent threshold shift (PTS) or TTS, which means that fish lose all or part of their hearing range on a permanent or temporary basis. Popper et al. (2005) found the effects from even substantial TTS to have worn off for fish within 18 hours of exposure. However, hearing loss, even if temporary, could render the fish unable to respond to environmental sounds that indicate the presence of predators or that allow the location of prey or potential mates (Popper and Hastings, 2009).

The acoustic metrics and thresholds for fish published by GARFO (2016) are presented in Table 4.3-15. It is highlighted that criteria for behavioral impacts to fish are included here while they are not in the Popper et al. (2014) metrics, which is an indicator of the ongoing scientific and policy uncertainty pertaining to this issue. According to GARFO (2016), behavioral responses to the construction noise are expected to occur where noise levels exceed the L_p 150 dB re 1 µPa and could affect fish reproduction and population levels if biologically important activities such as migration, feeding, and spawning are interrupted (Thomsen et al., 2006). While studies have generally found that effects on fish decrease the further from the source of the sound, this effect is not straightforward. In some cases, sound levels may be higher at greater distances from the source from propagation through the seabed and sound reflections from objects (Hastings and Popper, 2005).

Table 4.3-15. Acoustic metrics and thresholds for fish (from Stadler and Woodbury (2009) and GARFO (2016)

Fish group	Injury			Behavior
	$L_{E,12h}$ (dB re 1 µPa²·s)	L_{pk} (dB re 1 µPa)	L_p (dB re1 µPa)	L_p (dB re 1 µPa)
Fish	187 a	206 a	--	150 b

Thresholds for fish are for individuals with a total mass of ≥ 2 g

L_{pk} = peak sound pressure; L_p = root mean square of the sound pressure; $L_{E,12hr}$ = cumulative sound exposure level over 12 hours

-- = not applicable

a = Stadler and Woodbury (2009)

b = GARFO (2016)

Elevated noise levels are expected to cause some fish species to temporarily vacate the area, causing a temporary disruption in feeding, mating, and other essential activities. Less mobile species and benthic early life stages are expected to be more susceptible to noise effects than more mobile species as they will not be able to leave the area as quickly (Gill and Kimber, 2005). Atlantic sturgeon, the only endangered finfish species found within the SFWF, have been shown to avoid pile-driving activities in the Hudson River, and based on this, they were not expected to be exposed to the cumulative SEL (Krebs et al., 2016). The same avoidance response is expected if they should be present during pile driving activities at the SFWF because this species is highly mobile.

Fish species also make a variety of sounds, many of which are used for mating or communication purposes, and sounds associated with construction of the SFWF may mask these sounds. As the sounds associated with pile driving may be audible over great distances, the masking of these fish sounds may have implications on mating and other behaviors (Thomsen et al., 2006). This potential for disruption may be influenced by the type of noises that fish make. Species that communicate using only a single sound may experience negligible impacts because pile driving pulses are very short in duration, while species with complex communications may experience more disruption (Thomsen et al., 2006). This masking effect may be magnified if pile driving is occurring at multiple locations at the same time.

Little is known about particle motion effects on finfish, and unlike sound pressure waves, no criteria to assess effects associated with particle motion have been established. It is expected that particle motion associated with pile driving will have similar effects as pressure waves with fish exhibiting behavioral responses such as temporarily vacating the impact area. Excess particle motion may also mask communication and could cause permanent or temporary damage to sensory structures.

Cable Installation Equipment, Vessel, and Aircraft Noise

Sounds created by cable installation equipment, vessels, or aircraft are continuous or nonimpulsive sounds, which have different characteristics underwater and impacts on marine life. Limited research has been conducted on underwater noise from cable installation equipment. Generally, the noise from this equipment is expected to be masked by louder sounds from vessels, especially DP vessels. Also, as most noise generated by these pieces of equipment will be below the sediment surface, noise levels are not expected to result in injury or mortality to finfish but may cause finfish to temporarily vacate the area. The duration of noise at a given location will be short, as the cable lay advance speed is expected to be approximately between 1 mile (1.6 km, 0.86 nm) and 2 miles (3.2 km, 1.73 nm) per day. Noise will occur over a very short period at any given location along the Inter-array Cable route. ***Minor, short-term, direct impacts*** are expected from cable installation equipment noise.

Helicopters will be used to a limited extent for emergency transport and/or limited maintenance activities between the WTGs and shore after an offshore landing pad has been constructed. Underwater noise associated with helicopters is generally brief as compared with the duration of audibility in the air (Richardson et al., 1995). Because of this, ***direct impacts*** to finfish are expected to be ***short-term and negligible***.

Vessel noise may also cause finfish to temporarily vacate the area. However, vessel noise is widely regarded as the predominant anthropogenic noise in the ocean. Research indicates that the direct effects of vessel noise will not cause mortality or body tissue injuries in adult fish (Hawkins et al., 2014). Vessel sound source levels have been shown to cause several different effects in behavior, TTS, auditory masking, and blood chemistry. The most common behavioral responses are avoidance, alteration of swimming speed and direction, and alteration of schooling behavior (Vabø et al., 2002; Handegard and Tjøstheim, 2005; Sarà et al., 2007; Becker et al., 2013). Laboratory and field studies have demonstrated several other behaviors that are influenced by vessel noise. For example, several studies have noted changes in time spent burrowing or using refuge, time spent defending or tending to nests and eggs (Picciulin et al., 2010; Bruintjes and Radford, 2013), intraspecific aggression and territoriality interactions (Sebastianutto et al., 2011; Bruintjes and Radford, 2013), foraging behavior (Purser and Radford, 2011; Bracciali et al., 2012; Voellmy et al., 2014a, 2014b), vocalization patterns (Picciulin et al., 2008, 2012), and overall frequency of movement (Buscaino et al., 2009). These studies also demonstrated that the behavioral changes generally were temporary or that fish habituated to the noises. Some studies noted changes in the blood chemistry of several fish species (e.g., European sea bass, gilthead seabream, red drum, spotted sea trout) in response to vessel noise (Buscaino et al., 2009; Spiga et al., 2012).

Auditory masking and TTS in fish exposed to vessel noise has been demonstrated in a few studies. Auditory thresholds have been shown to increase by as much as 40 dB when fish are exposed to vessel noise playbacks (Wysocki and Ladich, 2005; Vasconcelos et al., 2007; Codarin et al., 2009). The degree of auditory masking or TTS generally depends on the hearing sensitivity of the fish, the frequency, and the noise levels tested (Wysocki and Ladich, 2005). The impact of auditory masking and TTS indicate that vessel noise can lower the ability of fish to detect biologically relevant sounds. However, the effects were found to be temporary and hearing abilities returned to normal. Finfish in the vicinity of SFWF construction vessels may be impacted by vessel noise but the duration of noise at a given location will be short and will occur over a very short period at any given location in the SFWF area or between ports and the SFWF. Therefore, ***minor, short-term direct*** impacts to finfish are expected because of most construction vessel noise.

The dominant vessel noise of concern for fish during SFWF construction will emit from the thrusters on the DPV during Inter-array Cable installation. A DPV will be utilized during both SFWF Inter-array Cable and SFEC lay activities. Popper et al., 2014 published guidance for acoustic thresholds from non-impulsive sounds for injury to fish but there are no adopted acoustic thresholds from non-impulsive sounds for behavioral impacts to fish. Recoverable injury and TTS may occur where peak noise levels exceed 170 and 158 dB respectively. The zone of acoustic influence for injury would be concentrated right at the DPV itself. Fish within this ensonified area over the brief duration of DPV use may experience noise that may temporarily alter their behavior. However, impacts of this magnitude are expected to be ***short-term*** and ***minor.***

Traffic

Impacts associated with vessel traffic during SFWF construction are identified under the Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting sections.

Lighting

Artificial lighting during construction at the SFWF will be associated with navigational and deck lighting on vessels from dusk to dawn. Reaction of finfish to this artificial light is highly species-dependent and may include attraction and/or avoidance of an area.

Artificial lighting may disrupt the diel vertical migration patterns of fish and this may affect species richness and community composition (Nightingale et al., 2006; Phipps, 2001). It could also increase the risk of predation and disruption of predator/prey interactions and result in the loss of opportunity for dark-adapted behaviors including foraging and migration (Orr et al., 2013). Because of the limited area associated with the artificial lighting used on project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible and short-term*** for benthic early life stages and ***negligible or minor*** for benthic later life stages and pelagic early and later life stages during construction.

Trash and Debris

The release of trash and debris into offshore waters potentially may occur from any on-water activities. Certain types of trash and debris could be accidentally lost overboard during construction, with subsequent effects to finfish. In compliance with existing federal regulations, the amount of trash and debris dumped offshore would be minimal as only accidental loss of trash and debris is anticipated, some of which could sink to the seafloor. Affected fish species were not fully assessed in the NOAA marine debris summary (2014) but are known to be greatly impacted by derelict fishing gear and are likely affected similarly by other marine debris. It is likely that ingestion and entanglement impacts are not fully realized because of the inaccessibility of affected fish.

Vessel operators, crew, and personnel present on offshore structures are required to comply with the requirements of federal regulations regarding safe disposal of trash and debris. In addition, USCG and EPA regulations require operators to develop waste management plans, post informational placards, manifest trash sent to shore, and use special precautions such as covering outside trash bins to prevent accidental loss of solid materials. Also, BOEM lease stipulations require adherence to Notice to Lessee (NTL) 2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of placards at prominent locations on offshore vessels and structures, and mandates a yearly marine trash and debris awareness training and certification process. The SFWF's compliance with laws and regulations as well as BSEE NTL 2015-G03 will avoid or reduce the potential for impacts from trash and debris on the environment.

Therefore, taking into account the USCG and EPA regulations as well as BOEM guidance, trash and debris from construction and operational activities will not be released into the marine environment. Debris would consist only of isolated items that were accidentally lost overboard. In addition, sturgeon are very sparsely distributed in the SFWF and SFEC areas; therefore, debris ingestion and entanglement impacts on finfish are expected to be ***negligible***.

Operations and Maintenance

Table 4.3-16 summarizes the level of impacts expected to occur to finfish and EFH during the O&M phases of the SFWF. Minor impacts and long-term impacts during O&M are largely associated with the presence of the SFWF. Additional details on potential impacts to finfish and EFH from the various IPFs during O&M are described in the following sections.

Table 4.3-16. IPFs and Potential Levels of Impact on Finfish and EFH for the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact[a]			
		Benthic/Demersal Early Life Stages[b]	Pelagic Early Life Stages [b]	Benthic/Demersal Later Life Stages[b]	Pelagic Later Life Stages [b]
Seafloor Disturbance	Foundation	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect
	OSS platform	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect	Minor long-term indirect
	SFWF Inter-array Cable	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect
Noise	Ship Noise and Aircraft Noise,	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct
	WTG Operational Noise	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct
Electromagnetic Field		Negligible	Negligible	Negligible	Negligible
Traffic		See Seafloor disturbance, noise, sediment suspension and deposition, and lighting IPFs.			
Lighting		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct
Discharges and Releases [c]		Negligible			

Table 4.3-16. IPFs and Potential Levels of Impact on Finfish and EFH for the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact[a]			
		Benthic/Demersal Early Life Stages[b]	Pelagic Early Life Stages [b]	Benthic/Demersal Later Life Stages[b]	Pelagic Later Life Stages [b]
Trash and Debris [c]		Negligible			

[a] Maximum level of impact is the highest impact levels for direct or indirect effects. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Early life stages include eggs and larvae. Later life stages include juveniles and adults.

[c] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

Impact producing factors associated with seafloor disturbance during O&M of the SFWF have been split into foundation, OSS platform, SFWF Inter-array Cable, and vessel anchoring (including spuds). See Section 3.1.2.1 for the expected impact areas associated with the monopile foundation that will be used to support the WTGs and OSS and the impact area associated with the Inter-array Cable.

Foundations

The presence of the foundations and associated scour protection is expected to result in ***minor, long-term indirect impacts*** to finfish because of the conversion of existing sand or sand with mobile gravel habitat to hard bottom. This is expected for all life stages of benthic/demersal and pelagic finfish species that are associated with these habitats. This conversion to hard bottom habitat may trigger an effect known as a "reef effect" which could result in both ***minor impacts*** for some species but could also benefit some species. Species such as Atlantic halibut, haddock, monkfish, smooth and spiny dogfish, and windowpane flounder that spawn or lay eggs on, occur on, or feed on species that are present in soft bottom habitat or sand with mobile gravel habitat are expected to have a ***minor impact*** as available habitat in the area will decrease. Those species such as Atlantic cod, black sea bass, red hake, scup, tautog, and wolf fish that prefer harder bottom habitat are expected to ***benefit*** from this activity. For further information on common habitat types by species, see Table 4.3-11. However, this effect is expected to be small based on the expected size of habitat conversion at each WTG relative to the available sand and sand with mobile gravel habitat.

Habitat conversion is expected to cause a ***long-term, minor, indirect impact*** resulting in a shift in species assemblages towards those found in rocky reef/rock outcrop habitat; this is known as the "reef effect" (Wilhelmsson et al., 2006; Reubens et al., 2013). This effect is also well known from other anthropogenic structures in the sea, such as oil platforms, artificial reefs piers, and shipwrecks (Claudet and Pelletier, 2004; Wilhelmsson et al., 2006; Seaman, 2007; Langhamer and Wilhelmsson, 2009). The impact is expected to be minor because both soft and hard bottom habitats are already present in and around the SFWF. Data collected as part of the G&G survey at the SFWF (Appendix H) indicate that sand sheet habitat is not a limiting habitat in the region, and that numerous hard bottom boulder habitats are also present within the area. As a result, the conversion of a small area of sand sheet habitat to hard bottom habitat is unlikely to result in perceptible changes to the benthic community outside of the immediate area impacted.

Species composition and abundance of finfish is expected to be influenced by the foundation for the WTGs and OSS. Wind farms with steel monopile foundations showed a species-dependent effect with some species having higher abundance and some having lower abundance post wind farm installation. At the Horns Rev wind farm, 7 years after construction fish densities decreased at both the wind farm and control sites, indicating inter-annual variation in fish populations more strongly influenced abundances than any attraction effect of the wind farm (Leonhard et al., 2011). This study also revealed that fish aggregated around the wind farm during daylight hours, then migrated to deeper water at night. Fish species diversity was also found to be higher close to the turbines and this diversity was primarily driven by species that prefer hard bottom (Leonhard et al., 2011; Stenberg et al., 2015).

At the offshore wind farm Egmond aan Zee, a tagging study of sole (*Solea vulgaris*) and cod revealed that sole were neither attracted to nor avoided the wind farm turbines (Winter et al., 2010). All sampled cod were juveniles and they were strongly attracted to the monopiles, but individual behavior varied greatly, with some using spatial scales larger than the wind farm, while others stayed within the wind farm for months, moving among the WTGs. In addition, sole, whiting (*Merlangius merlangus*), and striped red mullet (*Mullus surmuletus*) abundances increased and lesser weever (*Echiichthys vipera*) abundances decreased within the wind farm when compared to baseline sampling. Cod were observed on the scour protection rocks 2 years after construction.

Overall, increases in abundance of certain finfish have been observed around WTG foundations at most wind farms that were built in soft-bottom habitat (Bergström et al., 2014). Similar offshore structures like oil and gas platforms have been found to exhibit a reef effect with increased abundance of larval and juvenile fish. This increased abundance may be because the structures extend throughout the water column, making it more likely that juvenile or larval fish encounter and settle on them (RI CRMC, 2010). There may also be less predation on small fish in midwater habitats, so they can safely hide in the vicinity of the structure at a variety of depths (Love et al., 2003). In addition, at these structures, fish can take advantage of the shelter provided while also being exposed to stronger currents created by the structures, which generate increased feeding opportunities and decreased potential for predation (Wilhelmsson et al., 2006). A similar effect is expected for the WTGs. Overall, any adverse or beneficial direct impacts associated with the steel monopile foundations and scour protection will be limited to the immediate vicinity of the individual WTG or foundation, while the vast majority of the SFWF area will not be impacted. In addition, the existing sand and sand with mobile gravel habitat is not expected to be a limiting factor for finfish in the area. Any "reef effect" observed will be limited to the immediate vicinity of that structure and will not cover the entire area where the SFWF is located.

SFWF Inter-Array Cable

Benthic life stages are expected to experience ***minor, short-term, direct impacts*** and pelagic life stages are expected to experience ***negligible, short-term, direct impacts*** if the Inter-array Cable requires maintenance that will expose it. Maintenance of the Inter-array Cable is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the Inter-array Cable are expected to be similar but less frequent to those described for the construction/installation phase. The presence of the Inter-array Cable is expected to have ***negligible impacts*** to finfish because the cable will be buried beneath the seabed. However, some areas of the Inter-array Cable may require armoring which may result in ***minor, long-term indirect impacts*** through conversion to hard bottom as described in the Foundation section.

Vessel Anchoring (Including Spuds)

Vessels are not expected to anchor during O&M activities unless the Inter-array Cable or WTGs require maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to those discussed in the Seafloor Preparation and Pile Driving/Foundation Installation section for the construction phase.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M will primarily result from vessel anchoring and any maintenance activities that will require exposing the Inter-array Cable. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during SFWF O&M are expected to be similar to vessel-related sediment suspension and deposition impacts described for the construction phase.

Noise

Direct impacts from noise during SFWF O&M may occur associated with vessels, aircraft, and operational noise at the WTGs.

Vessel and Aircraft Noise

Impacts from vessel and aircraft noise during SFWF O&M are expected to be similar to impacts described in the construction phase.

WTG Operational Noise

The underwater noise produced by wind turbines are within the hearing ranges of fish. Depending on the noise intensity, such noises could disturb or displace fish within the surrounding area or cause auditory masking (DOI-MMS, 2007). Noise levels are not expected to result in injury or mortality and finfish may become habituated to the operational noise (Thomsen et al., 2006; Bergström et al., 2014). A recent study also found no difference in the residency times of juvenile cod around monopiles between periods of turbine operation or when turbines were out-of-order. This study also found that sandeels (*Ammodytes marinus* and *Ammodytes tobianus*) did not avoid the wind farm (Lindeboom et al., 2011). In a similar study, the abundance of four of the most commonly occurring species, cod, eel, shorthorn sculpin (*Myoxocephalus scorpius*), and goldsinny wrasse (*Ctenolabrus rupestris*), were found to be higher near WTGs, indicating potential noise effects from operation did not override the “reef effect.” Avoidance of WTGs was not observed in this study either (Bergström et al., 2013).

With generally low noise levels generated by the WTGs, fish would be impacted only at close ranges, within approximately 328 feet (100 m) (Thomsen et al., 2006). Thomsen et al (2006) reviewed the findings of observations of fish behaviors in proximity to an operational turbine and found varying results from no perceived changes in swimming behavior (European eels); and both increased and decreased catch rates of cod within 328 feet (100 m) of turbines. As a result, direct impacts associated with long-term noise during WTG operation are expected to be ***negligible***.

Electromagnetic Field

The Inter-array Cable will be shielded. Shielded electrical transmission cables do not directly emit electrical fields into surrounding areas but are surrounded by magnetic fields that can cause induced electrical fields in moving water (Gill et al., 2012).

A modeling analysis of the magnetic fields and induced electric fields anticipated to be produced during operation of the SFWF Inter-array Cable and SFEC was performed and results are included in Appendix K. These modeling results were compared to published studies available in the scientific literature on the sensitivity of marine species to EMF. The modeling results and scientific literature analysis indicates that the EMF associated with the operational buried Inter-array Cable or SFEC will not be detected by bony fish, elasmobranch, or invertebrate species. Given that the calculated values are below the thresholds of detection reported in the scientific literature, behavioral effects impacting regional abundances and distributions of such species are not expected.

Additional field data from 50-Hz submarine cable sites and offshore windfarms support this conclusion, indicating no distributional or behavioral effects on resident fish, elasmobranchs, or invertebrates. It should be noted that these conclusions are in line with the findings of a previous comprehensive review of the ecological impacts of Marine Renewable Energy (MRE) projects, where it was determined that “to date there has been no evidence to show that EMFs at the levels expected from MRE devices will cause an effect (whether negative or positive) on any species” (Copping et al., 2016). Given these findings and the findings presented in Appendix K, impacts from EMF to finfish or EFH are expected to be negligible within the SFWF or SFEC.

Traffic

Impacts associated with vessel traffic during SFWF O&M are identified under the Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting sections.

Lighting

Artificial lighting during O&M will be associated with O&M vessels, the WTGs, and the OSS. Reaction of finfish to artificial light and potential impacts to finfish from artificial light is described under the Lighting section for the construction phase. Lighting on the WTG foundations and the OSS will be coordinated with the USCG to ensure it meets appropriate safety standards and to minimize potential impacts on marine organisms. Because of the limited area associated with the artificial lighting at each WTG, the OSS, and project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible, long-term*** during operation.

Decommissioning

Decommissioning of the SFWF is expected to have similar impacts as construction of the WTGs, OSS, and Inter-array Cable. After removal, the area is expected to return to pre-project conditions.

South Fork Export Cable

SFEC – OCS and SFEC – NYS

Construction

Table 4.3-17 summarizes the level of impacts expected to occur to finfish and EFH during the construction and decommissioning phases of the SFEC. Decommissioning of the SFEC is included in Table 4.3-17 because the structures are expected to be removed and their removal will be accomplished by similar methods or result in similar impact areas as their installation. Additional details on potential impacts to finfish and EFH from the various IPFs during construction of the SFEC are described in the following sections.

Table 4.3-17. IPFs and Potential Levels of Impact on Finfish and EFH for the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/ Demersal Early Life Stages [b]	Pelagic Early Life Stages [b]	Benthic/ Demersal Later Life Stages [b]	Pelagic Later Life Stages [b]
Seafloor/Land Disturbance	Seafloor Preparation	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect
	Pile Driving/ Cofferdam Installation	Minor short-term direct	Negligible short-term direct	Minor short-term direct	Negligible short-term direct
	SFEC installation	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Minor short-term direct Negligible short-term indirect
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct	Negligible short-term direct Negligible short-term indirect

Table 4.3-17. IPFs and Potential Levels of Impact on Finfish and EFH for the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/ Demersal Early Life Stages [b]	Pelagic Early Life Stages [b]	Benthic/ Demersal Later Life Stages [b]	Pelagic Later Life Stages [b]
				Negligible long-term indirect	
Noise	Vibratory Pile Driving	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct
	Ship Noise, Trenching Noise, Aircraft Noise	Minor short-term direct	Minor short-term direct	Minor short-term direct	Minor short-term direct
Traffic		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct
Lighting		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct
Discharges and Releases [c]		Negligible			
Trash and Debris [c]		Negligible			

[a] Maximum level of impact is the highest impact levels for direct or indirect effects. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Early life stages include eggs and larvae. Later life stages include juveniles and adults.

[c] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

IPFs associated with seafloor disturbance during construction of the SFEC has been split into seafloor preparation, pile driving, SFEC installation, and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce ***negligible to minor, direct and indirect impacts*** to species depending on the life stages present for each species. Other IPFs that are interrelated with seafloor disturbance such as pile driving noise and sediment suspension and deposition are discussed in subsequent sections. See Section 4.1 for the expected impact areas associated with the SFEC cable and HDD cofferdam.

Similar to the SFWF, the construction and decommissioning of the SFEC is not expected to have major long-term impacts on finfish or designated EFH. Many of the species identified in Table 4.3-10 as possibly present at the SFEC have a completely pelagic lifestyle, and many other species have pelagic early life stages and are not dependent on benthic habitat. As such, modification or disturbance of the substrate is expected to have a negligible impact on the habitat or EFH of pelagic species, if present. There may be some adverse impacts to finfish habitat and EFH of demersal/benthic species resulting from the Project, but because of the small acreage relative to the total area of surrounding finfish habitat and EFH, these are expected to be ***negligible to minor, localized, and short-term*** in nature. See Sections 3.2.2.1 and 4.1 for the expected acreage of benthic habitat that will be affected by construction of the SFEC.

Following completion of construction and during O&M of the SFEC, the substrates at the SFEC are expected to fundamentally remain the same as pre-project conditions. Benthic infauna and epifauna are expected to recolonize the disturbed areas, allowing them to continue to serve as foraging habitat for finfish species, including those with designated EFH. The exception is the conversion of sand and sand with mobile gravel substrate to hard bottom associated with the protective armoring for discrete portions of the SFEC. However, because of the small acreage associated with this conversion relative to the total area of available surrounding finfish habitat and EFH, these impacts to finfish habitat and EFH are expected to be ***minor, short-term and long-term***.

Seafloor Preparation

Seafloor preparation activities at the SFEC during construction include removal of obstructions and installation trials prior to installing the SFEC. A PLGR will be used to clear debris from the area prior to laying the SFEC. Up to five installation trials may be conducted, resulting in a temporary seabed disturbance of up to 9.3 acres (3.75 ha). In addition, boulder relocation may be required within 49 feet (15 m) of each side of the cable centerline where boulders are present. Temporary seabed disturbance from boulder relocation related to preparation for SFEC-OCS installation could include a total temporary disturbance of up to 124.9 acres (50.5 ha). Boulder relocation will not be required along the SFEC-NYS.

Impacts associated with seafloor preparation are expected to be similar to those described for the SFWF.

Pile Driving/Cofferdam Installation

Physical impacts to finfish from SFEC cofferdam installation consisting of sheet pile or gravity cell are expected to be similar to those described for SFWF pile/foundation installation.

SFEC Installation

Impacts associated with installation of the SFEC are expected to be similar to those described for the SFWF Inter-array Cable.

In addition, as described in the SFWF construction section, fish eggs and larvae (ichthyoplankton), as well as zooplankton, are expected to be entrained during installation of the SFEC if using a jet plow. An ichthyoplankton and zooplankton assessment was conducted to analyze the potential loss of fish and zooplankton related to this activity (Appendix O, Attachment 1). The results indicate that total estimated losses of zooplankton and ichthyoplankton related to entrainment from installation of the longest potential SFEC route using a jet plow were less than 0.001 percent of the total zooplankton and ichthyoplankton abundance present in the study region (Appendix O, Attachment 1). Therefore, impacts to early life stages of EFH species from entrainment caused by installation of the SFEC are expected to be negligible to minor and short-term.

Vessel Anchoring (Including Spuds)

Impacts associated with vessel anchoring and the use of spuds during construction of the SFEC are expected to be similar to those described for the SFWF.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during construction of the SFEC can result from seafloor disturbance caused by vessel anchoring, installation of the SFEC, and limited excavation required at the cofferdam. Direct impacts associated with increased sediment suspension and deposition are expected to be ***negligible or minor and short-term in nature***. Indirect impacts associated with increased suspended sediment and deposition include changes in habitat and species composition after sediments have settled out. These impacts are expected to result in ***negligible to minor, long-term, indirect impacts*** for benthic early and later life stages and ***negligible short-term indirect impacts*** for pelagic early and later life stages as described in more detail below. Vessel mooring or anchoring activity resulting in sediment suspension is expected to be limited to areas of seafloor immediately adjacent to the spuds or anchors. For cable installation at the SFEC - OCS and SFEC - NYS, and excavation at the cofferdam, a sediment transport study was completed that estimated the suspended sediment concentrations, sediment transport, and resulting sediment deposition that may result from jet plow installation, one of three potential types of equipment to be used for cable installation (Appendix I).

Temporary Increase in TSS

In order to estimate the extent of potential impacts from sediment suspension generated by jet plow installation of the SFEC, one of three potential types of equipment to be used for cable installation, a modeling simulation of the burial of the SFEC was conducted. A summary of the modeling results specific to the SFEC - OCS and SFEC - NYS is summarized below.

SFEC – OCS Installation

The modeling results indicate that the maximum modeled TSS concentration from SFEC - OCS installation using a jet plow is 1,347 mg/L. The highest TSS concentrations using this type of cable installation equipment are predicted to occur in locations where the jet plow passes over pockets of finer sediments (e.g., between VC-217 and VC-220, and again between VC-235 and the end of the route –Appendix I), but concentrations above 30 mg/L otherwise remain within approximately 328 feet (100 m) of the source during the simulation. Water column concentrations of 100 mg/L or greater are predicted to extend up to 1,115 feet (340 m) from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.4 hours after the conclusion of jet plow trenching. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation (Appendix I).

SFEC – NYS Installation

The modeling results indicate that the maximum modeled TSS concentration from SFEC - NYS installation using a jet plow is 578 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 394 feet (120 m) from the jet plow and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.3 hours after the jet plow crosses into federal waters. Modeling also indicates that elevated TSS concentrations are expected to remain very close to the seabed and that plumes are not predicted to extend vertically beyond 3 to 9 feet (1 to 3 m) of the jet plow at any time during the simulation (Appendix I).

Cofferdam Installation

A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore transition was also conducted. The maximum predicted TSS concentration from suction dredging at the HDD site is 562 mg/L. Water column concentrations of 100 mg/L or greater are predicted to extend up to 476 feet (145 m) from the source and TSS concentrations are predicted to return to ambient levels (less than 10 mg/L) in 1.1 hours after the conclusion of suction dredging.

Potential impacts to finfish from increases in sediment suspension are similar to those described for the SFWF. Given the limited extent and duration of the elevated TSS based on the predictive modeling described above, these impacts are expected to be ***negligible to minor*** to benthic/demersal species because they will be ***short-term and highly localized***. Direct impacts to pelagic species are expected to be ***negligible*** as older life stages will likely leave the area and not be affected by increased suspended sediment and early life stages are expected to have tolerance for short-term increases in suspended sediment.

Sediments are expected to come out of suspension quickly after the impact occurs, returning pelagic habitat to pre-impact conditions in a short-time frame, resulting in a ***negligible, short-term, indirect impact*** for pelagic early and later life stages. Indirect impacts to benthic/demersal species from a potential change in habitat composition are described in the Sediment Deposition section below.

Sediment Deposition

The model (Appendix I) also predicted sediment deposition extent and depth resulting from installation of the SFEC using a jet plow, one of three potential types of equipment to be used for cable installation. A summary of the modeling results specific to the SFEC - OCS and SFEC - NYS is summarized below.

SFEC – OCS Installation

The model predicted that sediment deposition resulting from installation of the SFEC - OCS using a jet plow will be limited to the area immediately adjacent to the burial route, typically, extending no more than 328 feet (100 m) from the cable-laying track. The maximum predicted deposition thickness is estimated to be 0.45 inches (11.4 mm). Sedimentation at or above 0.4 inch (10 mm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.72 ha) of the seabed (Appendix I).

SFEC – NYS Installation

The model predicted that sediment deposition resulting from installation of the SFEC - NYS using a jet plow will also be limited to the area immediately adjacent to the burial route as described above. The maximum predicted deposition thickness is estimated to be 0.39 inch (9.9 mm). Sedimentation at or above 0.4 inch (10 mm) extends a maximum of 29.5 feet (9 m) from the burial route and covers a cumulative area of 4.3 acres (1.72 ha) of the seabed (Appendix I).

Cofferdam Installation

A modeling simulation of suction dredging and side-casting at the HDD exit point for the sea-to-shore transition was also conducted. The model predicted that sedimentation will be limited to the area immediately adjacent to the exit pit (within 656 feet [200 m] of the source). Unlike previous scenarios where sediment is resuspended along a linear path, the dredge and side-cast operation occurs from a single point within the model domain. For this reason, the deposit is thicker, but is far more limited in extent. The maximum predicted deposition thickness is 12.5 inches (31.8 cm). Sedimentation at or above 10 mm extends a maximum of 177 feet (54 m) from the side-cast point and covers a cumulative area of only 1.38 acres (0.56 ha) of the seabed (Appendix I).

Potential Impacts to finfish from increases in sediment deposition are similar to those described for the SFWF. Direct impacts from sediment deposition to finfish are considered to be ***short-term, localized,*** and ***minor*** because of the limited extent of sedimentation predicted by the model. Indirect impacts are expected to be ***negligible to minor and long-term*** for benthic early and later life stages. Indirect impacts from sediment deposition are expected to result in ***no impact*** to pelagic early of later life stages.

Noise

The primary sources of underwater sound during SFEC construction that pose risks of impacts to fish are vibratory hammer pile driving for the sheet pile cofferdam and DPV use for SFEC installation. The potential underwater acoustic impacts on fish were addressed in the discussion about the SFWF Inter-array Cable. ***Minor, short-term behavioral impacts*** to fish within the ensonified area of approximately 12 acres (0.05 km^2) around the DPV along the cable route would be expected.

The sheet pile cofferdam installation differs from the main SFWF installation in several ways. The location is close to shore, the duration of the installation is estimated to be short (roughly 12 to 24 hours), and the source type is non-impulsive or continuous, compared to impact pile driving for WTG foundations. According to the acoustical impact analysis provided in Appendix P2, the only quantitative threshold that Popper et al. (2014) give for evaluating the impacts of non-impulsive (shipping) noise is for fish with swim bladders. Popper et al. (2014) does not give quantitative thresholds for other fish categories. The Stadler and Woodbury (2009) criteria were originally developed for impulsive sounds, but they have been used for non-impulsive sounds. The zone of acoustic influence for injury would be concentrated right at the cofferdam and vibratory hammering. Based on the modeling provided in Appendix J1, the radial distance to a 150 dB threshold would be approximately 779 m from the source while the radial distance to a 180 dB threshold would be approximately 31 m. Fish within close proximity to the vibratory hammering are at risk to injury from the noise. However, further away from the hammering, fish within the ensonified area over the brief duration of vibratory hammering may experience noise that may temporarily alter their behavior. Impacts of this magnitude are expected to be ***short-term*** and ***minor*** because fish are likely to swim away and not enter the area once hammering has begun.

Traffic

Impacts associated with vessel traffic during construction of the SFEC are identified under the Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting sections.

Lighting

Artificial lighting during construction of the SFEC will be associated with navigational and deck lighting on vessels from dusk to dawn. Reaction of finfish to this artificial light is highly species-dependent and may include attraction and/or avoidance of an area. Because of the limited area associated with the artificial lighting used on project vessels relative to the surrounding unlit areas, the effects are expected to be ***negligible and short-term*** for both benthic and pelagic early and later life stages during construction. Additional information on impacts to finfish from artificial lighting are similar to those described for the SFWF.

<u>Operations and Maintenance</u>

Table 4.3-18 summarizes the level of impacts expected to occur to finfish and EFH during the O&M phases of the SFEC. ***Minor and long-term impacts*** during O&M are associated with the presence of the SFEC and associated cable armoring. Additional details on potential impacts to finfish and designated EFH from the various IPFs during O&M are described in the following sections.

Table 4.3-18. IPFs and Potential Levels of Impact on Finfish and EFH for the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/Demersal Early Life Stages [b]	Pelagic Early Life Stages [b]	Benthic/Demersal Later Life Stages [b]	Pelagic Later Life Stages [b]
Seafloor Disturbance	Cofferdam	No impact	No impact	No impact	No impact
	SFEC	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Minor long-term indirect
	Vessel anchoring (including spuds)	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect

Table 4.3-18. IPFs and Potential Levels of Impact on Finfish and EFH for the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact [a]			
		Benthic/Demersal Early Life Stages [b]	Pelagic Early Life Stages [b]	Benthic/Demersal Later Life Stages [b]	Pelagic Later Life Stages [b]
Sediment Suspension and Deposition		Minor short-term direct Minor long-term indirect	Negligible short-term direct Negligible short-term indirect	Negligible short-term direct Negligible long-term indirect	Negligible short-term direct Negligible short-term indirect
Ship and Aircraft Noise		Negligible short-term direct	Negligible short-term direct	Negligible short-term direct	Negligible short-term direct
Electromagnetic Field		Negligible	Negligible	Negligible	Negligible
Traffic		See Seafloor disturbance, noise, sediment suspension and deposition, and lighting IPFs			
Lighting		Negligible long-term direct	Negligible long-term direct	Negligible long-term direct	Negligible long-term direct
Discharges and Releases [c]		Negligible			
Trash and Debris [c]		Negligible			

[a] Maximum level of impact is the highest impact levels for direct or indirect effects. Long-term impacts were considered to have a higher potential for impacts than short-term impacts if within the same impact category.

[b] Early life stages include eggs and larvae. Later life stages include juveniles and adults.

[c] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

IPFs associated with seafloor disturbance during O&M of the SFEC has been split into cofferdam, SFEC, and vessel anchoring (including spuds). See Section 3.2.3 for a description of the SFEC construction.

Cofferdam

The cofferdam will be a temporary structure used during construction only. Therefore, no conversion of habitat is expected, and ***no long-term, indirect impacts*** associated with pile driving of the cofferdam is expected.

South Fork Export Cable

Benthic life stages are expected to experience ***minor, short-term, direct impacts*** and pelagic life stages are expected to experience ***negligible, short-term, direct impacts*** if the SFEC requires maintenance that will expose it. Maintenance of the SFEC is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the SFEC are expected to be similar but less frequent to those described for the construction/installation phase. The presence of the SFEC is expected to have ***negligible impacts*** to finfish because it will be buried beneath the seabed. However, some areas of the SFEC may require armoring which is expected to result in ***minor, long-term, indirect impacts*** through conversion to hard bottom, as described in the Foundation section for the SFWF.

Vessel Anchoring (Including Spuds)

Vessels are not expected to anchor during O&M activities unless the SFEC requires maintenance. Impacts associated with potential vessel anchoring during O&M of the SFEC are expected to be similar to those described for the SFWF.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M of the SFEC will primarily result from vessel anchoring and any maintenance activities that will require exposing the SFEC. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during O&M of the SFEC are expected to be similar to vessel-related sediment suspension and deposition impacts described for the SFEC construction phase, but less frequent and at a smaller scale.

Noise

Direct impacts to finfish associated with noise during O&M of the SFEC may occur associated with vessels and aircraft. Impacts from vessel and aircraft noise during O&M of the SFEC are expected to be similar to those described for the SFWF.

Electromagnetic Field

EMF impacts to finfish from the SFEC are expected to be similar to those described for the Inter-array Cable at the SFWF.

Traffic

Impacts associated with vessel traffic during SFEC O&M are identified under the Seafloor Disturbance, Noise, Sediment Suspension and Deposition, and Lighting sections.

Lighting

Artificial lighting during O&M of the SFEC will be associated with O&M vessels. Reaction of finfish to artificial light and potential impacts to finfish from artificial light is as described under the Lighting section for the SFEC construction phase.

Decommissioning

Decommissioning of the SFEC is expected to have similar impacts as construction. The area is expected to return to pre-project conditions.

Threatened and Endangered Finfish

As described in the Affected Environment section, the endangered Atlantic sturgeon has the potential to occur in the SFWF and SFEC areas. It is extremely unlikely for the endangered shortnose sturgeon to occur in either the SFWF or SFEC area.

Potential impacts on the Atlantic sturgeon would not be materially different from impacts on other fish species described in the previous sections. No spawning habitat will be affected because Atlantic surgeon spawn in hard-bottom, freshwater habitats. Seasonal migratory patterns allow the potential for Atlantic sturgeon to be present in the SFWF construction area; however, they are not expected to be a regular visitor or occupant in large numbers. IPFs for Atlantic sturgeon include seafloor disturbance, sediment suspension and deposition, noise, traffic (i.e., physical disturbance and risk of collisions), and trash and debris (i.e., ingestion and entanglement). Impacts resulting from these IPFs are described again in direct relevance to potential impacts to the Atlantic sturgeon in Appendix P1.

4.3.3.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to finfish and essential fish habitat.

- The SFWF and SFEC - Offshore will minimize impacts to important habitats for finfish species.

- Installation of the SFWF Inter-Array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize sediment disturbance and alteration of demersal finfish habitat.
- The SFWF Inter-Array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
- Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to finfish and EFH resources, as compared to use of a vessel relying on multiple-anchors.
- The SFEC sea-to-shore transition will be installed using HDD to avoid impacts to the dunes, beach, and near-shore zone, including finfish and EFH resources.
- Siting of the SFWF and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys.
- SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction.
- A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).

4.3.4 Marine Mammals

The description of the affected environment and assessment of potential impacts for marine mammals were developed by reviewing current public data sources related to marine mammals, including state and federal agency-published papers and databases, published journal articles, online data portals and mapping databases, and correspondence and consultation with federal and state agencies. A description of the marine mammals with the potential to occur within the SFWF and SFEC is provided in this section, followed by an evaluation of potential Project-related impacts. In support of this impact evaluation, SFW has completed a comprehensive underwater acoustic modeling effort (Appendix J1) and a detailed impact assessment for marine mammals, sea turtles, and sturgeon (Appendix P1), including animal movement modeling (Appendix P2) as it relates to exposures to project-related underwater noise. SFW has also developed a protected species mitigation and monitoring plan (Appendix P3).

4.3.4.1 Affected Environment

Thirty-six species of marine mammals inhabit the regional waters upon the Western North Atlantic OCS and may occur in the SFWF and SFEC, including 6 Mysticetes (baleen whales), 25 Odontocetes (toothed whales, dolphins, and porpoise), 4 Pinnipeds (earless or true seals), and 1 species of Sirenia (manatees). All 36 species are protected under the MMPA; 6 species are also protected under the federal ESA. Table 4.3-19 summarizes the marine mammal species potentially present within the Western North Atlantic OCS, including the relative occurrences for each species within the SFWF and SFEC Project areas. The table also includes each species' conservation status, including the designation as a 'strategic stock,' as defined by the MMPA. A species that is a strategic stock meets the following criteria: the population experiences a level of human-caused mortality that exceeds the potential biological removal level; the population is declining and is likely to be listed as a threatened species under the ESA, based on the best available information; or the population is listed as a threatened marine mammal species under the ESA or is designated as depleted under the MMPA. Nonstrategic stock is defined as any marine mammal stock that does not match the strategic stock criteria.

Table 4.3-19. Marine Mammals Possibly Occurring in the SFWF and SFEC Project Areas

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the SFWF and SFEC	Best Estimate[1]
Order Cetacea					
Suborder Mysticeti (baleen whales)					
Minke whale	*Balaenoptera acutorostrata*	Canadian East Coast	Non-strategic	Common	21,968
Sei whale	*Balaenoptera borealis*	Nova Scotia	ESA Endangered/ Depleted and Strategic	Regular	6,292
Blue whale	*Balaenoptera musculus*	Western North Atlantic	ESA Endangered/ Depleted and Strategic	Rare	402
Fin whale	*Balaenoptera physalus*	Western North Atlantic	ESA Endangered/ Depleted and Strategic	Common	6,802

Table 4.3-19. Marine Mammals Possibly Occurring in the SFWF and SFEC Project Areas

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the SFWF and SFEC	Best Estimate[1]
North Atlantic right whale	*Eubalaena glacialis*	Western North Atlantic	ESA Endangered/ Depleted and Strategic	Common	412
Humpback whale	*Megaptera novaeangliae*	Gulf of Maine	Non-strategic	Common	1,393
Suborder Odontoceti (toothed whales, dolphins, and porpoises)					
Sperm whale	*Physeter macrocephalus*	North Atlantic	ESA Endangered/ Depleted and Strategic	Common	4,349
Pygmy sperm whale	*Kogia breviceps*	Western North Atlantic	Non-strategic	Rare	7,750
Dwarf sperm whale	*Kogia sima*	Western North Atlantic	Non-strategic	Rare	7,750
Northern bottlenose whale	*Hyperoodon ampullatus*	Western North Atlantic	Non-strategic	Not Expected	unknown
Cuvier's beaked whale	*Ziphius cavirostris*	Western North Atlantic	Non-strategic	Rare	5,744
Mesoplodont beaked whales	*Mesoplodon spp.*	Western North Atlantic	Depleted	Rare	10,107
Killer whale	*Orcinus orca*	Western North Atlantic	Non-strategic	Rare	unknown
False killer whale	*Pseudorca crassidens*	Western North Atlantic	Strategic	Rare	1,791
Pygmy killer whale	*Feresa attenuata*	Western North Atlantic	Non-strategic	Not Expected	unknown
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic	Strategic	Rare	28,924
Long-finned pilot whale	*Globicephala melas*	Western North Atlantic	Strategic	Common	39,215
Melon-headed whale	*Peponocephala electra*	Western North Atlantic	Non-strategic	Not Expected	unknown
Risso's Dolphin	*Grampus griseus*	Western North Atlantic	Non-strategic	Common	35,493
Common dolphin	*Delphinus delphis*	Western North Atlantic	Non-strategic	Common	172,974
Fraser's dolphin	*Lagenodelphis hosei*	Western North Atlantic	Non-strategic	Rare	unknown
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Western North Atlantic	Non-strategic	Common	93,233

Table 4.3-19. Marine Mammals Possibly Occurring in the SFWF and SFEC Project Areas

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the SFWF and SFEC	Best Estimate[1]
White-beaked dolphin	*Lagenorhynchus albirostris*	Western North Atlantic	Non-strategic	Rare	536,016
Pantropical spotted dolphin	*Stenella attenuata*	Western North Atlantic	Non-strategic	Rare	6,593
Clymene dolphin	*Stenella clymene*	Western North Atlantic	Non-strategic	Not Expected	4,237
Striped dolphin	*Stenella coeruleoalba*	Western North Atlantic	Non-strategic	Rare	67,036
Atlantic spotted dolphin	*Stenella frontalis*	Western North Atlantic	Non-strategic	Uncommon	39,921
Spinner dolphin	*Stenella longirostris*	Western North Atlantic	Non-strategic	Rare	4,102
Rough toothed dolphin	*Steno bredanensis*	Western North Atlantic	Non-strategic	Rare	136
Bottlenose dolphin	*Tursiops truncatus*	Western North Atlantic, offshore	Non-strategic	Common	62,851
		Western North Atlantic, Northern migratory coastal	Depleted and Strategic	Rare	6,639
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	Non-strategic	Common	95,543
Order Carnivora					
Suborder Pinnipedia					
Hooded seal	*Cystophora cristata*	Western North Atlantic	Non-strategic	Rare	unknown
Gray seal	*Halichoerus grypus*	Western North Atlantic	Non-strategic	Regular	27,131
Harp seal	*Pagophilus groenlandica*	Western North Atlantic	Non-strategic	Rare	unknown
Harbor seal	*Phoca vitulina*	Western North Atlantic	Non-strategic	Regular	75,834

Table 4.3-19. Marine Mammals Possibly Occurring in the SFWF and SFEC Project Areas

Common Name	Scientific Name	Stock	Federal ESA/MMPA Status	Relative Occurrence in the SFWF and SFEC	Best Estimate[1]
Order Sirenia					
Florida manatee[2]	*Trichechus manatus latirostris*	-	ESA Threatened/ Depleted and Strategic	Rare	13,000[3]

ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act.

[1]Best estimate from the most recently updated National Oceanic and Atmospheric Administration Stock Assessment Reports (Waring et al., 2007, 2010, 2014, 2015, 2016; Hayes et al., 2017; NMFS, 2018).

[2]Under management jurisdiction of United States Fish and Wildlife Service rather than National Marine Fisheries Service (USFWS, 2019).

[3]Current range-wide estimate from the USFWS (2019).

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Definitions:

- Common – Occurring consistently in moderate to large numbers;
- Regular – Occurring in low to moderate numbers on a regular basis or seasonally;
- Uncommon – Occurring in low numbers or on an irregular basis;
- Rare – Records for some years but limited; and
- Not expected – Range includes the Project Area but due to habitat preferences and distribution information species are not expected to occur in the Project Area although records may exist for adjacent waters.

Cetaceans are composed of two separate groups: Mysticetes (baleen whales) and Odontocetes (toothed whales, dolphins, and porpoise). The Odontocetes all possess teeth, and generally feed on fish and invertebrates. The Mysticetes possess large baleen filtration systems instead of teeth, which they use to sieve smaller prey out of the water. Their prey usually consists of zooplankton and small schooling fish. Both groups transit over large distances with Mysticetes migrating seasonally between distinct feeding and breeding areas and Odontocetes following prey species and less distinct migratory behavior. The toothed whales, dolphins, and porpoises are generally found in large, stable pods throughout their lives. Baleen whales are known to maintain small, unstable groups or remain as solitary individuals when not breeding (Wilson and Ruff, 1999). Whales are capable of very deep or prolonged dives while the smaller dolphin and porpoise species generally dive to shallower depths for shorter periods of time. Cetaceans inhabit all the world's oceans, and can be found in coastal, estuarine, shelf, and pelagic habitats, including the SFWF area (NMFS, 2020).

The various seal species (Pinnipeds) inhabit the cooler waters of the northeast and frequent the waters and inland areas around Long Island. Pinnipeds are composed of three families: Odobenidae (the walrus), Otariidae (eared seals, including sea lions and fur seals), and Phocidae (earless seals). Phocidae are the most diverse and widespread pinnipeds and are the only family of seals with the potential to occur within the SFWF and SFEC. Historically, seal species typically included harbor and gray seals, which are still relatively abundant in these waters from late fall until late spring. In recent years, arctic species, such as harp, hooded, and ringed seals, that were once extremely rare for the project area have been sighted (CRESLI, 2017). West Indian manatees (Sirenian) have also been sighted in the region; however, their occurrences are extremely rare. They typically occur in the southeastern United States, which is the northern limit of their range (Lefebvre et al., 2001).

Appendix P provides additional information on the biology, habitat use, abundance, distribution, and the existing threats to the marine mammals that are common to the region and have the potential to occur in the SFWF and SFEC. Furthermore, the potential exposures of marine mammals were investigated through a combination of studies including the underwater sound propagation modeling included in Appendix J1 and the animal exposure modeling included in Appendix P2. The animal exposure modeling quantified the number of marine mammals or percentage of a population within the SFWF and SFEC Project areas. Please refer specifically to Table 4 of Appendix P2 for marine mammal density estimates for the SFWF and SFEC.

4.3.4.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to impact marine mammals, as presented on Figure 4.3-11. The IPFs with potential to result in negligible and greater impacts on marine mammals are evaluated in this section.

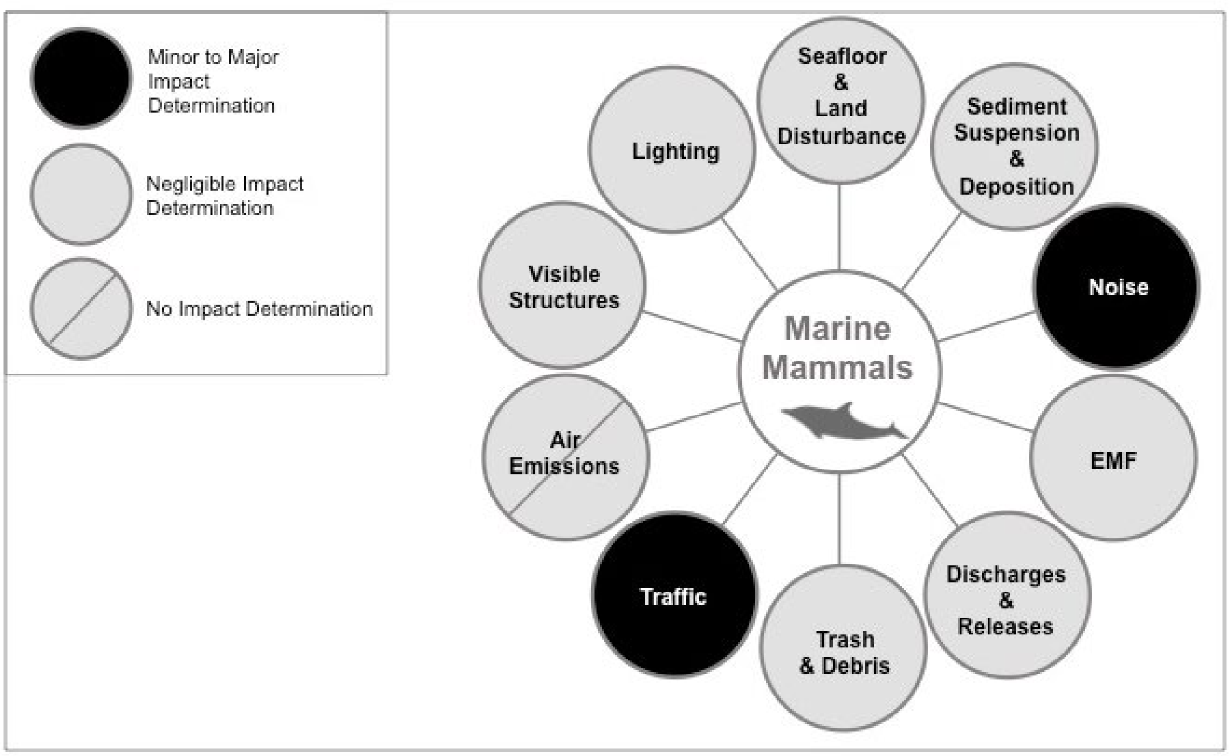

Figure 4.3-11. IPFs on Marine Mammals

Illustration of potential impacts to marine mammals resulting from SFWF and SFEC activities

South Fork Wind Farm

This section summarizes the assessment of potential impacts on 16 species of marine mammals as detailed in Appendix P. The primary IPFs associated with the SFWF that could result in minor to moderate impacts to marine mammals are underwater noise from construction and vessel traffic, in the case of vessel strikes and entanglement in vessel anchor lines. Short-term major impacts to certain species could occur from pile driving noise. Other IPFs considered but anticipated to have negligible impacts to marine mammals are seafloor disturbance, sediment suspension and deposition, EMFs, discharges and releases, trash and debris, visible structures, and lighting. The potential impacts associated with each phase of the SFWF are addressed in the following sections.

Construction

Table 4.3-20 summarizes the level of impacts expected to occur to marine mammals during the construction and decommissioning phases of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-20. IPFs and Potential Levels of Impact on Marine Mammals at the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Seafloor Preparation	Negligible short-term localized
	Foundation Installation	Negligible short-term localized
	Vessel Anchoring	Negligible short-term localized
	Inter-array Cable Installation	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Pile driving	Minor to Major short-term
	Equipment Uses	Negligible short-term
	Vessel traffic	Negligible to Minor short-term
Discharges and Releases		Negligible indirect
Trash and Debris		Negligible indirect
Traffic	Increased Vessels	Minor to Moderate short-term
	Entanglement	Negligible short-term
Visible Structures	Physical structure; navigation impediment	Negligible indirect
Lighting	Navigational and Deck Lighting	Negligible short-term localized

Seafloor and Land Disturbance

During construction, seafloor disturbances would be associated with seafloor preparation, foundation installation, vessel anchoring, and cable installation. Some limited benthic habitat conversion will occur, as described in Section 4.3.2. Marine mammals occurring in the SFWF would likely be transiting the area in search of prey species, which would rarely be benthic species except for the sand lance (*Ammodytes* spp.) which is widely distributed throughout the region. In the unlikely event that marine mammals forage on the seafloor in the SFWF and their prey is displaced from those areas because of SFWF construction, the impacts would be ***negligible*** because they are limited to those few impacted individuals and not groups or populations of marine mammals. The conversion of seabed habitat will be relatively minor when compared to the large expanse of similar habitat available in the region so that marine mammals would find comparable benthic habitat for feeding or resting.

Sediment Suspension and Deposition

As discussed in Section 4.1 and again in Section 4.2.2, SFWF inter-array installation will result in short-term, localized increases in sedimentation close to the seafloor and several feet up and outward into the water column (i.e., increased turbidity). Because of the short-term and localized increases in turbidity and decreases in water quality from SFWF Inter-array Cable installation, ***negligible impacts*** would be anticipated to the few marine mammals that may be located near the cable installation activities. As discussed in the next section, underwater construction noise is likely to repel marine mammals from the area before they are impacted by increased turbidity.

Noise

Underwater noise is the primary construction-related IPF that could impact marine mammals if they are present in the area at the time of SFWF construction. Acoustic modeling of construction-related underwater noise was completed to estimate the impacts from construction-related noise-producing activities, such as pile driving, vibratory pile driving, and the use of DP vessel thrusters. Dependent on many factors, as detailed in the underwater acoustic modeling report (Appendix J1) and marine mammal impact assessment (Appendix P), elevated underwater sound pressure levels (SPLs) can cause physiological impacts or behavioral modifications on marine mammals. Noise will be generated during the construction phase of the SFWF from pile driving, trenching and cable lay equipment, and vessel traffic. Pile driving and DP vessel thruster usage are identified as the activities that would likely have the greatest potential for impacts on marine mammals. As discussed in the IPF section (Section 4.1), above water noise during construction would result in ***negligible impacts*** to marine mammals. Therefore, the potential for above water noise impacts to marine mammals is not further discussed in the assessment.

Not all marine mammals have identical hearing capabilities or are equally susceptible to noise-induced hearing loss. Therefore, they have been delineated into five functional hearing groups based on their similarities in hearing sensitivities. The five groups include (1) low-frequency cetaceans (LFCs) (Mysticetes), (2) mid-frequency cetaceans (MFC) (Odontocetes), (3) high-frequency cetaceans (HFC) (true porpoises), (4) Phocid pinnipeds in water (PPW) (true seals), and (5) Otariid pinnipeds (OW) (sea lions and fur seals). Otariid pinnipeds do not occur in the North Atlantic; therefore, they are not further discussed in this assessment. Table 4.3-21 defines the generalized hearing ranges for each hearing group (NMFS, 2016).

Table 4.3-21. Marine Mammal Hearing Groups

Hearing Group	Species or Taxonomic Groups (Relevant Species Examples)	Generalized Hearing Range[a]
LFC	Baleen whales (e.g., fin whale, North Atlantic right whale, sei whale)	7 Hz to 35 kilohertz (kHz)
MFC	Dolphins, toothed whales (e.g., sperm whale), beaked whales, bottlenose dolphins	150 Hz to 160 kHz
HFC	True porpoises (e.g., harbor porpoise)	275 Hz to 160 kHz
PPW	True seals (e.g., harbor seal, gray seal)	50 Hz to 86 kHz
OW b	Sea lions and fur seals	60 Hz to 39 kHz

Source: NMFS, 2018.

[a] Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on an approximate 65 dB threshold from normalized composite audiogram, with the exception for lower limits for LFC (Southall et al., 2007) and PPW (approximation).

[b] OW do not occur in the North Atlantic or the SFWF and SFEC.

Received sound levels have been developed based on current scientific criteria associated with the onset of a physiological effect (e.g., auditory injury) to or behavioral responses from marine mammals. Acoustic thresholds are used to determine impact levels by providing some quantifiable and spatial context for indicating whether marine mammals could be injured or disturbed by anthropogenic underwater noise. NMFS (2018) defines regulatory criteria for protecting marine mammals by setting potential hearing loss thresholds. These acoustic thresholds for the onset of permanent threshold shift (PTS) from temporary threshold shift (TTS) are used to help assess and quantify exposures from the proposed activities that could result in physiological effects or injury. Table 4.3-22 provides the underwater acoustic thresholds levels for impulsive and nonimpulsive sounds associated with PTS onset (physiological impacts) for marine mammals found in the North Atlantic (NMFS, 2018). The NMFS (2018) guidance recommends dual criteria for assessing potentially injurious exposures, including peak, unweighted sound pressure (SPL_{pk}) and frequency-weighted cumulative sound exposure level (SEL_{cum}). As explained in Appendix P, the SELs are used to assess potential impacts to marine mammals from impact pile driving because they resulted in larger distances from the activity and thus higher potential for animals to be exposed to noise levels resulting in physiological impacts.

Table 4.3-22. Summary of NOAA-NMFS Physiological Impacts Acoustic Thresholds

Hearing Group	Impulsive	Nonimpulsive
LFC	Lpk,flat: 219 dB LE,LF,24h: 183 dB	LE,LF,24h: 199 dB
MFC	Lpk,flat: 230 dB LE,MF,24h: 185 dB	LE,MF,24h: 198 dB
HFC	Lpk,flat: 202 dB LE,HF,24h: 155 dB	LE,HF,24h: 173 dB
PPW	Lpk,flat: 218 dB LE,PPW,24h: 185 dB	LE,PPW,24h: 201 dB

Source: NMFS, 2018.

Notes:

Listed are PTS Onset Thresholds (Received Level) with dual metric acoustic thresholds for impulsive sounds. Use whichever results in the largest isopleth for calculating PTS onset. If a nonimpulsive sound has the potential of exceeding the peak SPL thresholds associated with impulsive sounds, these thresholds should also be considered.

Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound expose level (L_E) has a reference value of 1 μPa^2 s.

Agency-adopted behavioral acoustic thresholds are unweighted by hearing group or species. Table 4.3-23 outlines these acoustic threshold limits for marine mammal behavior impacts. These unweighted thresholds were used in the marine mammal impact assessment (Appendix P) because they have a regulatory foundation. While it is acknowledged that weighted thresholds are commonly applied and may be a more appropriate impact metric, the current review status for behavioral acoustic criteria and lack of regulatory basis for weighted values at this time warrant the use of the unweighted metric for this analysis.

Table 4.3-23. Summary of NOAA-NMFS Behavioral Impacts Acoustic Thresholds

Criterion	Acoustic Threshold (SPL_{rms})
Possible Behavioral Disruption (for impulsive noise)	160 dB
Possible Behavioral Disruption (for nonimpulsive, continuous noise)	120 dB

Source: NMFS, 2018.

SPL_{rms} – root-mean-square sound pressure level. Acoustic threshold units (dB) are referenced to 1 μPa.

The determination of how, when, and to what degree marine mammals are exposed to underwater noise that could result in a physiological and/or behavioral impact is very complex. The analysis done in support of this impact evaluation considered many of the factors relevant to the problem including underwater sound propagation based on several operational assumptions, project area-specific marine animal densities, marine animal movements, and the context within which animals may be exposed to project-related noise. In no scenario was the analysis as simple as determining that if any one marine species is likely to occur in the vicinity of the project during noise-generating activity, it would be impacted by the project. Rather, potential physiological and behavioral impacts to marine mammals were assessed based on rational methods using the best available data and modeling applicable to the situation as discussed below.

Impulsive Sounds – Impact Pile-driving

Underwater noise from the impulsive sounds generated by impact pile driving is considered an important IPF in potential physiological and behavioral impacts to marine mammals. The assessment of potential acoustical impacts to marine mammals was completed based on the results of underwater acoustic modeling and animal movement modeling studies specific to proposed SFWF and SFEC construction activities. Appendix J1 provides predicted sound propagation distances based on key construction variables associated with the SFWF and SFEC design envelope, such as: hammer type, pile type, pile schedule (hammer energy/number of strikes/piling duration), season, geographic location, and implementation of noise mitigation (i.e., sound attenuation) measures. Appendix P provides a summary of the animal movement modeling and impact assessments based not only on underwater sound characteristics but the marine environment, autecological characteristics of at-risk species, mitigation factors, and animal behavior.

Based on the results of the underwater noise modeling and animal noise exposure estimates, impacts to marine mammals during pile driving for the SFWF would likely be ***minor*** with a few seasonal exceptions where unmitigated impact pile driving could be ***major*** impact to certain species. For example, the risk of acoustic exposures to North Atlantic right whales is higher during March and April when historical sightings are relatively high; however, outside of spring, the risk of exposure to North Atlantic right whales diminishes. The implementation of noise attenuation systems capable of achieving 6 to 12 dB reductions during pile driving reduces the exposure risk to minimal for most species (Appendix P).

The marine mammal impact assessment determined that seasonality is an important parameter when estimating exposures to potentially harmful underwater noise due to the variable monthly densities of animals in the Project area (Appendix P1). Exposure estimates for impact pile driving (Appendix J1) shows that the potential for physiological-level acoustic exposures are low even with no sound attenuation. With 10 dB noise attenuation, all exposures drop to <1 individual (calculated by rounding up any fraction greater than or equal to 0.5) for all 16 species evaluated in Appendix P1 except for the following species in specific months:

- Fin whales with 1 individual exposed in May, June, July, August, September, or October;
- Minke whales, which had 1 individual exposed in May and June;
- Humpback whales with 1 individual exposed in July, August, November, or December; 2 individuals exposed in May, June, or October, or 4 individuals exposed in September; and
- Harbor porpoise with 1 individual exposed in May.

The maximum number of modeled physiological-level and behavioral impact-level exposures for the species assessed including ESA-listed marine mammals are presented in Appendix P.

Nonimpulsive Sound – Vessel Noise

The noise from Project-related vessel traffic is expected to be similar to existing vessel-related underwater noise levels in the area. Thus, it is presumed that individual or groups of marine mammals in the area are familiar with various and common vessel-related noises and will not be further impacted by Project-related vessel traffic. The use of DP cable-laying vessels for the SFWF Inter-array Cable and SFEC is an exception. The dominant underwater noise source on the DPV is due to cavitation on the propeller blades of the thrusters (e.g., Leggat et al., 1981). The noise power from the propellers is proportional to the number of blades, the propeller diameter, and the propeller tip speed. The noise from the DPV thrusters is nonimpulsive and typically more dominant than mechanical or hydraulic noises from the cable trenching equipment.

Underwater noise modeling of the nonimpulsive sounds from DPV thruster operations and vibratory hammer (discussed in the following section for SFEC construction) use was conducted for two representative locations: offshore and nearshore. The results of the modeling are presented in Appendix J1. Table 4.3-24 shows the average distances to published physiological and behavioral thresholds for marine mammal functional hearing groups along the SFEC corridor and Inter-array Cable routes.

Table 4.3-24. Maximum Distances to Regulatory Acoustic Thresholds during Operation of Thrusters on a Dynamically Positioned Vessel along the Inter-array Cable Lay Route

Faunal Group	Distances (m) to Physiological Thresholds[1]	Distances (m) to Behavioral Thresholds[2]
LFC	112	14,734
MFC	35	14,734
HFC	103	14,734
PPW	50	14,734

[1]-Physiological thresholds based on cumulative sound exposure accumulated over a 24-hour period ($SEL_{cum,\ 24\ hr}$)

[2]-Behavioral thresholds based on root-mean-square sound pressure levels (SPL_{rms})

The physiological and behavioral impacts on marine mammals due to underwater continuous noise from the SFWF inter-array installation are expected to be ***short-term*** and ***negligible*** to ***minor***. Injuries to marine mammals from underwater noise from DP thrusters, are unlikely because of short distances from the sound source to physiological thresholds, the relatively low density of mammals expected to occur in the region, and the short duration of the activity. For those few individuals in the vicinity that could be at risk of exposure to noise levels over the behavioral threshold, it is likely that other non-project-related noises from vessel traffic would interfere or interact, making it very uncertain if marine mammals will experience behavioral impacts from DP thruster operations or other sound sources. For those very few individuals that may perceive the continuous noise from the thrusters, they might experience short-term disruption of communication or echolocation from auditory masking; behavior disruptions; or limited, localized, and short-term displacement from ensonfied areas around the vessels.

Discharges and Releases / Trash and Debris

During construction of the SFWF, sanitary and other waste fluids, trash, and miscellaneous debris will be generated but properly managed in accordance with federal and state laws. Accidental discharges, releases, and disposal do represent a risk factor to marine mammals because they could potentially ingest or become entangled in debris, causing lethal or injurious impacts. As explained in Sections 4.1.5. and 4.1.6., the total quantities of hazardous and nonhazardous materials would be small and strictly managed. An OSRP (Appendix D) has been developed describing the procedures to be employed when responding to an oil spill, or the substantial threat of an oil discharge from any SFWF or SFEC component. SFW and its contractors will also maintain SPCC plans during construction. Therefore, impacts on marine mammals from discharges, releases, trash, and debris are considered ***negligible*** because of the low likelihood of such routine and accidental events.

Vessel Traffic – Strikes

Short-term construction vessel traffic will occur over a 1- to 2-year period. Project-related vessel traffic will slightly increase vessel traffic within the area, but the number of vessels that operate for SFWF construction and decommissioning is expected to be a ***negligible*** addition to the normal traffic in the region (Appendix X, SFWF Navigational Safety Risk Assessment). Vessel collisions with marine mammals is not uncommon, and if they were to occur, would likely result in animal injury or death.

Vessel strikes happen when either whales or vessels fail to detect one another in time to avoid the collision. Variables that contribute to the likelihood of a collision include vessel speed, vessel size and type, and visibility. Marine mammal strikes have been reported at vessel speeds of 2 to 51 knots, and lethal or severe injuries are most likely to occur at speeds of 14 knots or more (DOI-MMS, 2007). Vessel types involved include Navy vessels, container and cargo ships, freighters, cruise ships, and ferries. Generally, the larger the vessel size (262 feet [80 m] or more), the more likely a collision will result in fatal or severe injuries (DOI-MMS, 2007).

Whale species that are most frequently involved in vessel collisions include fin whale, North Atlantic right whale, humpback whale, minke whale, sperm whale, sei whale, gray whale, and blue whale (Dolman et al., 2006). Smaller cetaceans and pinnipeds are also at risk of vessel strikes; however, these species tend to be more agile power simmers and are more capable of avoiding collisions with oncoming vessels (DOI-MMS, 2007).

Construction vessel traffic will result in a relatively ***short-term*** and ***localized impact*** around the SFWF, increasing the volume and movement of vessels in the SFWF. Large work vessels for foundation and WTG installation will generally transit to the work location and remain in the area until installation is complete. These large vessels will move slowly and over a short distance between work locations. Transport vessels will travel between several ports and the SFWF over the course of the construction period. These vessels will range in size from smaller crew transport boats to tug and barge vessels. Dependent on the time of year, the Project-related increase in vessel traffic will be ***negligible*** when compared to other vessel operations within the area.

To mitigate marine mammal vessel strikes, SFW will abide by vessel strike avoidance measures based on NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* (2008). Adherence to these provisions would further reduce the risk of associated vessel strikes or disturbance to marine mammals that might result from the proposed SFWF construction activity. It is not anticipated that the SFWF would cause a significant increase in frequency of vessel collisions to marine mammals; therefore, impacts caused by construction vessels would be considered ***minor***. However, because of low population estimates for threatened and endangered whale species that may occur in the area, vessel collisions could be detrimental to their population; therefore, impacts to ESA-listed species would be considered ***moderate***.

Entanglement of marine mammals can occur from the Project vessel traffic if lines, cables, or other tethered gear are placed in the water. However, since the only lines that will potentially be deployed would be steel anchor lines that will be under significant tension and short-term, it would be highly unlikely that marine mammals would become entangled. Therefore, the expected impact to marine mammals from entanglement would be ***negligible***.

Lighting

Artificial lighting during SFWF construction will be associated with navigational and deck lighting on vessels from dusk to dawn. It is likely that reaction of marine mammals to this artificial light is species-dependent and may include attraction or avoidance of an area. Because of the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for marine mammals during construction.

Visible Structures

Vessels, equipment, and structural elements used during SFWF and SFEC construction will be present for a limited time and only from certain locations on the OCS, Long Island, and the ports to be used during construction. If and how marine mammals perceive the physical presence of these vessels or structures is not well understood. However, the temporary nature of these sources during construction have such a ***negligible*** anticipated impact on resources that they are not considered further in this discussion.

Operations and Maintenance

Table 4.3-25 summarizes the level of impacts expected to occur to marine mammals during the O&M phase of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-25. IPFs and Potential Levels of Impact on Marine Mammals at the SFWF during Operation and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Seafloor Disturbance	Foundations	Negligible long-term indirect
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Continuous Mechanical Noise	Minor to Moderate long-term
EMF		Negligible localized
Traffic	Collision	Negligible short-term localized
Discharges and Releases [a]		Negligible short-term
Trash and Debris [a]		Negligible short-term
Visible Structures	Physical presence; impediment to navigation	Negligible localized
Lighting		Negligible short-term

[a] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

The installation of the foundations and resulting conversion of existing sandy bottom to hard bottom habitat may produce a "reef effect" that will attract benthic and pelagic fish species similar to those found in rocky/reef outcrop habitat (Wilhelmsson et al., 2006; Reubens et al., 2007). This could potentially lead to an increased number of marine mammals using this habitat for foraging. Russel et al (2014) observed harbor and grey seals displaying concentrated foraging efforts around windfarms with site fidelity indicating successful foraging behavior. Impacts from the conversion of habitat to hard bottom would have measurable but not adverse impacts on only a few marine mammal species and are therefore expected to be ***negligible, long-term*** and ***indirect*** based on the pre-defined impact characterizations in Section 4.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M will primarily result from vessel anchoring and any maintenance activities that will require exposing the Inter-array Cable. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during SFWF O&M are expected to be similar to vessel-related sediment suspension and deposition impacts described for the construction phase.

Underwater Noise

Operating WTGs produce mechanical noise that transmits underwater through the towers and pilings, resulting in continuous underwater sounds. The frequency and sound level generated from operating WTGs depends on WTG size, wind speed and rotation, foundation type, water depth, seafloor characteristics, and wave conditions (Miller et al., 2010). Underwater noise from turbines has been measured within the hearing frequency of marine mammals; but at the anticipated levels, the impacts would be limited to audibility and perhaps some degree of behavioral response or auditory masking, (DOI-MMS, 2007). Behavioral responses include changes in foraging, socialization, or movement, while auditory masking could impact foraging and predator avoidance. Estimated underwater sound levels are summarized in Section 4.1.3, which reference sources that WTG sounds have been documented to range from 90 to 128 dB re 1 μPa in relative proximity (150 to 350 feet [46 to 107 m]) to operational turbines.

It is presumed that although wind turbine noise during O&M will persist for longer periods of time and potentially expose a higher number of individuals to increased noise levels, compared to noise produced by construction (DOI-MMS, 2007), the impacts to marine mammals during O&M will be smaller than during the construction phase (Scheidat et al., 2011). Studies conducted on the harbor seal indicate that abundance may be reduced during the construction phase, but that population sizes during the operational phase can return to preconstruction levels (Vellejo et al., 2017).

Additionally, Scheidat et al. (2011) indicated that harbor porpoise population sizes can be higher within wind farms compared to reference areas. Reasons for this may be an increased food supply (Vellejo et al., 2017) or habituation to the noise produced from turbines (Teilmann and Carstensen, 2012). Operational wind turbines sampled are only audible to harbor porpoises at distances of 207 feet (63 m) or less (English et al., 2017). Underwater noise during O&M is anticipated to result in ***minor*** impacts to marine mammals, if long-term avoidance behaviors by marine mammals result in potential abandonment of feeding grounds or migratory routes near the SFWF, then ***long-term, minor*** to ***moderate impacts*** could be expected.

Electromagnetic Field

Available evidence for marine mammals does not indicate that these species are capable of detecting the magnetic fields associated with the Project's 60-Hz AC cables. In particular, marine mammal surveys conducted at offshore windfarm sites indicate no adverse long-term impacts to these species. Appendix K has a more detailed discussion about the potential impacts of EMF on marine mammals. EMF is expected to be present near the cable, and marine mammals must surface to breathe. So, such behavior is expected to limit time spent near cables. Furthermore, the broad scale of marine mammal migrations and the generally low density of individuals within a given area are also expected to lower the likelihood that individuals will regularly encounter the cable route and Project-associated EMF. This broad distribution and movement means that the SFWF represents a small portion of the available habitat for migratory marine mammals. ***Negligible impacts*** from EMF during O&M are expected.

Vessel Traffic

The potential impacts of vessel collision during O&M on marine mammals would be less than those identified in the construction phase of the SFWF because the volume of vessel traffic will be much less than traffic experienced during construction, and negligibly contribute to existing vessel traffic in the area. Vessel strike impacts during SFWF O&M are anticipated to be ***negligible***.

Visible Structures

Structural elements of the SFWF will be present for the O&M life of the project. If and how marine mammals perceive or avoid the physical presence of the structures is not well understood. However, only ***negligible*** anticipated impacts on marine mammals due to the physical impediments to their movements is assumed.

Lighting

Artificial lighting during O&M will be associated with O&M vessels, the WTGs, and the OSS. Lighting on the WTG foundations and the OSS will be coordinated with the USCG to ensure it meets appropriate safety standards and to minimize potential impacts on marine organisms. It is likely that reaction of marine mammals to this artificial light is species-dependent and may include attraction or avoidance of an area. Because of the limited area associated with the artificial lighting used on Project vessels, the WTGs, and the OSS relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for marine mammals during O&M.

Decommissioning

During decommissioning activities, marine mammals could be impacted by underwater noise generated by the dismantling of the WTGs and potential collisions with the decommissioning vessels. Decommissioning would conceptually reverse the sequence of construction steps to dismantle or remove the SFWF. Decommissioning activities resulting in underwater noise and vessel traffic are expected to be less intensive than the activities associated with the construction phase of the Project. A more detailed description of decommissioning activities is provided in Section 3.1.6. Impacts to marine mammals would be considered ***negligible***.

South Fork Export Cable

Construction, O&M, and decommissioning activities associated with the SFEC have the potential to impact marine mammals. This section summarizes the potential impacts on marine mammals from activities associated with the SFEC. IPFs that could have more than negligible impacts include underwater noise and vessel traffic. Impacts associated with each phase of the SFEC are addressed in the following sections.

SFEC - OCS and SFEC - NYS

Construction

Table 4.3-26 summarizes the level of impacts expected to occur to marine mammals during the construction and decommissioning phases of the SFEC. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-26. IPFs and Potential Levels of Impact on Marine Mammals at the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Cable Installation	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Installation of Cable	Negligible to Minor short-term
	Vibratory Hammering of Sheet Piles for Cofferdam	Negligible short-term
Discharges and Releases		Negligible short-term
Trash and Debris		Negligible short-term
Traffic	Increased Vessels	Negligible short-term localized
Lighting		Negligible short-term localized

Seafloor Disturbance

Seafloor disturbance associated with installation of the SFEC may impact marine mammals. Impacts are considered ***short-term*** and ***negligible*** for similar reasons as described for seafloor disturbances from SFWF construction.

Sediment Suspension and Deposition

As previously discussed for SFWF construction, impacts to the few marine mammals that may be located near the cable installation activities that could be exposed to sediment suspension are expected to be ***localized, short-term,*** and ***negligible***.

Underwater Noise

As described for the SFWF Inter-array Cable, the impacts of underwater noise generated from Project construction vessels, including the use of DP thrusters, on marine mammals are expected to be ***short-term*** and ***negligible***. ***Short-term, minor*** behavioral impacts can also occur during SFEC installation if marine mammals are exposed to the nonimpulsive sound generated by the DP thrusters. However, the likelihood of measurable impacts to marine mammals is considered very low because SFEC installation will occur over a relatively short timeframe; along a relatively narrow swath of ocean, and depending on the time of year of installation, few marine mammals would be expected in the region. As the cable-laying operation enters SFEC - NYS waters, the likelihood of impact decreases with the lower occurrence of marine mammals in nearshore waters, with the possible exception of some dolphins, porpoises, and seals, which may be found closer to shore on a seasonal basis.

Construction of a temporary cofferdam will be required for the nearshore SFEC connection and will require vibratory hammering and subsequent vibratory removal of sheet piles. This construction method differs from the pile driving associated with the SFWF foundations in several ways. The location is close to shore, the duration of the installation and removal is estimated to be short (roughly 12 to 24 hours for each activity), and the source type is nonimpulsive, compared to impulsive for the SFWF pile driving. Predicting marine mammal exposure estimates resulting from vibratory pile driving is complicated by the location, short duration of cofferdam installation, large behavioral isopleths created by a low acoustic threshold, and static species density data that are not indicative of animals transiting the near shore environment. No injury-level exposures are expected from vibratory pile driving due to the small isopleths in the case of MFC, HFC, and PPWs and due to the short duration of activity and low densities of LFC indicating that 24-hour duration exposures (required to meet the threshold) would not be achieved.

As detailed in Appendix P, the large behavioral isopleth for marine mammals (~36 km) is the result of a very conservative, and likely outdated, regulatory SPL_{rms} threshold of 120 dB re 1 μPa. This exaggerated isopleth suggests that all species within it will experience behavioral impacts from project-related non-impulsive noise, which is very likely not the case and ignores the complexity of factors involved for a receptor or group of receptors to be exposed to any one sound source in the ocean.

In the event that marine mammals were in the vicinity of the cofferdam installation during the limited construction period, the near-shore setting of the sound source and the masking effects of other non-project-related sounds diminishes the likelihood that marine mammals would be exposed solely to vibratory hammer noises resulting in physiological or behavioral impacts. For those very few individuals that may perceive the continuous noise from the vibratory hammering, they might experience short-term disruption of communication or echolocation from auditory masking; behavior disruptions; or limited, localized, and short-term displacement from ensonfied areas around the nearshore cofferdam. Therefore, marine mammal impacts from vibratory hammering of sheet piles for the SFEC cofferdam are expected to be ***short-term*** and ***negligible***.

Discharges and Releases / Trash and Debris

The potential for marine mammal exposure and impacts from routine and nonroutine discharges, releases, trash, and debris will be similar to those identified in the SFWF.

Traffic

The potential impacts of vessel traffic on marine mammals would be similar to those discussed above for the SFWF; however, the occurrence of impacts would be less likely because fewer vessels are required for SFEC installation. As the SFEC installation activity approaches the landing site in the SFEC - NYS, few marine mammals are expected in the area because of the shallow water.

Lighting
Artificial lighting during construction of the SFEC will be associated with navigational and deck lighting on vessels from dusk to dawn. Because of the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for marine mammals during construction.

Operations and Maintenance

Table 4.3-27 summarizes the level of impacts expected to occur to marine mammals during the O&M phase of the SFEC. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-27. IPFs and Potential Levels of Impact on Marine Mammals at the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Seafloor Disturbance	Potential SFEC Maintenance	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Vessel Noise	Negligible short-term localized
EMF		Negligible localized
Traffic	Collision	Negligible short-term localized
Discharges and Releases [a]		Negligible short-term
Trash and Debris [a]		Negligible short-term
Lighting		Negligible short-term localized

[a] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1

Seafloor Disturbance
Maintenance of the SFEC is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the SFEC are expected to be similar but less frequent to those described for the construction/installation phase.

Sediment Suspension and Deposition
Increases in sediment suspension and deposition during O&M of the SFEC will primarily result from vessel anchoring and any maintenance activities that will require exposing the SFEC. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during O&M of the SFEC are expected to be similar to vessel-related sediment suspension and deposition impacts described for the SFEC construction phase, but less frequent and at a smaller scale.

Noise
Direct impacts to marine mammals associated with noise during O&M of the SFEC may occur associated with vessels. Impacts from vessel noise during O&M of the SFEC are expected to be similar to vessel noise impacts described for the SFWF construction, but at a smaller scale.

Electromagnetic Fields
The potential EMF impacts from the SFEC on marine mammals is similar to that described for the SFWF Inter-array Cable. Impacts to marine mammals relating to the EMF emitted from the SFEC will be ***negligible*** because of the low density of marine mammals in the water, their habit of surfacing for air, and the relatively narrow corridor occupied by the SFEC.

Traffic

The potential impacts of vessel collision will be similar to those identified in the SFWF.

Lighting

Artificial lighting during O&M will be associated with O&M vessels. Because of the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for marine mammals during O&M.

Decommissioning

Impacts expected to marine mammals would be similar to impacts during installation, assuming that similar vessels are used for the removal activity.

4.3.4.3 Potential Environmental Protection Measures

Environmental protection measures will be implemented to minimize impacts on marine mammals to the maximum extent possible, including the use of noise attenuation and ramp-up, soft-start, and shutdown pile-driving procedures. SFW will consider the use of technically and commercially feasible noise attenuation technology. SFW has also developed a protected species mitigation and monitoring plan (Appendix P3).

Several environmental protection measures will reduce potential impacts to marine mammals.

- Exclusion and monitoring zones for marine mammals will be established for pile driving activities and HRG survey activities.
- Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate.
- Impact pile driving activities will not occur at the SFWF between January 1 and April 30 to minimize potential impacts to the North Atlantic right whale, which will have a protective effect for other marine mammal species.
- Vessels will follow NOAA guidelines for marine mammal strike avoidance measures, including vessel speed restrictions.
- All personnel working offshore will receive training on marine mammal awareness and marine debris awareness.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).

SFW intends to comply with federal regulations and guidelines to avoid and minimize impacts to marine mammals and has identified several potential measures based on protocols and procedures that have been successfully implemented for similarly approved offshore projects for marine mammals and other protected marine species.

4.3.5 Sea Turtles

The description of the affected environment of sea turtles, including documentation of regional occurrences and Project-related impact evaluation provided in this section, are based on the most recent literature and studies available that focus on renewable energy sites in the Mid-Atlantic and New England regions, including the Massachusetts Wind Energy Area (WEA), RI-MA WEA, OSAMP area, and the New York Offshore Planning Area. Studies encompassing these areas that were used for this assessment include the NOAA NEFSC's Atlantic Marine Assessment Program for Protected Species (AMAPPS) (Palka, 2010, 2011, 2012, 2013, 2014, and 2015), the *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles* (Kraus et al., 2016), Remote Marine and Onshore Technology surveys for NYSERDA (Normandeau, 2016a, 2016b, 2017a, 2017b, 2017c, and 2018) and a technical report, *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Management Area Plan* (Kenney and Vigness-Raposa, 2010). In support of this impact evaluation, SFW has completed a comprehensive underwater acoustic modeling effort (Appendix J1) and a detailed impact assessment for marine mammals, sea turtles, and sturgeon, including animal movement modeling as it relates to exposures to project-related underwater noise (Appendix P2).

4.3.5.1 Affected Environment

There are four sea turtle species that are commonly found throughout the western North Atlantic Ocean and may occur in the SFWF and SFEC Project areas. These species are the green sea turtle (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and loggerhead sea turtle (*Caretta caretta*). A fifth species, hawksbill sea turtle (*Eretmochelys imbricata*), may potentially occur within the region. However, it is considered extremely rare because this species is commonly found in tropical waters and coral reef habitats (GARFO, 2017). The four turtle species included in this COP section are listed as endangered or threatened. The USFWS and NMFS share the responsibility for sea turtle recovery under the authority of the ESA.

Table 4.3-28 lists the sea turtles that may occur within the vicinity of the SFWF and SFEC. Appendix P1 provides additional information on the distribution and ecology of listed turtle species relevant to this discussion. The northeast coast, including areas around Long Island, contains a variety of marine habitats that are suitable for these sea turtles, such as shallows, enclosed waters of the Peconic, and the southern bays and the deeper waters of Long Island Sound and the Atlantic Ocean (Burke et al., 1993). In offshore and coastal waters of New York, the four species of sea turtles, loggerhead, green sea turtle, Kemp's ridley, and leatherback, have been recently documented predominantly in the summer and fall by the NYSERDA Digital Aerial Baseline Surveys (Normandeau, 2016a, 2016b, 2017a, 2017b, 2017c, and 2018). Winter turtle strandings have been documented on Long Island, although surveys of the waters north of the SFWF have not recorded turtle observations in the winter (Kraus et al., 2016).

Table 4.3-28. Sea Turtles That Occur within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Status[a]	Seasonal Presence in SFWF and SFEC[b, c]
Green Sea Turtle (North Atlantic DPS)	Threatened	Summer, fall
Kemp's Ridley Sea Turtle	Endangered	Summer, fall
Leatherback Sea Turtle	Endangered	Summer, fall
Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)	Threatened	Summer, fall

[a] ESA
[b] GARFO, 2017

Table 4.3-28. Sea Turtles That Occur within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Status[a]	Seasonal Presence in SFWF and SFEC[b, c]

[c] Kraus et al., 2016; Palka, 2010, 2011, 2012, 2013, 2014, 2015, and 2016; Palka et al., 2016; and Normandeau, 2016a, 2016b, 2017a, 2017b, 2017c, and 2018

Appendix P2 includes the results of the animal movement modeling completed in support of the impact assessment for marine mammals and sea turtles. The model considered sea turtle density estimates derived from SERDP-SDSS NODE database (http://seamap.env.duke.edu/serdp). Loggerhead, Kemp's ridley, and leatherback turtles are common visitors to the SFWF and SFEC Project area. The loggerhead and leatherback are the species that are expected to occur in higher densities offshore, while Kemp's ridley turtles would be more likely to occur nearshore of the SFEC and not as likely offshore near the SFWF.

4.3.5.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to impact sea turtles depending on when and where impact-producing activities occur. A review of the IPFs for sea turtles associated with the SFWF and SFEC is presented on Figure 4.3-12. The IPFs with potential to result in negligible or greater impacts on sea turtles are discussed in this section and in detail in Appendix P.

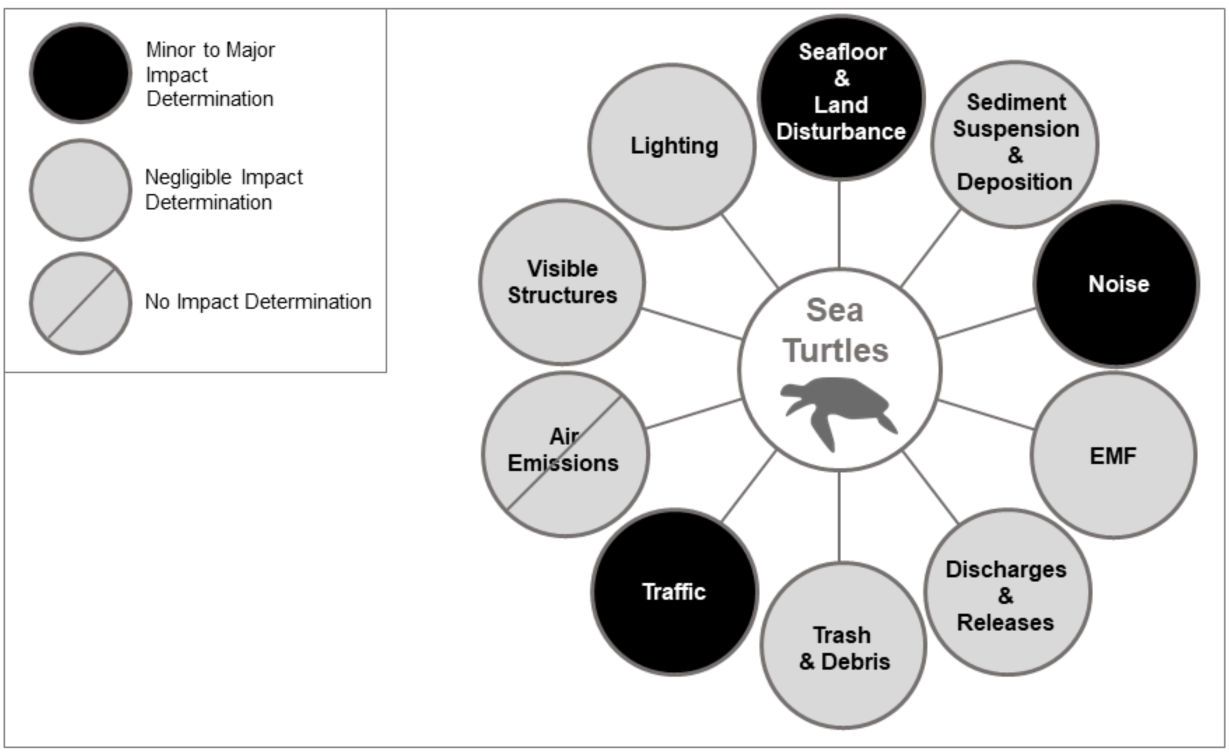

Figure 4.3-12. IPFs on Sea Turtles
Illustration of potential impacts to sea turtles resulting from SFWF and SFEC activities

South Fork Wind Farm

This section provides an overall assessment of potential impacts on sea turtles from the SFWF that is further explored in Appendix P. The primary IPFs associated with the SFWF that will result in minor to moderate impacts to sea turtles are underwater noise from construction, seafloor disturbance and vessel traffic. Other IPFs considered but anticipated to have negligible or no impacts to sea turtles are sediment suspension and deposition, EMFs, discharges and releases, trash and debris, visible structures, and lighting. The potential impacts associated with each phase of the SFWF are addressed separately in the following sections.

Construction

Table 4.3-29 provides a summary of the IPFs and potential levels of impact on Sea Turtles during Construction and Decommissioning.

Table 4.3-29. IPFs and Potential Levels of Impact on Sea Turtles at the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Seafloor Preparation	Negligible short-term localized
	Foundation Installation	Negligible short-term localized
	Vessel Anchoring	Negligible short-term localized
	Inter-array Cable Installation	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Pile Driving	Minor to Moderate short-term
	Equipment Uses	Negligible short-term localized
	Vessel Traffic	Negligible short-term
Discharges and Releases		Negligible indirect
Trash and Debris		Negligible indirect
Traffic	Collision	Minor to Moderate short-term localized
	Entanglement	Negligible short-term localized
Visible Structures	Physical structure; navigation impediment	Negligible indirect localized
Lighting	Navigational and Deck Lighting	Negligible short-term localized

Seafloor Disturbance

During construction, seafloor disturbances will be associated with seafloor preparation, foundation installation, vessel anchoring, and cable installation. Sea turtles occurring in the SFWF will likely be transiting the area in search of prey species, some of which could be benthic species. In the unlikely event that leatherback or loggerhead sea turtles forage on the seafloor in the SFWF and could be displaced from those areas because of SFWF construction, the impacts will be ***negligible*** because they are limited to those few impacted individuals and not groups or populations of turtles.

Sediment Suspension and Deposition

As discussed in Section 4.1 and again in Section 4.2.2, SFWF construction activities will result in short-term, localized increases in sedimentation in the water column (i.e., increased turbidity) and consequent impacts to the quality of the water column. Because of the relatively low anticipated densities of sea turtles in the SFWF, and the momentary and localized increases in turbidity and decreases in water quality from SFWF Inter-array Cable installation, ***negligible impacts*** are anticipated to the few leatherback or loggerhead sea turtles occurring near the cable installation activities.

Noise

Sea turtles may be impacted by underwater sounds produced during the construction of the SFWF with the potential for physiological and behavioral effects. Impacts of sound on sea turtles are largely unknown because of a lack of information on hearing capabilities and behavioral responses to sound. However, the data available suggest that sea turtles can detect and behaviorally respond to acoustic stimuli (Dow Piniak et al., 2012a). A detailed explanation of underwater noise impacts on sea turtles is provided in Appendix P, with an overview of the primary issues provided in this section.

A few experimental studies have been conducted on the hearing capabilities of green sea turtles, loggerhead sea turtles, Kemp's ridley sea turtles, and leatherback sea turtles; however, the frequency ranges vary per species. Based on Bartol et al. (1999), juvenile loggerheads respond to click stimuli with a mean threshold of -10.8 dB re 1-gram (g) rms ± 2.3 dB standard deviation (SD). The hearing range from tone bursts was 250 to 750 Hz. The lowest frequency tested was 250 Hz, with a mean threshold of -23.3 dB re: 1 g rms ± 2.3 dB SD.

Bartol and Ketten (2006) measured the auditory evoked potentials (AEPs) of two Atlantic green sea turtles and six sub-adult Pacific green turtles. Sub-adults were found to respond to stimuli between 100 and 500 Hz, with a maximum sensitivity of 200 and 400 Hz. Juveniles responded to stimuli between 100 and 800 Hz, with a maximum sensitivity between 600 and 700 Hz.

Martin et al. (2012) recorded the AEPs of one adult loggerhead sea turtle. The loggerhead responded to frequencies between 100 and 1131 Hz, with greatest sensitivity between 200 and 400 Hz. This limited research indicates that sea turtles are capable of hearing LF sounds with some variation depending on size, age, and species.

In two separate studies conducted in 2012, Dow Piniak et al. recorded AEPs of turtles in air and underwater. Dow Piniak et al. (2012b) found that the AEPs of juvenile green turtles were between 50 and 1600 Hz in water, and 50 and 800 Hz in air; with ranges of maximum sensitivity between 50 and 400 Hz in water, and 300 and 400 Hz in air. Sensitivity decreased sharply after 400 Hz in both media. Dow Piniak et al. (2012a) found that hatchling leatherback sea turtles responded to stimuli between 50 and 1200 Hz in water, and 50 and 1600 Hz in air. The maximum sensitivity was between 100 and 400 Hz in water, and 50 and 400 Hz in air. These studies show that turtle hearing is more suited to underwater than in air.

Limited research has been conducted on the physiological impacts of underwater or in-air sound on sea turtles, and very few data are available on the behavioral responses of sea turtles to sound. The few studies that are available only examine the behavioral responses of loggerhead and green sea turtles to underwater sound produced by seismic guns. Behavioral responses observed during seismic surveys included avoiding the source of the sound (O'Hara and Wilcox, 1990), startled reactions (DeRuiter and Doukara, 2012), and increased swimming speed (McCauley et al., 2000). Other possible behavior responses could include increased surfacing time and decreased foraging. McCauley et al. (2000), reported that source levels of 166 dB re 1 μPa rms were required to induce behavioral reactions of sea turtles.

NOAA has not established formal acoustic thresholds for behavioral harassment or injury for sea turtles. As explained in the animal movement modeling report in Appendix P2, BOEM and NOAA have adopted the injury thresholds based on the dual criteria of peak pressure and accumulated sound energy reported by Popper et al. (2014) and the behavior thresholds developed by the Fisheries Hydroacoustic Working Group (FHWG, 2008) and U.S. Navy (Blackstock et al., 2017). Table 4.3-30 summarizes the agency-adopted acoustic thresholds for sea turtles, which are used to evaluate noise impacts to sea turtles from impulsive sounds generated by impact pile driving and nonimpulsive sounds generated by DPV thrusters and vibratory hammering.

Table 4.3-30. Physiological and Behavioral Threshold Criteria for Impulsive and Nonimpulsive Sounds for Sea Turtles

Faunal Group	Sound Source Type	Injury Criteria Metric	Physiological Threshold	Behavior Criteria Metric	Behavioral Threshold
Sea Turtles	Impulsive sounds	SPL_{pk}	232 dB re 1 μPa	SPL_{rms}	175 dB re 1 μPa
		$SEL_{cum,\ 24hr}$	204 dB re 1 μPa^2 s		
	Nonimpulsive sounds	SPL_{rms}	180 dB re 1 μPa	SPL_{rms}	175 dB re 1 μPa

Source: FHWG, 2008; Popper et al., 2014; Blackstock et al., 2017.

Underwater acoustic modeling was conducted to estimate the impacts produced from construction-related, noise-producing activities, such as pile driving, vibratory pile driving, and DPV thrusters. Dependent on many factors as detailed in the underwater acoustic modeling study (Appendix J1) and sea turtle impact assessment (Appendix P1), elevated underwater SPLs may impact sea turtles. Pile driving and DPV thruster usage are identified as the activities that will likely have the greatest potential for impacts on sea turtles. As discussed in the IPF section (Section 4.1), above-water noise impacts on sea turtles during construction will result in negligible impacts because sea turtle exposures to underwater noises are more probable and impact-producing by comparison. Therefore, the potential for above-water noise impacts to sea turtles is not further discussed in this assessment of impacts.

Impulse Sound – Impact Pile-driving

Underwater noise from the impulsive sounds generated by impact pile driving is considered an important IPF in potential physiological and behavioral impacts to sea turtles. The assessment of potential acoustical impacts to sea turtles was completed based on the results of underwater acoustic modeling and animal movement modeling studies specific to proposed SFWF and SFEC construction activities. Appendix J1 provides predicted sound propagation distances based on key construction variables associated with the SFWF and SFEC design envelope, such as: hammer type, pile type, pile schedule (hammer energy/number of strikes/piling duration), season, geographic location, and implementation of noise mitigation (i.e., sound attenuation) measures. Appendix P2 provides a summary of the animal movement modeling and impact assessments based not only on underwater sound characteristics but the marine environment, autecological characteristics of at-risk species, mitigation factors, and animal behavior.

Based on the results of the underwater noise modeling and animal noise exposure estimates, impacts to sea turtles during pile driving for the SFWF would likely be ***minor*** to ***moderate***. Modeled impact pile driving at SFWF resulted in a mean exposure range of 39 feet (12 m) for kemps ridley sea turtles, 167 feet (51 m) for leatherback sea turtles, and 587 feet (179 m) loggerhead sea turtles, defined as the minimum SEL_{cum} accumulated over a 24-hour period that could potentially induce the onset of a mortal injury. The potential for physiological-level acoustic exposures are low even with no sound attenuation. The sea turtle impact assessment determined that seasonality is an important parameter when estimating exposures to potentially harmful underwater noise due to the variable monthly densities of animals in the Project area (Appendix P). With 10 dB noise attenuation, all exposures drop to <1 or fewer individuals (calculated by rounding up any fraction greater than or equal to 0.5) for all species evaluated in Appendix P2 except for leatherback and loggerhead sea turtles.

Sea turtles are not expected to linger within the ensonified area around impact pile driving for durations that would result in a physiological impacts. The maximum distance to SPL_{pk} thresholds representing the greatest potential for instantaneous injury to sea turtles was 260 m, which would be reached only at the highest hammer energy near the end of pile installation (Appendix J1). Due to the placement of sound attenuation devices and general construction activities combined with much smaller impact isopleths for most hammer strikes, sea turtles are not expected to encroach any of the SPL_{pk} isopleths and, therefore, no physiological exposures are expected for sea turtles from impact pile driving.

Modeled behavioral thresholds ranged from 2,825 feet (861 m) with 12 dB attenuation to 8,871 feet (2,704 m) with no attenuation (Appendix J1). There is a likelihood of behavioral threshold exposure and general activity in the area that could result in sea turtles temporarily vacating the SFWF construction area. Exposures to acoustic thresholds are expected to be temporary and not biologically significant.

Nonimpulsive Sound

Commercial and recreational vessels can have varying SPLs dependent on the overall size, engine, propeller size, and configuration. These vessels can create LF noises that can be detected by turtles (Dow Piniak et al., 2012a). While the SPLs created may not directly damage hearing, the presence of vessels within sea turtle habitat may mask important auditory cues (Dow Piniak et al., 2012a). The additional noise from Project-related vessel traffic above the existing vessel-related underwater noise level is not expected to be significant, and the presumption is that individual sea turtles in the SFWF are familiar with various and common vessel-related noises, particularly within trafficked areas of the SFWF and nearby shipping lanes.

The use of DPV thrusters for laying the SFWF Inter-array Cable and SFEC is the vessel-related underwater noise source of concern to sea turtles. The cavitation on the propeller blades of the thrusters generate a continuous or nonimpulsive noise (e.g., Leggat et al., 1981). The noise power from the propellers is proportional to the number of blades, the propeller diameter, and the propeller tip speed. The noise from the DPV thrusters is expected to be more dominant than mechanical or hydraulic noises from the cable trenching equipment.

The hydroacoustic modeling calculations for DPV thruster operations presented in Appendix J1 include two representative locations, offshore and nearshore, for cable laying operations. Underwater noise from DPV thrusters is not expected to injure sea turtles because of the relatively low sound pressure levels and small estimated distances to behavior thresholds. If impacts occur to sea turtles from Project-related vessel noise then they will not be biologically significant and would be limited to short-term disruption and displacement of individuals from localized areas around the vessels. The impacts of underwater sound generated from most Project construction vessels on sea turtles is expected to be ***short-term*** and ***negligible***.

Discharges and Releases/Trash and Debris

During construction of the SFWF, sanitary and other waste fluids, trash, and miscellaneous debris will be generated but properly managed in accordance with federal and state laws. Accidental discharges, releases, and disposal do represent a risk factor to sea turtles because they could potentially ingest or become entangled in debris, causing lethal or injurious impacts. If sea turtles were to be exposed to an oil spill or a discharge of waste material, studies have indicated that respiration, skin, some aspects of blood chemistry and composition, and salt gland function could be significantly impacted (Vargo et al., 1986).

As explained in Sections 4.1.5. and 4.1.6., the total quantities of hazardous and nonhazardous materials will be small and strictly managed. An OSRP (Appendix D) has been developed describing the procedures to be employed when responding to an oil spill, or the substantial threat of an oil discharge from any SFWF or SFEC component. SFW and its contractors will also maintain SPCC plans during construction. Therefore, impacts on sea turtles from discharges, releases, trash, and debris are considered ***negligible*** because of the low likelihood of such routine and accidental events.

Vessel Traffic

Sea turtles swimming or feeding at or near the surface of the water can be vulnerable to boat and vessel strikes. Propeller and collision injuries to sea turtles from boats or vessels are not uncommon (NOAA and USFWS, 1991). It is estimated that approximately 50 to 500 turtle mortalities per year in U.S. waters result from boat collisions (Plotkin, 1995). Vessel strikes happen when either turtles or vessels fail to detect one another in time to avoid the collision. Variables that contribute to the likelihood of a collision include vessel speed, vessel size and type, and visibility.

SFWF construction vessels could potentially collide with sea turtles, which could result in turtle injury or death. In the unlikely event that injury or death were to occur to one of the ESA-listed turtle species as a direct result of SFWF construction activities, these impacts will be considered ***moderate*** because of the conservation status of these species. Construction vessel traffic will be relatively short-term and localized around the SFWF where a concentrated increase in the volume and movement of vessels will occur. Large work vessels for foundation and WTG installation will generally transit to the work location and remain in the area until installation is complete. These large vessels will move slowly and over short distances between work locations. Transport vessels will travel between several ports and the SFWF over the course of the construction period. These vessels will range in size from smaller crew transport boats to tug and barge vessels.

Dependent on the time of year, Project-related vessel traffic will slightly increase within the area, but the number of vessels that operate for SFWF construction and decommissioning is expected to represent a negligible addition to the normal traffic in the region.

Entanglement of sea turtles can occur from Project vessels, especially from lines, cables, anchors, or other gear placed in the water. However, because the only lines that will potentially be deployed will be steel cables that will be under significant tension and short-term, it is highly unlikely that sea turtles will become entangled. Therefore, the expected impact to sea turtles from entanglement from SFWF construction activities will be ***negligible***.

Visible Structures

Vessels, equipment and structural elements used during SFWF and SFEC construction will be present for a limited time and only for certain locations on the OCS, Long Island, and the ports to be used during construction. If and how sea turtles perceive the physical presence of these vessels or structures is not well understood; however, the potential beneficial habitat alterations are discussed under "Seafloor Disturbance." The temporary nature of these sources during construction are expected to have a ***negligible*** anticipated impact on resources and they are not considered further in this discussion.

Lighting

Artificial lighting during SFWF construction will be associated with navigational and deck lighting on vessels from dusk to dawn. Reaction of sea turtles to this artificial light is dependent on species-specific and environmental factors that are impossible to predict but likely are to include attraction or avoidance of a lighted area. Because of the low anticipated density of sea turtles in the area and the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for sea turtles during construction.

Operations and Maintenance

Table 4.3-31 summarizes the level of impacts expected to occur to sea turtles during the O&M phase of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-31. IPFs and Potential Levels of Impact on Sea Turtles at the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Seafloor Disturbance	Foundations	Minor long-term indirect

Table 4.3-31. IPFs and Potential Levels of Impact on Sea Turtles at the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Continuous Mechanical Noise	Negligible short-term localized
EMF		Negligible localized
Traffic	Collision	Negligible localized
Discharges and Releases [a]		Negligible short-term
Trash and Debris [a]		Negligible short-term
Visible Structures	Physical presence; impediment to navigation	Negligible localized
Lighting		Negligible short-term

[a] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

The construction of the SFWF will create hard-bottom habitats as discussed in Section 4.3.2 that will benefit sea turtles. Sea turtles have been observed within the vicinity of offshore structures, such as oil platforms (i.e., visible structures). High concentrations of sea turtles have been reported around these oil platforms NRC, 1996). During a surface survey at a platform off the coast of Galveston, Texas, approximately 170 sightings were reported (Gitschlag, 1990). Sea turtles use these offshore structures as areas to rest, seek refuge, and feed (NRC, 1996). It is estimated that offshore petroleum platforms in the Gulf of Mexico, provided an additional 2,000 square miles (5,180 km^2) of hard bottom habitat (Gallaway, 1981). For sea turtles visiting the SFWF mainly in the summer and fall, created habitat could result in a benefit to those individual turtles.

The potential "reef effect" caused by the introduction of a new hard bottom habitat in this area is expected to attract numerous species of algae, shellfish, finfish and sea turtles to this site (Wilhelmsson et al., 2006; Reubens et al., 2013). For sea turtles, artificial reefs can provide multiple benefits including foraging habitats, shelter from predation and strong currents, and methods of removing biological build-up from their carapace (NRC 1996; Barnette 2017). The increased fish activity is also expected to attract commercial and recreational fishing to the area, which could pose an ***indirect*** threat to sea turtles through entanglement or ingestion of fishing gear. Greater fishing effort around this site would increase the amount of equipment in the water increasing the risk of sea turtles ingesting or becoming entangled in this discarded equipment (Barnette 2017). Due to the current status of local sea turtles and the likelihood of increased fishing effort around the windfarm, the potential impacts are anticipated to be ***minor*** and ***long-term.***

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M will primarily result from vessel anchoring and any maintenance activities that will require exposing the Inter-array Cable. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during SFWF O&M are expected to be similar to vessel-related sediment suspension and deposition impacts described for the construction phase.

Noise

Operational WTGs have the potential to produce underwater sound levels of 90 to 115 dB at a distance of 351 feet (110 m) in moderate winds and frequencies of 20 to 1,200 Hz, with peak levels at 50, 160, and 200 Hz (Thomsen et al., 2006). Potential impacts from operational noise produced by the turbines may include avoidance of the SFWF, disorientation, and disruption of feeding behaviors (BOEM, 2007). In contrast to the short-term duration of construction activities, noise generated during normal operation will be long-term over the operational life of the Project (i.e., 25 to 30 years). Adults and juveniles have strong enough swimming abilities to avoid the operational noises of a wind project, but hatchlings passively traveling through a wind project on currents may not be able to actively leave, thus subjecting them to long-term exposure to turbine noise (BOEM, 2007). The impacts of long-term noise exposure on sea turtles is generally unknown; however, because the sound levels produced during operation are less than the behavioral and physiological thresholds for sea turtles impacts to sea turtles are expected to be ***negligible***.

Electromagnetic Field

Sea turtles are highly migratory species and undergo trans-oceanic migrations during certain periods of their lives. Hatchlings swim from beaches into open ocean, juveniles migrate to and from seasonal habitats, and adults will leave feeding grounds to mate and migrate back to their natal beaches (Lohmann et al., 1999). To navigate and orient themselves, sea turtles are known to use the earth's magnetic fields. Sea turtles possess the ability to detect two different features of the geomagnetic field, including inclination angle and intensity (Lohmann and Lohmann, 1994). These fields vary across the earth's surface, and turtles can derive positional information from these fields.

It is theorized that sea turtles use these fields in two different ways (1) as a magnetic compass, for directional sense that enables them to establish a heading and maintain their course; and (2) for positional information, where turtles can approximate their position within the ocean (Lohmann and Lohmann, 1996). Multiple studies have demonstrated magneto-sensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 microteslas (μT) and 29.3 to 200 μT for loggerheads and green turtles, respectively (Normandeau, 2011).

Despite the potential for sea turtle orientation to be impacted by specific magnetic fields, available evidence for sea turtles does not indicate that these species are capable of detecting the magnetic fields associated with the Project's 60-Hz AC cables. Luschi et al. (1996) placed magnets on the head of sea turtles to mask the earth's magnetic fields from the sea turtles. Results showed that sea turtles with the magnets were still capable of returning home; however, their routes were less direct than the control (Normandeau, 2011; Luschi et al., 1996). Appendix K provides a more detailed discussion about the potential impacts of EMF on sea turtles.

Sea turtles could encounter EMF from the SFWF Inter-array Cable if feeding on benthic organisms in the SFWF at the sediment surface above the cable. Because these species must surface to breathe, such behavior is expected to limit time spent near cables. Furthermore, the broad scale of sea turtle migrations and the generally low density of individuals within a given area are also expected to lower the likelihood that individuals will regularly encounter the cable route and Project-associated EMF. This broad distribution and movement means that the SFWF represents a very small portion of the available habitat for migratory sea turtles. The impact of EMF on sea turtles during O&M is anticipated to be ***negligible***.

Traffic

The potential impacts of vessel collision on sea turtles will be less than those identified in the construction phase of the SFWF because the infrequent vessel traffic that will negligibly contribute to existing vessel traffic in the area. Vessel strike impacts on sea turtles during SFWF O&M are anticipated to be ***negligible***.

Visible Structures

Structural elements of the SFWF will be present for the O&M life of the project. If and how marine mammals perceive or avoid the physical presence of the structures is not well understood. However, only *negligible* anticipated impacts on marine mammals due to the physical impediments to their movements is assumed.

Lighting

Artificial lighting during O&M will be associated with O&M vessels, the WTGs, and the OSS. Lighting on the WTG foundations and the OSS will be coordinated with the USCG to ensure it meets appropriate safety standards and to minimize potential impacts on marine organisms. It is likely that reaction of sea turtles to this artificial light is species-dependent and may include attraction or avoidance of an area. Because of the limited area associated with the artificial lighting used on Project vessels, the WTGs, and the OSS relative to the surrounding unlit areas, the impacts are expected to be negligible and short-term for sea turtles during O&M.

Decommissioning

During decommissioning activities, sea turtles could be impacted by noise generated by the dismantling of the WTGs, collisions with the decommissioning vessels, and exposure to accidental release of hazardous materials or fuel spills. Decommissioning would conceptually reverse the sequence of construction steps to dismantle or remove the SFWF. Decommissioning activities resulting in underwater noise and vessel traffic are expected to be less intensive than the activities associated with the construction phase of the Project. Impacts to sea turtles during decommissioning are expected to be ***negligible***.

South Fork Export Cable

Construction, O&M, and decommissioning activities associated with the SFEC have the potential to impact sea turtles. This section summarizes the potential impacts on sea turtles from activities associated with the SFEC. IPFs that could have more than negligible potential impacts include noise and vessel traffic. Impacts associated with each phase of the SFEC are addressed in the following sections.

SFEC - OCS and SFEC - NYS

Construction

Table 4.3-32 summarizes the level of impacts expected to occur to marine mammals during the construction and decommissioning phases of the SFEC. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-32. IPFs and Potential Levels of Impact on Sea Turtles at the SFEC during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impact
Seafloor/Land Disturbance	Cable Installation	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Installation of Cable	Negligible short-term
	Vibratory Hammering of Sheet Piles for the Cofferdam	Negligible short-term
Discharges and Releases		Negligible short-term
Trash and Debris		Negligible short-term
Traffic	Collision	Minor to Moderate short-term localized
	Entanglement	Negligible short-term
Lighting		Negligible short-term localized

Seafloor Disturbance

Seafloor disturbance associated with installation of the SFEC may impact sea turtles. Impacts are considered ***short-term*** and ***negligible*** for similar reasons as described for seafloor disturbances from SFWF construction.

Sediment Suspension and Deposition

As previously discussed for SFWF construction, impacts to the few transiting individual sea turtles in the region that could be exposed to sediment suspension are expected to be ***localized, short-term,*** and ***negligible***.

Noise

As described for the SFWF, the impacts of underwater noise generated from Project construction vessels on sea turtles are expected to be short-term and negligible. ***Short-term, negligible impacts*** may also occur during SFEC installation because of the considerable range of potentially disruptive sound propagation generated by the DPV thrusters during cable laying, and because cable installation will occur over a relatively short time frame. Also, the likelihood decreases for sea turtles occurring in shallow waters as the cable laying operation enters New York State waters. Therefore, the risk of sea turtles exposed to DPV noise is lower close to shore.

Construction of a cofferdam will be required for the nearshore SFEC connection and will require vibratory hammering of sheet piles. This installation differs from the piledriving for SFWF foundations because the location is close to shore, the duration of the installation is estimated to be short (roughly 12 to 24 hours), and the source type is nonimpulsive and continuous. Both the propagation characteristics of the sheet pile vibratory pile driving and the threshold criteria for sea turtles are different than for the pile driving for the foundation.

Vibratory pile driving associated with SFEC construction, while within the estimated hearing range of sea turtles, is expected to produce lower noise levels relative to impact pile driving. Propagation modeling of vibratory pile driving at the SFEC indicates that isopleth ranges to both physiological and behavioral thresholds are relatively small: 102 feet (31 m) to physiological thresholds and 174 feet (53 m) to behavioral thresholds (Appendix J1). No injury or mortality is expected, and behavioral exposures are unlikely. If behavioral exposures occur, behavioral responses are expected to be temporary, short-term, and would not affect the reproduction, survival, or recovery of threatened or endangered species. Vibratory pile driving is anticipated to have ***negligible*** impacts on sea turtle species and may have no affect depending on the season in which this activity would take place. Winter and spring have very low densities of sea turtles in the area and would have a lower potential for any exposure risk.

Discharges and Releases/Trash and Debris

The potential for sea turtle exposure and impacts from routine and nonroutine discharges, releases, trash, and debris will be similar to those identified in the SFWF.

Traffic

The potential impacts of vessel traffic (collision or entanglement risk) on sea turtles will be less than those discussed for the SFWF because of the fewer anticipated vessels involved in SFEC construction.

Lighting

Artificial lighting during construction of the SFEC will be associated with navigational and deck lighting on vessels from dusk to dawn. Because of the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for sea turtles during construction.

<u>Operations and Maintenance</u>

Table 4.3-33 summarizes the level of impacts expected to occur to sea turtles during the O&M phase of the SFEC. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-33. IPFs and Potential Levels of Impact on Sea Turtles at the SFEC during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Seafloor Disturbance	Potential SFEC Maintenance	Negligible short-term localized
Sediment Suspension and Deposition		Negligible short-term localized
Noise	Vessel noise	Negligible short-term localized
	Vibratory pile driving of the cofferdam	Negligible short-term localized
EMF		Negligible localized
Traffic	Collision	Negligible short-term localized
Discharges and Releases [a]		Negligible short-term
Trash and Debris [a]		Negligible short-term
Lighting		Negligible short-term

[a] Supporting information on the negligible level of impact for the Discharges and Trash/Debris IPFs is provided in Section 4.1.

Seafloor Disturbance

Maintenance of the SFEC is considered a nonroutine event and is not expected to occur with any regularity. Impacts associated with exposing the SFEC are expected to be similar but less frequent to those described for the construction/installation phase.

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M of the SFEC will primarily result from vessel anchoring and any maintenance activities that will require exposing the SFEC. Both activities are expected to be nonroutine events and not expected to occur with any regularity. Sediment suspension and deposition impacts resulting from vessel activity during O&M of the SFEC are expected to be similar to vessel-related sediment suspension and deposition impacts described for the SFEC construction phase, but less frequent and at a smaller scale.

Noise

Direct impacts to sea turtles associated with noise during O&M of the SFEC may occur associated with vessels. Impacts from vessel noise during O&M of the SFEC are expected to be similar to vessel noise impacts described for the SFWF and SFEC construction, but very limited in occurrence and duration.

Electromagnetic Fields

The potential EMF impacts from the SFEC on sea turtles is similar to that described for the SFWF Inter-array Cable. Impacts to sea turtles relating to the EMF emitted from the SFEC will be ***negligible*** because of the low density of sea turtles in the water, their habit of surfacing for air, and the relatively narrow corridor occupied by the SFEC.

Traffic

The potential impacts of vessel collision will be similar to those identified in the SFWF.

Lighting

Artificial lighting during O&M will be associated with O&M vessels. Because of the limited area associated with the artificial lighting used on Project vessels relative to the surrounding unlit areas, the impacts are expected to be ***negligible*** and ***short-term*** for sea turtles during O&M.

Decommissioning

The impacts expected to sea turtles will be similar to impacts during installation, assuming that similar vessels are used for the activity.

4.3.5.3 Proposed Environmental Protection Measures

Environmental protection measures will be implemented to minimize impacts on sea turtles to the maximum extent possible, including the use of noise attenuation and ramp-up, soft-start, and shutdown pile-driving procedures. SFW will consider the use of technically and commercially feasible noise attenuation technology. SFW has also developed a protected species mitigation and monitoring plan (Appendix P3).

- Exclusion and monitoring zones will be established for sea turtles during pile driving activities and HRG survey activities.
- Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate.
- Impact pile driving activities will not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right whale, which will have a protective effect for sea turtles.
- Vessels will follow NOAA guidelines for sea turtle strike avoidance measures, including vessel speed restrictions.
- All personnel working offshore will receive training on sea turtle awareness and marine debris awareness.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).

4.3.6 Avian Species

The description of the affected environment and assessment of potential impacts to avian species and their habitats was evaluated by reviewing survey results from land-based, ship-based, aerial, and radar surveys; online data modeling and mapping databases; and correspondence and consultation with federal and state agencies. Recent data on listed species include preliminary results of digital very high-frequency (VHF; nanotag) tracking studies funded through BOEM and boat-based bird surveys at the BIWF off the coast of Rhode Island. The BIWF is the first offshore wind farm in the United States and is currently the only regional wind development site with both pre- and post-construction data. These results can help inform potential impacts to birds at the SFWF and other offshore wind projects in the region. Avian species within the potentially affected environment are described below, followed by an evaluation of potential project-related impacts. For more information regarding the avian species at the SFWF, see the SFWF Draft Avian and Bat Risk Assessment and Draft Avian and Bat Resources Technical Report, and the BIWF Post-Construction Avian Ship-based Survey in Appendix Q.

4.3.6.1 Affected Environment

Regional Overview

As described in BOEM's Revised Environmental Assessment (BOEM, 2013), the Atlantic Coast along New York, Rhode Island, and Massachusetts is used by a variety of avian species for foraging, breeding, and migration. Water depth is likely the primary physical feature affecting bird species distribution in the marine environment, as this physical habitat characteristic limits where different species can successfully access food resources. However, other factors such as coastline character, substrate, water temperature, salinity, and currents all affect resource availability throughout the year and, consequently, seasonal bird species distribution and abundance. Major habitat types expected to be found within the SFWF and SFEC are described in Section 4.3.1. The nearshore open waters surrounding Montauk Point, New York, including Montauk Shoals and Endeavor Shoals, provide important seabird and wintering waterfowl habitat. Generally, as the distance from shore increases, bird abundance decreases (Paton et al., 2010; Winiarski et al., 2011; Geo-Marine Inc., 2010; and Menza et al., 2012).

State- and federally listed species documented or potentially present in the SFWF and portions of the SFEC − OCS, SFEC - NYS, and SFEC − Onshore include northern harrier (*Circus cyaneus*) (state threatened), bald eagle (*Haliaeetus leucocephalus*) (state threatened), piping plover (*Charadius melodus*) (federally threatened and state endangered), rufa red knot (*Calidris canutus rufa*) (federally threatened), least tern (*Sternula antillarum*) (state threatened), roseate tern (*Sterna dougallii*) (federally and state endangered), and common tern (*Sterna hirundo*) (state threatened). These species are discussed in the following sections.

For the purposes of this summary, "offshore" is defined as waters beyond a 3-nm (5.6 km) distance from land and 'nearshore' is within the 3-nm (5.6 km) distance from land.

South Fork Wind Farm

Offshore waters provide high-value foraging habitat for seabirds in locations with a varied resource base of forage fish, crustaceans, and mollusks. The SFWF will be located in deep water (approximately 105 to 147 feet (32 to 45 m) where there are no shoals, but fish, crustaceans, and other zooplankton are available at different depths. Benthic resources, including shellfish, and associated habitat types are described in Section 4.3.2.

Table 4.3-34 summarizes species present or potentially present within the SFWF. The table delineates timing, distribution, and status of avian groups expected to occur in the SFWF. Avian groups likely to use deeper offshore waters within the SFWF at least seasonally include loons (*Gavia spp.*), shearwaters (*Procellariidae spp.*), fulmars (*Procellariidae spp.*), storm-petrels (*Hydrobates pelagicus*), gannets (*Morus spp.*), seaducks (*Merginae spp.*), jaegers (*Stercorariidae spp.*), gulls (*Laridae spp.*), kittiwakes (*Rissa spp.*), terns (*Laridae spp.*), alcids (*Alcidae spp.*), and to a lesser extent, migrating shorebirds and land birds. Appendix Q includes additional details about the presence of these species groups. Shorebirds (except for phalaropes) are not expected to occur away from shore unless flying during migratory movements. Species that are state- or federally listed are described in more detail in relation to proposed SFWF activities in the following sections. See Appendix Q for additional information on listed species.

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Table 4.3-34 Timing, Distribution, and Status of Avian Species Groups That Have Potential to Occur in the SFWF

Species Group	Status	Seasonal Use	Peak Season	Primary Location	Status Offshore
Loons (*Gavia spp.*) Common (*Gavia immer*) Red-throated (*Gavia stellate*)	State special concern	Migrant, winter resident	Fall, winter	Nearshore, offshore	 Uncommon Uncommon
Shearwaters (*Procellariidae spp.*) Manx (*Puffinus puffinus*) Great (*Puffinus gravis*) Sooty (*Ardenna grisea*) Cory's (*Calonectris borealis*) Audubon's (*Puffinus iherminieri*)	 -- -- -- --	Summer resident	Summer	Offshore	 Common Abundant Common Abundant Uncommon
Northern fulmars (*Fulmarus glacialis*)	--	Winter resident	Fall, winter	Offshore	Uncommon
Storm-petrels (*Hydrobates pelagicus*) Wilson's (*Oceanites oceanicus*) Leach's (*Oceanodroma leucorha*)	 -- --	Summer resident	Summer	Offshore	 Abundant Uncommon
Northern gannets (*Morus bassanus*)	--	Migrant, winter resident	Spring, fall, winter	Offshore	Common
Seaducks (*Merginae spp.*) Common eider (*Somateria mollissima*) Black scoter (*Melanitta americana*) White-winged scoter (*Melanitta deglandi*) Surf Scoter (*Melanitta perspicillata*) Long-tailed duck (*Clangula hyemalis*)	 -- -- -- --	Migrant, winter resident	Winter	Nearshore, offshore	 Uncommon Uncommon Uncommon Uncommon Uncommon
Jaegers (*Stercorariidae spp.*) Parasitic (*Stercorarius parasiticus*) Pomarine (*Stercorarius pomarinus*)	 -- --	Migrant	Spring, fall	Offshore, nearshore	 Uncommon Rare

Table 4.3-34 Timing, Distribution, and Status of Avian Species Groups That Have Potential to Occur in the SFWF

Species Group	Status	Seasonal Use	Peak Season	Primary Location	Status Offshore
Gulls (*Laridae spp.*)		Breeder, migrant, winter resident	Year-round	Nearshore, offshore	
Herring (*Larus argentatus*)	--				Common
Great black-backed (*Larus marinus*)	--				Uncommon
Bonaparte's (*Chroicocephalus philadelphia*)	--				Uncommon
Laughing (*Leucophaeus atricilla*)	--				Common
Black-legged kittiwakes (*Rissa tridactyla*)	--	Migrant, winter resident	Winter	Offshore	Abundant
Terns (*Laridae spp.*)	New York Threatened	Breeder, migrant	Summer	Nearshore, offshore	
Common (*Sterna hirundo*)	Federal Endangered				Rare
Roseate (*Sterna dougallii*)	New York Endangered				Rare
Least (*Sternula antillarum*)	New York Threatened				Rare
Alcids (*Alcidae spp.*)		Migrant, winter resident	Winter	Nearshore, offshore	
Razorbill (*Alca torda*)	--				Uncommon
Common murre (*Uria aalge*)	--				Uncommon
Thick-billed murre (*Uria lomvia*)	--				Uncommon
Atlantic puffin (*Fratercula arctica*)	--				Rare
Dovekie (*Alle alle*)	--				Common
Black guillemot (*Cepphus grylie*)	--				Uncommon
Land birds*		Migrant	Spring, fall	Migrating	Uncommon

Sources: Paton et al., 2010; Tetra Tech and DeTect, 2012; Winiarski et al., 2012; and Sussman and USGS, 2014.

* Observed land bird species: various swallow species

SFEC – OCS and SFEC - NYS

The following summary focuses on avian groups documented or expected to occur in portions of the SFEC − OCS. The SFEC − OCS is primarily a pelagic environment, and bird species composition, distribution, seasonality, and resource base are likely to be similar to that described for the SFWF. Where the proposed cable route travels south of Montauk Point, the bird community is expected to include more coastal species. In the area where the proposed cable route comes within 10 miles (16 km) of Montauk Point, pelagic species become more uncommon and the composition of birds begins to include species that occur both nearshore and offshore.

Table 4.3-35 summarizes species present or potentially present within the SFEC. Avian groups likely to use deeper offshore waters at least seasonally include loons, shearwaters, fulmars, storm-petrels, gannets, seaducks, jaegers, gulls, kittiwakes, terns, alcids, and to a lesser extent, migrating shorebirds and land birds. Appendix Q provides additional detail about the occurrence on bird species and their status with respect to the SFEC, including additional information on listed species.

The SFEC − NYS will be more than 3 miles (5 km) from the productive shallow waters nearshore, including Montauk Shoals and Endeavor Shoals. Data from local surveys, such as Christmas Bird Counts, indicate a variety of land birds and waterbirds occur onshore in the area. Horseshoe crabs breed on the beaches in large numbers during the spring providing forage for migrant shorebirds, including the rufa red knot. Species known to occur in the New York Bight, the location of the SFEC route, include terns, gulls, cormorants (*Phalacrocoracidae spp.*), and shorebirds during summer and seaducks, bay ducks (*Aythyinae spp.*), fish ducks (*Anatidae spp.*), dabblers (*Anas spp.*), loons, grebes (*Podicipedidae spp.*), and alcids during winter. In the fall, the highest densities of seabirds are observed south and east of Montauk Point and along the south shore of Long Island. Other more pelagic species that could occur around the SFEC − NYS include Cory's shearwater (*Calonectris borealis*), northern gannet (*Morus bassanus*), and black-legged kittiwake (*Rissa tridactyla*). Table 4.3-36 summarizes species present or potentially present within New York State waters. Appendix Q provides additional detail about the occurrence on bird species and their status with respect to the SFEC − NYS nearshore and onshore.

Shorebirds will use intertidal zones of beaches for foraging for invertebrates, small crustaceans, bivalve mollusks, small polychaete worms, insects, and talitrid amphipods (Macwhirter et al., 2002). Terns and related species will forage over shallow waters and sandspits near shore in pursuit of small prey fish (Nisbet et al., 2017). Breeding shorebirds on Long Island include piping plover, American oystercatcher (*Haematopus palliates*), and killdeer (*Charadrius vociferous*). Several species will overwinter on Long Island (sanderling [*Calidris alba*], dunlin [*C. alpine*], purple sandpiper [*C. maritima*]), but most shorebirds occur as migrants. Other species likely to occur on Long Island during migration include black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Charadrius semipalmatus*), ruddy turnstone (*Arenaria interpres*), semipalmated sandpiper (*Calidris pusilla*), and short-billed dowitcher (*Limnodromus griseus*). During migration, rufa red knots occur on large waterbodies with suitable shoreline habitat. Concentrations of this species can occur on the south shore of Long Island in spring and fall. Preliminary results from BOEM's nanotag study detected birds flying around Long Island's south shore (Loring et al., 2017).

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Table 4.3-35. Timing, Distribution, and Status of Avian Species Groups That Have Potential to Occur in the SFEC – OCS

Avian Group	Seasonal Use	Peak Seasons	Peak/Primary Location	Status Offshore
Loons	Migrant, winter resident	Fall, winter	Offshore, nearshore	Common (more common nearshore)
Shearwaters	Summer resident	Summer	Offshore	Common
Storm-petrels	Summer resident	Summer	Offshore	Common
Gannets	Migrant, winter resident	Winter, spring, fall	Offshore	Common
Seaducks[a]	Migrant, winter resident	Winter, spring, fall	Offshore, nearshore	Uncommon
Jaegers	Migrant	Spring, summer, fall	Offshore	Rare
Gulls[b]	Breeder, migrant, winter resident	Year-round	Offshore, nearshore	Abundant (more abundant nearshore)
Kittiwakes	Migrant, winter resident	Winter	Offshore	Abundant
Terns	Migrant, post-breeding	Summer	Offshore, nearshore	Rare offshore
Alcids	Migrant, winter resident	Winter	Offshore, nearshore	Common (more common nearshore; exc. dovekie, more common offshore)
Land birds[c]	Migrant	Spring, fall	Migrating	Uncommon

Sources: Paton et al., 2010; Tetra Tech and DeTect, 2012; Winiarski et al., 2012; and Sussman and USGS, 2014.

[a] Observed waterfowl species: common eider, surf scoter, black scoter, long-tailed duck, white-winged scoter, red-breasted merganser.
[b] Observed gull species: herring gull, great black-backed gull, laughing gull, ring-billed gull, Bonaparte's gull.
[c] Observed land bird species: various swallow species.

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SFEC – Onshore

A variety of land birds have potential to occur in upland and coastal habitats associated with the onshore portions of the SFEC. A wide variety of passerines and other land birds use Long Island as a potential stopover location along the Atlantic Coast during migration and could fly over the cable route when coming to land. These migrants include species that breed in the surrounding dune, coastal wetland, shrub, forested, and urban habitats near the SFEC − Onshore, as well as species with breeding ranges further to the north and east that only pass through Long Island in spring and fall.

Avian species that may breed in the area primarily include locally nesting marsh and wading birds using nearby coastal wetlands and common swallows, thrushes, corvids, warblers, sparrows, and blackbirds using residential, backyard, and small field habitats proximal to the SFEC − Onshore.

The state threatened northern harrier is known to breed at locations across Long Island, with breeding records near the SFEC − Onshore, including Napeague State Park, Hither Hills State Park, Napeague Harbor (NYSDEC, 2017). Their breeding period extends from April through September, with nesting habitat in marshes, meadows, and grasslands with low, thick vegetation (Smith et al., 2011). Species occurring only in winter are even fewer and may include species such as snow buntings (*Plectrophenax nivalis*), horned larks (*Eremophila alpestris*), and snowy owls (*Bubo scandiacus*) as well as some of the year-round resident land bird species, including corvids, chickadees, and titmice.

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Table 4.3-36. Timing, Distribution, and Status of Avian Species Groups Likely to Occur in the Onshore Cable Route and Landing Sites of the SFEC – NYS

Avian Group	Seasonal Use	Peak/Primary Seasons	Peak/Primary Location	Status in Coastal Waters
Loons	Migrant, winter resident	Fall, winter	Offshore, nearshore	Common
Grebes	Migrant, winter resident	Winter	Nearshore	Occasional
Gannets	Migrant, winter resident	Spring, fall	Offshore	Uncommon
Cormorants	Summer breeder; winter resident	Summer, fall	Nearshore	Common (exc. great cormorant, occasional)
Seaducks[a]	Winter resident	Winter	Offshore, nearshore	Common
Geese, bay ducks, fish ducks, and dabblers[b]	Migrant, winter resident	Fall, winter	Offshore, nearshore	Common
Shorebirds[c]	Breeding, migrant, winter resident	Spring, fall	Nearshore, onshore	Common
Gulls[d]	Breeding, migrant, winter resident	Spring, summer	Offshore, nearshore, onshore	Abundant
Kittiwakes	Winter resident	Winter	Offshore	Occasional
Terns[e]	Breeding, migrant	Summer, fall	Nearshore, onshore	Common
Land birds[f]	Breeding, migrant, winter resident	Spring, summer	Onshore	Common

Sources: Paton et al., 2010; O'Connell et al., 2011; Tetra Tech and DeTect, 2012; Veit et al., 2016; Sussman and USGS, 2014; and land-based surveys and nearshore boat surveys.

[a] Observed seaduck species: black scoter, white-winged scoter.
[b] Observed geese and duck species: Canada goose, brant, common goldeneye, bufflehead, greater scaup, hooded merganser, red-breasted merganser, American black duck, mallard, American widgeon, harlequin duck.
[c] Observed overwintering shorebird species: purple sandpiper, sanderling, dunlin, piping plover.
[d] Observed gull species: herring gull, great black-backed gull, laughing gull, ring-billed gull, Bonaparte's gull.
[e] Observed tern species and allies: common tern, Forster's tern, roseate tern, least tern, black skimmer.
[f] Observed land birds include raptors, herons, doves, and passerines.

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4.3.6.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential to affect avian species through both direct and indirect impacts, including habitat loss/modification, disturbance, and collision risk, and displacement, attraction, barrier effects, and mortality or injury associated with discharges/releases or trash/debris.

The IPFs and anticipated levels of impact to birds associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are outlined in Tables 4.3-37 through 4.3-39 and Figure 4.3-13, including potential impacts to the federally listed roseate tern, piping plover, and red knot, and state-listed least tern and common tern. Impacts resulting from the SFWF and SFEC are anticipated to range from no impact to minor. The SFWF and SFEC's risk assessment in Appendix Q includes additional details of these impacts which are summarized below.

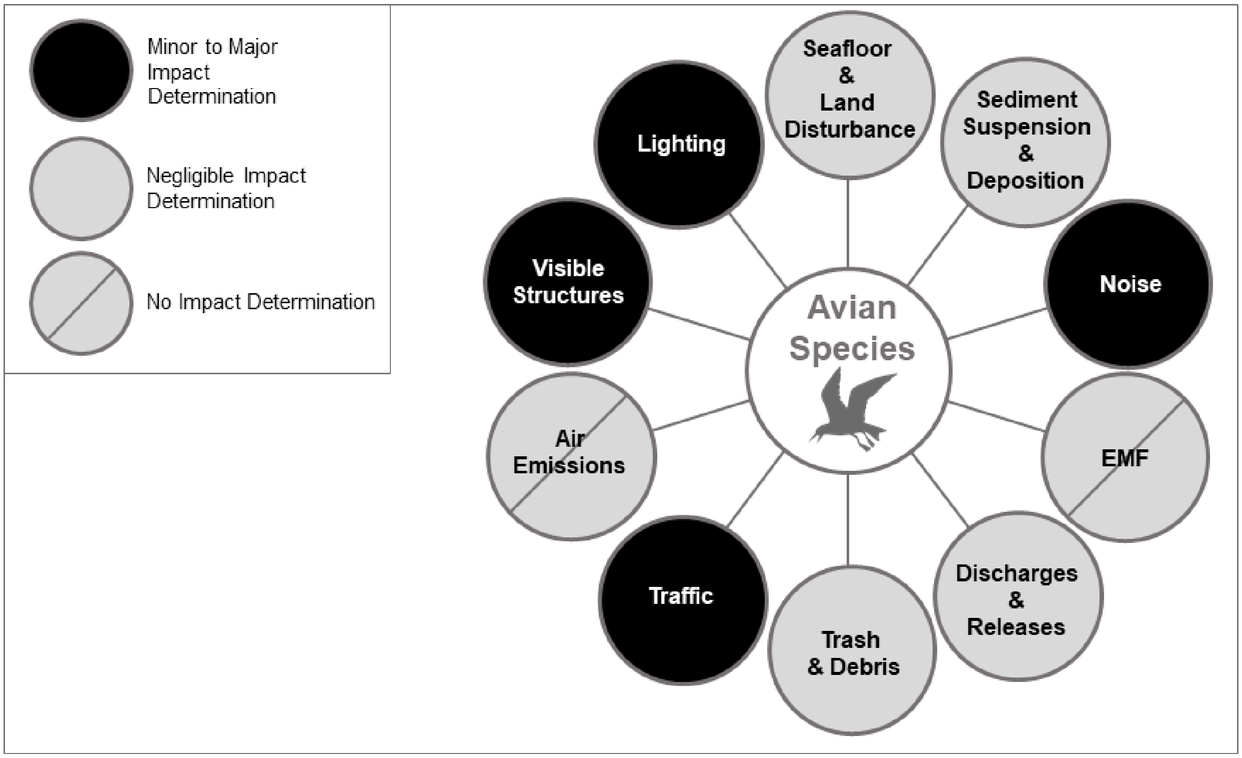

Figure 4.3-13. IPFs on Avian Species

Illustration of potential impacts to avian species, including potential impacts to the federally listed roseate tern, piping plover, and red knot, and state-listed least tern and common tern resulting from SFWF and SFEC activities

South Fork Wind Farm

This section summarizes the assessment of potential impacts on avian species presented in Appendix Q. The primary IPFs associated with the SFWF that could impact avian species include Seafloor or Land Disturbance, Sediment Suspension and Deposition, Noise, Traffic, Visible Structures and Lighting, Discharges and Releases, and Trash and Debris. The potential impacts associated with each phase of the SFWF are addressed separately in the following sections.

<u>Construction</u>

Table 4.3-37 summarizes the level of impacts expected to occur to avian species during the construction and decommissioning phase of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-37. IPFs and Potential Levels of Impact on Avian Species for the SFWF during Construction and Decommissioning

Impact Producing Factor	Project Activity	Potential Impact
Seafloor/Land Disturbance	Habitat loss/modification from WTG foundation and Inter-array Cable installation	Negligible direct
Sediment Suspension and Deposition	Habitat loss/modification from WTG foundation and Inter-array Cable installation	Negligible direct
Noise	Disturbance from pile-driving and Inter-array Cable installation	Negligible or Minor direct
Traffic	Disturbance from vessel activity	Negligible or Minor direct
Visible Structures / Lighting	Collision risk with construction vessels/platforms	Negligible to Minor direct
Discharges/Releases	Mortality/decreased breeding success during construction activities associated with WTG foundation and Inter-array Cable installation	Negligible indirect
Trash/Debris	Mortality/injury from accidental disposals associated with WTG foundation and Inter-array Cable installation	Negligible indirect

Seafloor Disturbance and Sediment Suspension and Deposition

Because of the short-term nature of construction and decommissioning activities, only ***negligible impacts*** associated with the direct effect of habitat loss or modification due to seafloor/land disturbance are anticipated.

Noise and Traffic

Only ***negligible*** to ***minor impacts*** to birds because of disturbances associated with noise and vessel traffic are expected during construction activities. These impacts will be short-term and similar to those observed with normal non-project-related vessel traffic.

Visible Structures and Lighting

Negligible to ***minor impacts*** associated with collision risk with visible structures for birds during construction may occur, depending on the species and number of individuals involved in potential collision events. Birds are susceptible to collision with both moving and stationary man-made structures extending above the surface of the water, particularly at night and/or during other periods of low visibility (e.g., rain or fog). Brightly illuminated structures offshore such as research platforms pose a risk to birds migrating at night particularly during rain or fog when birds can become disoriented by sources of artificial light. While nocturnal migrant passerines are known to be most prone to collision with man-made structures, among those species that may be at risk of collision include federally or state-listed species: roseate tern, rufa red knot, piping plover, least tern, and common tern. While collision risk for these species of concern is considered low, the loss of one or a few individuals to these populations already at risk could represent a ***minor impact***. Other bird groups with relatively stable populations may generally be at risk of ***negligible*** to ***minor impacts*** resulting from collision, depending on the time of year and number of individuals involved. Lighting during construction activities will be limited to the minimum required for safety during construction activities to minimize impacts.

Discharges and Releases
Potential indirect effects such as mortality or injury from contaminant discharges or releases during construction and decommissioning would be expected to result in ***negligible impacts*** because of the preemptive implementation of BMPs to prevent such incidents.

Trash and Debris
Potential indirect effects such as mortality or injury from accidental disposal of trash or debris during construction and decommissioning is expected to result in ***negligible impacts*** because of the preemptive implementation of BMPs to prevent such incidents.

Operations and Maintenance

Table 4.3-38 summarizes the level of impacts expected to occur to avian species during the O&M phase of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-38. IPFs and Potential Levels of Impact on Avian Species for the SFWF during Operations and Maintenance

IPF	Potential Effect from Project Activity	Potential Impact
Noise	Disturbance from WTG operation and maintenance vessel activity	Negligible to Minor direct
Traffic	Disturbance from maintenance vessel activity	Negligible to Minor direct
Visible Structures / Lighting	Collision risk with WTGs or OSS	Negligible to Minor direct
	Displacement, attraction, or barrier effect, based on presence of WTGs or OSS	Negligible to Minor direct
Discharges/Releases	Maintenance vessel activity at WTGs or OSS	Negligible indirect
Trash/Debris	Maintenance vessel activity at WTGs or OSS	Negligible indirect

Traffic and Noise
Direct impacts during O&M could include short-term disturbances associated with traffic or noise during maintenance activities. These disturbances would be ***short-term*** and ***negligible*** to ***minor*** and similar to those observed with normal vessel traffic.

Visible Structures and Lighting
The primary direct impact for birds during O&M is collision risk with WTGs at the SFWF because of visible structures and lighting. Species most at risk of collision are those that more frequently occur in the rotor-swept zone (RSZ) and those that may travel through the SFWF at night or periods of inclement weather. Impacts associated with risk of collision are anticipated to be ***negligible*** to ***minor*** and would be dependent on species and the number of individuals involved. Federally and state-listed species are among birds that may be susceptible to minor impacts associated with collision risk, including roseate tern, rufa red knot, piping plover, least tern, and common tern. While these species are not expected to frequent the SFWF, individuals in general may cross the area at most twice per year during migration. The loss of one or a few individuals, over the life of the SFWF, for a population already at risk would represent an adverse impact; however, it would not represent an impact that that these populations could not recover from. Other avian groups with relatively stable populations may generally be at risk of ***negligible*** to ***minor impacts*** resulting from collision, depending on the time of year and number of individuals involved.

Indirect operational impacts related to visible structures and lighting may pose ***negligible*** to ***minor impacts***, depending on type of impact (displacement, attraction, or barrier effect, or discharge/release). Displacement, attraction, and barrier effects are expected to generally result in ***negligible*** to ***minor impacts*** to most species that seasonally occur in the SFWF.

Discharges and Releases
The level of impact of a contaminant spill or release would be dependent on the type, size, and location of the spill. Federally and state-listed birds are among species that may be impacted after a spill or release. However, any potential spill-related impacts are expected to be mitigated by a series of avoidance and minimization measures and preemptive implementation of BMPs during operations; therefore, discharges and releases during O&M are expected to result in ***negligible impacts***.

Trash and Debris
Potential indirect effects such as mortality or injury from accidental disposal of trash or debris during O&M is expected to result in ***negligible impacts*** because of the preemptive implementation of BMPs to prevent such incidents.

Decommissioning

Decommissioning of the SFWF will have similar impacts as construction.

South Fork Export Cable

This section summarizes the assessment of potential impacts on avian species presented in Appendix Q. The primary IPFs associated with the SFEC that could affect avian species include Seafloor/Land Disturbance, Sediment Suspension and Deposition, Noise, Traffic, Visible Structures and Lighting, Discharges and Releases, and Trash and Debris. The potential impacts associated with each phase of the SFWF are addressed separately in the following sections.

SFEC – OCS and SFEC – NYS

Construction

Table 4.3-39 summarizes the level of impacts expected to occur to avian species during the construction and decommissioning phases of the SFEC. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-39. IPFs and Potential Levels of Impact on Avian Species for the SFEC during Construction and Decommissioning

IPF	Project Activity	Potential Impact
Seafloor/Land Disturbance	Habitat loss/modification from cable and interconnection facility installation	Negligible direct
Sediment Suspension and Deposition	Habitat loss/modification from cable installation	Negligible direct
Noise	Disturbance from cable installation, HDD, and interconnection facility installation	Negligible to Minor direct
Traffic	Disturbance from vessel and vehicle activity during cable and interconnection facility installation	Negligible to Minor direct
Discharges/Releases	Mortality/decreased breeding success during construction activities associated with cable and interconnection facility installation	Negligible indirect

Trash/Debris	Mortality/injury from accidental disposals associated construction activities associated with cable and interconnection facility installation	Negligible indirect

Seafloor Disturbance

Because of the short-term nature of construction and decommissioning activities, only ***negligible impacts*** associated with the direct effect of habitat loss or modification from seafloor disturbance are anticipated.

At the sea-to-shore transition, HDD will mitigate potential construction impacts on the inter-tidal community within the vicinity of the landing site. No long-term changes in inter-tidal habitat structure or prey availability is expected because of cable installation activities. Any increase in turbidity and potential relocation of sandy sediments would be ***short-term, localized,*** and ***negligible***, resulting in no lasting physical changes to coastal areas or beaches.

There will be ***no impacts*** to nesting areas at beaches as installation for the SFEC will occur under the beach. The need for time of year restrictions for beach work at onshore components will be determined in consultation with the agencies.

Noise and Traffic

Only ***negligible*** or ***minor impacts*** to birds from disturbances associated with noise and vessel traffic are expected during construction of the SFEC-OCS and SFEC-NYS. These impacts will be ***short-term*** and similar to those observed with normal non-project-related vessel traffic.

Noise from installation of the cofferdam and from HDD in the sea-to-shore transition and activities at beach work areas could result in ***short-term disturbance impacts*** that will be relatively ***short-term*** and ***localized***; therefore, only ***negligible*** to ***minor impacts*** to shorebirds are expected from construction. Because the construction period is expected to occur largely outside of the breeding period of listed species that breed in the area and use of the shoreline at the proposed landing sites is expected to be minimal for other listed species that may occur in the region, disturbance impacts for listed species are expected to be ***negligible*** to ***minor.***

Visible Structures and Lighting

Negligible to ***minor impacts*** associated with collision risk with visible structures (e.g., construction vessels or platforms) for birds during construction may occur, as described for the SFWF.

Discharges and Releases

Potential indirect effects such as contaminant discharges or releases during construction and decommissioning would be expected to result in ***negligible impacts*** because of the preemptive implementation of BMPs to prevent such incidents.

Trash and Debris

Potential indirect effects such as mortality or injury from accidental disposal of trash or debris during construction and decommissioning is expected to result in ***negligible impacts*** because of the preemptive implementation of BMPs to prevent such incidents.

<u>Operations and Maintenance</u>

No impacts to avian species are anticipated during routine O&M of the SFEC – OCS and SFEC – NYS.

<u>Decommissioning</u>

Decommissioning of the SFEC – OCS and SFEC – NYS will have similar impacts as construction.

SFEC – Onshore

<u>Construction</u>

Land Disturbance

There will be ***no impacts*** to nesting areas at beaches as installation for the sea-to-shore transition will occur under the beach.

Construction activities along the SFEC – Onshore route have the potential to affect shorebirds and some seabirds (e.g., terns), including potential impacts to listed species including piping plover (federally- and NYS-threatened), red knot (federally threatened) and least tern (NYS-threatened). These species breed, forage, and/or rest in the vicinity of the sea-to-shore transition and SFEC – Onshore. These potential impacts were considered during the siting process and the HDD work area was setback at least 650 feet (198 m) from the MHWL to minimize the potential for impacts. Additional construction activities are scheduled to occur outside of the tern and plover breeding period; red knots may be present during migration only briefly, if at all. SFW will develop a plan to manage listed species in consultation with regulatory agencies to address residual risk to these species; therefore, ***no impacts*** to listed species are expected.

A variety of land birds including passerines and raptors use terrestrial habitats on Long Island in the East Hampton area. Except for construction of the new SFEC – Interconnection Facility to be located adjacent to the existing East Hampton substation, all components of the SFEC – Onshore will be set within a new underground duct bank in developed areas along existing ROWs, thus avoiding disturbances to land birds. Woodland habitat will be cleared for construction of the new SFEC – Interconnection Facility, and there may be a small amount of additional clearing along railroad ROWs for the SFEC − Onshore. During the breeding season, clearing of trees or vegetation that may contain nests of land birds could result in destruction of nests, causing impacts to some individuals; however, significant impacts to local breeding populations are not anticipated. No listed land bird species are expected to occur at the new SFEC – Interconnection Facility location; therefore**,** ***no impacts*** are expected.

Noise and Traffic

HDD activities will generate noise and vibration that could temporarily flush birds, if present, during migration or winter. Certain activities may require limited equipment and vehicle activity on the beach (e.g., rollout of the conduit pipe to support HDD). SFW will develop a plan to manage listed species in consultation with regulatory agencies to address risk to these species.

There will be noise and traffic associated with construction of the SFEC - Onshore and the SFEC – Interconnection Facility. These activities could affect shorebirds, some seabirds, and land birds that use the beach and terrestrial habitats of eastern Long Island in the immediate vicinity of installation activities. Noise- and traffic-related impacts are expected to have ***short-term*** to ***minor impacts*** on these birds because construction will occur in already developed areas, and impacts associated with construction will be similar to existing sources of noise and traffic in the local area.

<u>Operations</u>

No impacts to avian species are anticipated during routine operations of the SFEC – Onshore.

<u>Decommissioning</u>

Decommissioning of the SFEC – Onshore will have similar impacts as construction.

4.3.6.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to avian species.

- The SFWF WTGs will be widely spaced allowing avian species to avoid individual WTGs and minimize risk of potential collision.

- The location of the SFWF, more than 18 miles (30 km, 16.6 nm) offshore, avoids the coastal areas, which are known to attract birds, particularly shorebirds and seaducks.
- Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction or disorientation.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone.
- An avian management plan for listed species will be prepared for the SFEC - Onshore.
- The SFEC - Onshore cable will be buried; therefore, avoiding the risk to birds associated with overhead lines.

4.3.7 Bat Species

The description of the affected environment and assessment of potential impacts to bat species and their habitats were evaluated by reviewing a compilation of published and unpublished environmental and technological literature, anecdotal records, records incidental to other scientific research, and studies that targeted bats offshore, including acoustic bat monitoring at the BIWF and vessel-based acoustic monitoring at the SFWF. Bat species that may occur within the SFWF and SFEC are described in this section, followed by an evaluation of potential project-related impacts. For more information regarding the bat species that may occur at the SFWF, see Vessel-based Acoustic Bat Monitoring, Draft Avian and Bat Risk Assessment, and Draft Avian and Bat Resources Technical Report in Appendix Q.

4.3.7.1 Affected Environment

For bats, relating occurrence to certain physical and biological features in the offshore environment is more difficult to estimate than for birds. While known to be present, the circumstances of when and where bats occur offshore is only beginning to be understood.

For the purposes of this summary, "offshore" is defined as waters beyond a 3-nautical-mile (5.6 km) distance from land, and "nearshore" is within the 3-nautical-mile (5.6 km) distance from land.

Regional Overview

The extent of scientific knowledge regarding the presence and behavior of bats in the offshore environment is limited. Historical observations and a few scientific studies indicate that bats migrate and possibly forage offshore. They will use islands, vessels, and other offshore structures as opportunistic or deliberate stopover sites (Pelletier et al., 2013). Bats may forage offshore during migration, perhaps to avoid competition or to exploit certain food sources (Ahlén et al., 2009). Detections of bats anecdotally in the offshore environment have been reported most often during the migratory periods, particularly in the fall (Nichols, 1920; Thomas, 1921; Norton, 1930; Griffin, 1940; Carter, 1950; Mackiewicz and Backus, 1956; Pelletier et al., 2013).

Historical observations of bats offshore have been predominately of the migratory tree-roosting species, which include eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*) (Pelletier et al., 2013). However, focused surveys documented offshore detections of species considered to be nonmigratory (Ahlén, 2006; Ahlén et al., 2007, 2009; Stantec, 2016; Pelletier et al., 2013), some of which are subject to population declines because of white-nose syndrome. The northern long-eared bat (*Myotis septentrionalis*) is the only bat species with potential to occur in the SFWF and SFEC that is afforded protection under the federal ESA and New York's Fish and Wildlife Law. See Appendix Q for additional information on listed species.

Bats were detected from 10 to 43 miles (16 to 70 km) offshore during either boat-based or high-definition video aerial surveys in the mid-Atlantic (Hatch et al., 2013). During acoustic studies conducted in the northeast, mid-Atlantic, and Great Lakes regions, Stantec Consulting Services Inc. (2016) found relative bat activity (mean number of bat passes per night) on coastal and offshore sites to be comparable to onshore sites. Prior statistical analyses also failed to detect significant differences in bat activity levels at island versus mainland sites (Pelletier et al., 2013). Bats are regularly detected at remote islands and offshore structures, but primarily on a seasonal basis, with declining activity as the distance from shore increases.

Bat acoustic detector surveys were conducted at BIWF during preconstruction, construction, and postconstruction phases. During postconstruction surveys, bat detection rates at BIWF were highest in the months of August and September. No bat passes were recorded from November through January, as described in Draft Avian and Bat Risk Assessment and Draft Avian and Bat Resources Technical Report in Appendix Q.

Available regional data suggest bats could occur anywhere in the SFWF or SFEC, particularly during the fall migratory period, but also potentially during spring migration and early summer. Table 4.3-40 provides a summary of probable occurrence of bat species in the SFWF or SFEC.

Table 4.3-40. Timing, Distribution, and Relative Frequency of Occurrence of Bat Species and Species Groups in the SFWF and SFEC

Species/Species Group	Scientific Name	Occurrence	Peak Occurrence	Relative Frequency of Occurrence		
				Onshore	Nearshore	Offshore
eastern red bat	*Lasiurus borealis*	May to October	August	Seasonally common	Uncommon	Uncommon
hoary bat	*Lasiurus cinereus*	July to October	August	Seasonally common	Uncommon	Uncommon
silver-haired bat	*Lasionycteris noctivagans*	May, July, August	August	Seasonally common	Uncommon	Uncommon
little brown bat	*Myotis lucifugus*	May to October	August	Seasonally common to abundant	Uncommon	Uncommon
northern long-eared bat	*Myotis septentrionalis*	May to October	August	Seasonally common to abundant	Uncommon	Uncommon
eastern small-footed bat	*Myotis leibii*	May to October	August	Seasonally common to abundant	Uncommon	Uncommon
big brown bat	*Eptesicus fuscus*	May to October	August	Seasonally common to abundant	Uncommon	Uncommon
tri-colored bat	*Perimyotis subflavus*	May to October	August	Seasonally common to abundant	Uncommon	Uncommon

SFWF, SFEC − OCS, and SFEC − NYS

Bat acoustic detector surveys were conducted during G&G surveys from mid-July to mid-November 2017. Vessel-mounted detectors recorded bat passes from July through November, with most calls recorded in the August – September period. Species identified within the SFWF included silver-haired bat, hoary bat, eastern red bat, tri-colored bat (*Perimyotis subflavus*), and little brown bat (*Myotis lucifugus*). A northern long-eared bat call was detected at the southeastern edge of the SFWF, and multiple northern long-eared bat calls were detected along the SFEC route (as described in Vessel-based Acoustic Bat Monitoring, Appendix Q). For the entire study area, northern long-eared bat calls represented 4 percent of all recorded calls (however, there are limitations to positive identification of northern long-eared bat calls due to overlaps with species that have similar call signatures). Most northern long-eared bat activity was detected in the month of August; however, it should be noted that the survey was conducted for only a portion of the year (mid-July through mid-November).

Available data suggest bats are more likely to occur at nearshore locations compared to offshore. Field surveys on Block Island documented resident populations of bats and indicated the island may act as a migration stopover point for migratory tree roosting species (Tetra Tech and DeTect, 2012; Stantec, 2016). The surveys demonstrated that Block Island, and to a lesser extent, nearshore waters immediately surrounding the island, provide habitat for at least five species of bat, including big brown bat (*Eptesicus fuscus*), little brown bat, eastern red bat, silver-haired bat, and hoary bat. Passive and active acoustic monitoring data showed detections were predominately limited to the island and nearshore waters, with a low rate of detection offshore.

SFEC − Onshore

Anecdotal and survey-focused evidence includes bat detections on the coast of Long Island in fall (Merriam, 1887). Mist-netting surveys and acoustic monitoring documented all eight species likely to occur on Long Island, based on these species' known ranges (Cane, 2011; Fishman, 2013). NYSDEC 2017 acoustic surveys did not identify northern long-eared bat within 1.5 miles (2.4 km) of the Beach Lane landing site; there have, however, been positive identifications for this species within 1.5 miles (2.4 km) of the Hither Hills landing site (Jennings and Gaidasz, 2018, pers. comm.).

4.3.7.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF and SFEC have the potential for both direct and indirect impacts to bat species, including habitat loss or modification, disturbance, collision risk, displacement, attraction, and barrier impacts.

The IPFs and anticipated levels of impact to bats associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are outlined on Figure 4.3-14 and in Tables 4.3-41 and 4.3-42, including potential impacts to the federally listed northern long-eared bat. Impacts resulting from the SFWF and SFEC are anticipated to range from no impact to minor. The SFWF and SFEC's risk assessment in Appendix Q includes additional details of these impacts, which are summarized in the rest of this section.

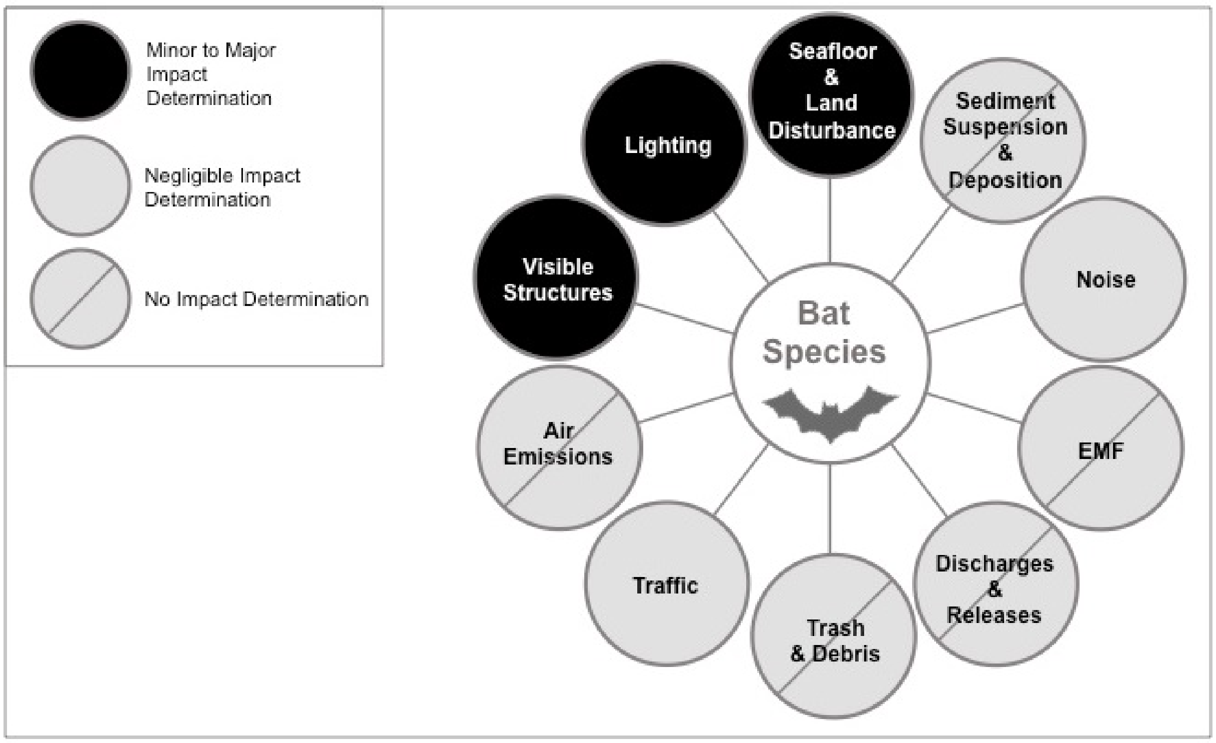

Figure 4.3-14. IPFs on Bat Species

Illustration of potential impacts to bat species, including the federally listed Northern Long-eared bat resulting from SFWF and SFEC activities

South Fork Wind Farm

This section summarizes the assessment of potential impacts on bat species presented in Appendix Q. The primary IPFs associated with the SFWF that could impact bat species include Visible Structures and Lighting. The potential impacts associated with each phase of the SFWF are addressed separately in the following sections.

Construction

No impacts are expected during construction of the SFWF. Bats are expected to seasonally occur in the SFWF while migrating, commuting, or foraging but will be unimpacted by seafloor disturbances during construction of the SFWF due to a lack of roosting habitat in these areas. There are ***no collision-related impacts*** to bats anticipated during construction because bats are expected to detect stationary structures. As bats are only anticipated to occur occasionally in the airspace of the SFWF during migration, impacts associated with traffic and noise during construction are anticipated to have ***no impact*** to bats. Bats are typically expected to forage for insects in flight (but may rarely take prey from the surface of the water); therefore, ***no impacts*** to bats from discharges or releases at the SFWF are expected.

Operations and Maintenance

Table 4.3-41 summarizes the level of impacts expected to occur to bat species during the O&M phases of the SFWF. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-41. IPFs and Potential Levels of Impact on Bats for the SFWF during Operations and Maintenance

IPF	Project Activity	Potential Impact
Visible Structures / Lighting	Collision risk with WTGs or OSS	Negligible to Minor direct
	Displacement, attraction, or barrier effect, based on presence of WTGs or OSS	Negligible to Minor direct

Visible Structures and Lighting

While bats are presumably less abundant in offshore environments than onshore, the possible attraction of bats to tall structures on an otherwise flat landscape may influence bat activity and risk of collision at offshore WTGs. The actual number of bats that may collide with offshore turbines is presently unknown, and methods for monitoring are limited. Further, the level of mortality observed at onshore turbines is not necessarily transferable to offshore turbines due to the different use of habitats and behaviors offshore. A lack of bat carcasses reported during large-scale, bird-related fatality events at illuminated lighthouses, lightships, and oil or research platforms indicates bats do not appear to be susceptible to the same large-scale collision events that birds are vulnerable to with lit structures (Appendix Q).

However, light sources on the SFWF, WTG decks, and OSS may serve as an attractant to bats as they navigate, or bats may potentially be indirectly attracted if insect prey are drawn to the lighting. Specific WTGs may also be lit with aviation lighting; however, aviation lighting has not been found to influence bat collision risk at onshore facilities in North America (Arnett et al., 2008).

Bat collision-related impacts may result in ***minor impacts*** at the SFWF, with long-distance migratory bats considered to be most at risk. Additionally, several North American nonmigratory bat species populations are in decline (notably the federally threatened northern long-eared bat). Given bats have low reproductive rates and require a high adult survivorship, those populations in decline are potentially vulnerable to impacts (Arnett et al., 2013). Despite an anticipated low collision risk, the level of impact to the listed northern long-eared bat is also considered ***minor*** (because they are a population already at risk).

Based on available information, bats may more likely be attracted to the wind farm rather than displaced due to the presence of the WTGs, as they may investigate WTGs for potential roosting opportunities or use the structures for navigational purposes while migrating. While these behaviors may increase their risk of collision, there are ***no impacts*** or ***negligible impacts*** associated with displacement or barrier impact anticipated during SFWF operations.

Noise and Traffic

Boat activity and noise already occur to some extent within and adjacent to the SFWF area due to existing levels of vessel traffic. Short-term increase of activity and associated disturbances during maintenance activities is expected to have ***no impact*** on bats in SFWF.

Discharges and Releases
There are also ***no impacts*** to bats anticipated with discharges and releases during operation at the SFWF, since these components will be buried beneath the seabed, and there will be no routine maintenance at these components.

Decommissioning

Decommissioning of the SFWF will have similar impacts as construction.

South Fork Export Cable

This section summarizes the assessment of potential impacts on bat species presented in Appendix Q. The primary IPFs associated with the SFEC that could impact bat species include seafloor and land disturbance, noise, traffic, visible structures, and lighting. The potential impacts associated with each phase of the SFEC are addressed separately in the following sections.

Construction

Similar to SFWF, no impacts to bat species are anticipated during construction of the SFEC – OCS and SFEC – NYS.

Operations and Maintenance

No impacts to bat species are anticipated during routine operations of the SFEC – OCS and SFEC – NYS.

Decommissioning

Decommissioning of the SFEC – OCS and SFEC – NYS will have similar impacts as construction.

SFEC – Onshore

Construction

Table 4.3-42 summarizes the level of impacts expected to occur to bat species during the construction and decommissioning phases of the SFEC-Onshore. Additional details on potential impacts from the various IPFs are described in the following sections.

Table 4.3-42. IPFs and Potential Levels of Impact on Bats for the SFEC - Onshore during Construction and Decommissioning

IPF	Project Activity	Potential Impact
Seafloor/ Land Disturbance	Habitat loss/modification from cable installation and interconnection facility installation	Negligible or Minor direct
Noise	Disturbance from cable installation, HDD, and interconnection facility installation	Negligible direct
Traffic	Disturbance from vessel and vehicle activity during cable and interconnection facility installation	Negligible direct

Land Disturbance
Installation of the SFEC – Onshore and construction of the SFEC – Interconnection Facility will result in ***short-term*** and ***minor*** land disturbances. Since the SFEC – Onshore is within existing ROWs (primarily existing roads), ***no impacts*** to bats are expected from installation of the SFEC – Onshore, and ***minor impacts*** are expected from construction of the SFEC – Interconnection Facility. Only ***minor impacts*** to bats are expected, given these activities will occur in already developed areas; and only a relatively small area will be cleared for the SFEC – Interconnection Facility, with minimal additional vegetation clearing along railroad ROWs for the SFEC – Onshore.

Noise and Traffic

There will be noise and traffic associated with construction of the SFEC – Onshore and SFEC – Interconnection Facility. Since these activities will occur in already developed areas, there are ***negligible impacts*** to bats expected.

Operations and Maintenance

No impacts to bat species are anticipated during routine operations of the SFEC – Onshore.

Decommissioning

Decommissioning of the SFEC – Onshore will have similar impacts as construction.

4.3.7.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to bat species.

- Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction (or attraction of insect prey) and possibly collision of bats at night.
- SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROW, therefore, minimizing potential impacts from clearing.

SFW will also consult with the agencies regarding the need for time-of-year restrictions for tree-clearing at onshore project components to mitigate potential impacts to tree-roosting bats.

4.4 Cultural Resources

Cultural resources include archaeological sites, above-ground buildings and structures, objects, districts, and other properties that illustrate important aspects of prehistory or history or that have important and long-standing cultural associations with established communities or social groups. Around the proposed Project (both the SFWF and the SFEC), there is potential to find cultural resources both in submerged marine contexts and in upland terrestrial contexts. Sites that relate to earliest periods of known human occupation in the area may be in what are currently submerged marine environments, as well as onshore terrestrial environments.

Several laws and regulations protect cultural resources. Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (54 U.S.C. 306108), requires that federal agencies consider the impacts of their actions on properties listed in or eligible for listing in the National Register of Historic Places (NRHP). The Archaeological Resources Protection Act (16 U.S.C. 470aa-mm) and Abandoned Shipwreck Act (43 U.S.C. 2101 et seq.) also outline protections for terrestrial and submerged cultural resources. The BOEM, as Lead Federal Agency, will lead the Section 106 process and engage the SHPOs and Native American tribes that may have an interest in the Project area. In many cases, Tribal Historic Preservation Officers (THPOs) participate in consultations as designated representatives of their tribes. As part of the consultation process for the SFWF and SFEC, BOEM will consult with the Rhode Island, Massachusetts, New York, and Connecticut SHPOs, as well as the Mashpee Wampanoag, Narragansett Indian, Mohegan, Mashantucket Pequot Tribal Nation, Shinnecock Indian Nation, and Wampanoag Tribe of Gay Head (Aquinnah) THPOs and the National Park Service (NPS). SFW has also facilitated consultation with the SHPOs and THPOs to support survey protocol development and design of the Project in a way that avoids and minimizes impacts on cultural resources to the extent practicable.

The identification of cultural resources in the SFWF and SFEC and the evaluation of potential impacts have involved several meetings with agency and tribal representatives, oral interviews, and the completion of desktop and field studies. The cultural resources studies that have been completed for the Project include the following surveys and assessments:

- A revised Historic Resources Visual Effects Analysis (HRVEA) and Visual Impact Assessment (VIA), which addressed changes to the proposed locations of WTGs on the OCS and assessed visual impacts to historic properties in New York, Rhode Island, and Massachusetts (EDR, 2019a, 2019b);
- A revised Marine Archaeological Resources Assessment report, which includes documentation of settings with the potential to contain archaeological sites on the OCS and in New York State waters surveyed in 2017 through 2019, inclusive of supplemental studies of an expanded work area on the OCS (Gray & Pape, 2019);
- Phase I Archaeological Survey report, which documented efforts to identify terrestrial archaeological sites onshore in New York (EDR, 2018a); and
- Historic Resources Assessment and Visual Resource Assessment (VRA) for the SFEC – Interconnection Facility, which assessed visual impacts to historic properties in the vicinity of the proposed substation (EDR, 2018b).

The full text of the revised HRVEA is included as Appendix W, while the full text of the revised VIA is included as Appendix V. The complete revised marine archaeology assessment is included as Appendix R, and the full text of the terrestrial archaeological resources assessment is included as Appendix S. The full text of the Historic Resources Assessment for the SFEC – Interconnection Facility is included as Appendix T, while the full text of the Visual Resources Assessment is included as Appendix U. Summaries of the findings of each study are presented below.

4.4.1 Above-Ground Historic Properties

4.4.1.1 Affected Environment

Regional Overview

Historic properties are defined as districts, buildings, structures, objects, or sites that are listed in or determined eligible for listing in the NRHP. SFW commissioned an analysis of visual impacts to historic resources within the visual Preliminary Area of Potential Effects (PAPE) of both the SFWF and the SFEC - Onshore to identify impacts to previously recorded and designated above-ground historic properties near the Project area, as well as additional properties that may be eligible for NRHP listing or state-level historic designation (Appendix W). The final Area of Potential Effects (APE) will be formally determined by BOEM as part of the agency's Section 106 process; "PAPE," as used here, refers to the areas SFW believes will be subject to direct or indirect impacts from Project activities. The process for identifying and evaluating visual impacts to historic properties from the SFWF and SFEC will involve consultation with BOEM, SHPOs, THPOs, and other consulting parties with a demonstrated interest in the historic properties (e.g., a local historical society).

South Fork Wind Farm

The PAPE was defined to include those areas where proposed WTGs will be visible and where there is a potential for a significant visual impact to historic properties. The PAPE was not based solely on potential Project visibility, but also on the distance within which visibility of the Project could result in a significant impact on the visual setting of a given historic property, as detailed in the revised HRVEA (Appendix W).

Based on the results of these studies, and to provide a conservative analysis of potential Project visibility from historic properties, the visual study area for the SFWF was defined as the area within a 40-mile (64.4-km) radius of each of the proposed turbines. This study area includes approximately 5,133 square miles (13,294.41 km^2) of open ocean, 755 square miles (1,955.44 km^2) of land (including inland water bodies), and over 1,000 linear miles (1,609.3 km) of shoreline in New York, Rhode Island, Massachusetts, and Connecticut. However, within this study area, only a relatively small portion of onshore areas will have open views of the SFWF. For example, topography, current land cover, and intervening land masses (Fishers Island and Block Island) screen views of the planned offshore facilities from Connecticut.

Based on viewshed mapping within a preliminary 40-mile (64.4-km) study area for the SFWF, the PAPE for assessing impacts to above-ground historic properties field survey was defined as all locations on Block Island and the New York, Rhode Island, and Massachusetts mainland with potential views of one or more WTGs. As a result of geographic information system (GIS) and light detection and ranging (LiDAR) viewshed analyses, approximately 2.1 percent of lands within the 40-mile (64.4 km) study area have potential views of some portion of the SFWF, based on the availability of an unobstructed line of sight.

The above-ground historic properties evaluation (Appendix W) was coordinated with the VIA for the Project (Appendix V). The VIA is dependent on, and contributes to, the anticipated review of the SFWF and SFEC's impact on historic resources, which is required as part of BOEM's review under Section 106 of the NHPA.

The viewshed analysis informed the selection of the historic properties recommended for impacts evaluation, and the identified historic properties were subsequently included as a category of visually sensitive receptors in the HRVEA. The HRVEA considered 9,883 historic properties either designated as National Historic Landmarks (NHLs), NRHP- or state-listed, or NRHP- or state-eligible individual resources or districts, Traditional Cultural Properties (TCPs), or state-inventoried resources in New York, Rhode Island, and Massachusetts. Of these resources, only 113 were determined to be located within the PAPE (i.e., within areas where there is a potential for visibility of the SFWF and SFEC, as determined by GIS-based viewshed analysis).

South Fork Export Cable

Additionally, consideration was given to areas where the SFEC – Interconnection Facility maintained a potential for a significant visual impact to historic properties surrounding its location on Long Island, as detailed in the VRA (Appendix U). For the SFEC - Onshore, a visual study area encompassed an area within a 3-mile (4.8-km) radius of the SFEC – Interconnection Facility, which covers approximately 28.3 square miles (73.3 km^2) within the towns of East Hampton and Southampton, encompassing the village of East Hampton in its entirety, as well as a portion of the village of Sagaponack.

4.4.1.2 Potential Impacts

Potential impacts (effects) on cultural resources range from physical alteration, disturbance, or destruction of a historic property caused by construction activities to changes such as the introduction of new and incompatible visual elements or auditory effects that diminish the historically significant characteristics of a historic property. The Federal Regulations entitled "Protection of Historic Resources" (36 CFR 800) define potential impacts (adverse effects) on historic resources as follows:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative (36 CFR 800.5(2)).

IPFs that could result in impacts to above-ground historic properties during the construction, O&M, and decommissioning phases of the SFWF and SFEC are described in Section 4.1. A summary of the IPFs that could result in impacts to above-ground historic properties are shown in Figure 4.4-1. Only those IPFs with anticipated impacts negligible or greater are included in the following discussion.

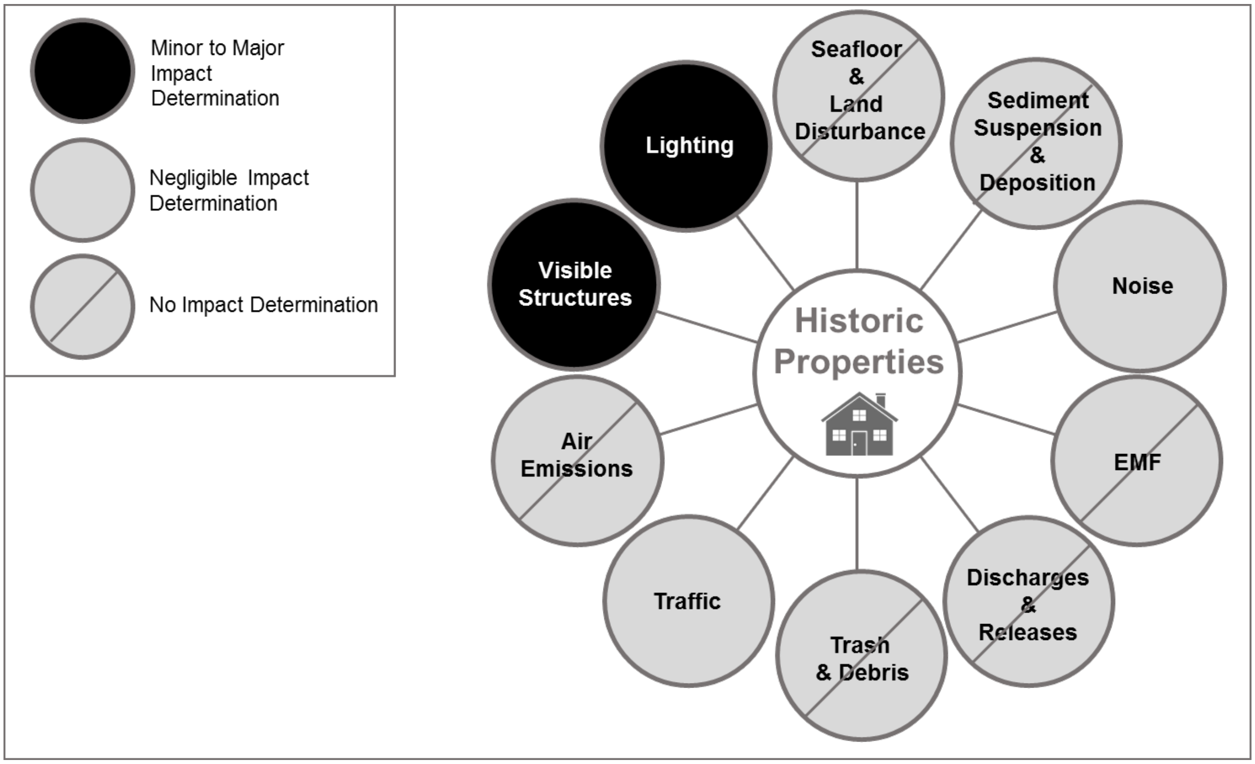

Figure 4.4-1. IPFs on Above-Ground Historic Properties
Illustration of potential impacts to above-ground historic properties resulting from SFWF and SFEC activities

South Fork Wind Farm

Of the three phases of the SFWF, the construction and O&M phases are expected to have the greatest impact on above-ground historic properties due to the potential visual intrusion of offshore facilities on the historic settings of shoreline properties. The sensitivity to individual historic properties located within the PAPE to these anticipated changes varies depending on the historical relationship of each property to maritime settings and viewscapes. The impacts are anticipated to persist for the period of operations and cease upon completion of decommissioning. Visual impacts during decommissioning would include a brief period when vessels and equipment are removing the WTGs and other components.

Construction, Operations, Decommissioning

Visible Structures

The Project will be visible and will result in a change to the visual setting of historic properties located along the shoreline. The proposed wind turbines would be a new feature in the visual setting and views toward the ocean. Due to their scale and form, they are likely to attract viewer attention. However, the relatively small number of WTGs, their distance from shorelines within the PAPE, and the relatively small area of the horizon they occupy all help to minimize the visual impact. The minimum distance separating above-ground historic properties from the proposed WTGs is approximately 19 miles. Even from the closest island or mainland viewpoints, the Project will occupy a relatively small portion of an expansive seaward view, and thus will not dominate the horizon. Changes to the existing viewsheds for shoreline areas at the east end of Long Island and southern shores of Block Island are further reduced by the existing Block Island Wind Farm WTGs. The closest point to shore from the proposed WTGs ranges from 19miles (30.5 km), on Block island, to 35 miles (56.3 km), in Montauk.

The Project is not expected to be a visually dominant feature of views from any historic properties within the PAPE. Although the visual impacts to historic properties within the PAPE are expected to be negligible or minor in most cases due to distance and/or partial obstruction of seaward views, ***moderate to major impacts*** may occur to properties for which historic maritime settings and open-ocean views are important aspects of the property's significance. The visual intrusiveness of the proposed WTGs and OSS relative to existing views is not necessarily greater from these properties than from other resource locations, but the relevant historic settings may be more expansive and inclusive of the wind farm. Historic lighthouses are the most prominent examples of such properties, as the historic location, function, and design of the properties are associated with distant seaward views. For these properties, the presence of visible twenty-first-century infrastructure on the ocean horizon would likely constitute a change in the historic settings. Historic lighthouses within the PAPE include the Southeast Lighthouse on Block Island, Beavertail Lighthouse in Jamestown, Watch Hill Lighthouse in Westerly, Rhode Island, and Montauk Lighthouse in Montauk, New York. The Breakers, Marble House, Ocean Drive and Bellevue Avenue historic districts in Newport, Rhode Island may also have an elevated sensitivity to visual impacts due to their location and historic architectural and landscape designs which embrace ocean views. Southeast Lighthouse and the four above-listed Newport properties are National Historic Landmarks and additional considerations of potential adverse effects are anticipated in accordance with Section 110(f) of the NHPA and 36 CFR 800.10. Appendix W provides a detailed summary of individual historic property impact assessments.

SFW recognizes that TCPs associated with Native American communities may be present within the study area, and such properties would potentially be sensitive to visual impacts from Project construction, O&M, or decommissioning. SFW coordinated with THPOs to identify sensitive viewpoints within the PAPE where visual impacts to TCPs might occur. Based on analyses and coordination with the tribes, SFW does not anticipate adverse impacts to TCPs, but recognizes that government-to-government consultation between BOEM and tribes under Section 106 may be beneficial to the consideration of such properties and potential Project impacts.

Lighting

The revised VIA (Appendix V) and the revised HRVEA (Appendix W) indicate that visibility of the SFWF is limited from most of New York, Rhode Island, and Massachusetts, resulting in ***negligible*** to historic properties in those areas. The historic properties with the highest potential for SFWF visibility were those that were situated to take advantage of panoramic ocean views, such as the Southeast Lighthouse on Block Island, Beavertail Lighthouse in Jamestown, and Watch Hill Lighthouse in Westerly, Rhode Island. These represent examples of NRHP properties that receive high public use/visitation in the region that will have at least some visibility of the SFWF, although nighttime safety lighting associated with WTGs will have only a ***minor impact*** to a limited number of areas along the coast. A comprehensive list of areas from which potential SFWF facilities will be visible within the PAPE are listed in Appendix A and depicted in Figure 8 of the revised HRVEA (Appendix W). The revised VIA report in Appendix V provides further discussion of the visibility of the WTGs within the 40-mile (64.4-km) study area and the methods used to assess potential visual impacts from the SFWF, including viewshed mapping, field reviews, and visual simulations.

There are no NRHP-listed or -eligible above-ground historic properties within the PAPE that will be directly affected by construction, O&M, or decommissioning of the SFWF. Therefore, construction and O&M of the SFWF would be expected to result in ***no direct impacts*** on above-ground historic properties.

The visual impacts assessment studies completed as part of the SFWF will be provided to SHPOs and THPOs as part of the Project's ongoing consultation. The formal impacts (effects) determination for the Project will be completed through the Section 106 consultation process between BOEM, SHPOs, THPOs, and other interested parties, as applicable.

SFEC - Onshore

Of the three phases of the SFEC, the construction and O&M phases are expected to pose a risk of adverse impacts to historic properties. When and if removal of the SFEC occurs as a result of decommissioning, then it is expected that short-term effects would occur during removal of the SFEC and its components.

Construction, Operations, Decommissioning

As described in Appendix U, there are no NRHP-listed or potentially eligible above-ground historic properties within the APE that would be directly affected by construction of the SFEC and the SFEC – Interconnection Facility. Therefore, construction and O&M of the SFEC - Onshore would be expected to result in ***no direct impacts*** to above-ground historic properties.

Visibility of the potential SFEC - Onshore cable routes on Long Island will have ***no impact***, since the cable will be buried beneath existing roads or within other public ROWs.

Visible Structures

Construction of the SFEC – Interconnection Facility will occur adjacent to the existing East Hampton substation, in a lot surrounded by mature trees. A digital surface model (DSM) of the study area was created from LiDAR data, which includes the elevations of buildings, trees, and other objects. This analysis indicates that the SFEC – Interconnection Facility could potentially be visible from only 1.8 percent of the 3-mile (4.8-km) visual study area. Field review indicated that actual visibility of the SFEC – Interconnection Facility is likely to be even more limited than suggested by the computer-based viewshed analysis. Throughout most of the study area, the SFEC – Interconnection Facility will likely not be visible due to the density of modern buildings and structures in the villages, and dense, mature evergreen and deciduous forest in the SFEC – Interconnection Facilities surroundings. Potential visibility of the substation will be generally limited to a few areas within approximately 0.25 mile (0.4 km) of the SFEC – Interconnection Facility. These areas generally correspond to the areas of predicted visibility as indicated by the LiDAR-based viewshed analysis. In these areas, the existing East Hampton substation, as well as the SFEC – Interconnection Facility, is visually screened from most nearby areas by dense, mature vegetation that ranges in height between approximately 50 and 70 feet (15.2 to 21.3 m).

During field review, photos were taken from the various historic districts within the study area to support preparation of photosimulations reflecting the nature and extent of visibility from historic properties within the study area (viewpoint references for examples detailed in Appendix V follow). These include Buell's Lane Historic District (see Viewpoints 6 and 28), Jericho Historic District (see Viewpoint 19), and East Hampton Historic District (see Viewpoints 26, 27, 31–33, 36-39, 50, and 75). At each of these locations, the Project would be screened due to the combination of large, mature street trees, forest vegetation, and intervening buildings and structures. No visibility of the Project is anticipated from these areas. As a result of this analysis, the SFEC – Interconnection Facility will result in ***minor*** to ***negligible impacts*** to historic properties.

The locations of NRHP-listed and state- and NRHP-eligible historic properties on Long Island in relation to the viewshed of the SFEC – Interconnection Facility are shown in Figure 7 of Appendix T. Section 4.5 and Appendix U provide further discussion of the visibility of the SFEC construction and O&M activities within the study area and the methods used to assess the potential visual impacts of the Project, including viewshed mapping, field reviews, and visual simulations. The visual impacts assessment studies appended to this report will be provided to the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) and BOEM for review, as part of the Project's ongoing consultation.

Noise

As discussed above, the Project would not directly affect NRHP-listed or state- or NRHP-eligible above-ground historic properties. The SFEC onshore components will be collocated with existing electric generation and transmission facilities, located on compatible industrial properties, or buried within existing roadway or other public ROWs to avoid negative visual impacts. Also, all of the SFEC-Interconnection Facility is at least partially obstructed from each of the historic properties by topography, vegetation, and intervening buildings and structures. As such, ***negligible impacts*** are anticipated from noise.

Traffic

During construction of the SFEC – Interconnection Facility, vehicular traffic will increase. As a result, short-term noise and vibration may occur as a result of the passage of equipment to and from the construction site. However, traffic will use the same means of ingress and egress as used for the existing East Hampton substation. Therefore, only ***short-term, negligible impacts*** to above-ground historic properties could result from traffic associated with the SFEC.

4.4.1.3 Proposed Environmental Protection Measures

For the SFWF, options for mitigating visual impacts of wind energy facilities of this type are limited, given the nature of offshore wind energy projects and their siting criteria. Because of these limitations, mitigation for impacts to historic properties typically consists of measures that directly benefit historic properties and/or the public's appreciation of them. Mitigation measures that have been proposed for other wind energy projects in states within the visual study area have included activities such as cultural resources studies, monetary contributions to historic property restoration causes, development of heritage tourism promotional materials, development of educational materials and lesson plans, and development of public history materials, such as roadside markers.

For the SFEC – Interconnection Facility, due to the relatively small size and modest height, views from visually sensitive resources have largely been avoided.

Several environmental protection measures will reduce potential impacts to historic resources.

- The location of SFWF, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive above-ground historic properties.
- SFWF WTGs will have uniform design, speed, height, and rotor diameter.
- The color of the SFWF WTGs (less than 5 percent grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips.
- The SFEC - Onshore cable will be buried; therefore, minimizing potential visual impacts to above ground historic properties.
- The SFEC - Interconnection Facility will be located adjacent to an existing substation on parcel zoned for commercial and industrial/utility use.
- The SFEC - Interconnection Facility land parcel is currently screened by mature trees. After construction, SFW will consider additional screening to further reduce potential visibility and visual impact.

The complete range of potential mitigation measures evaluated by SFW as part of Project development for the SFWF are detailed in the revised VIA and revised HRVEA reports, in Appendices V and W, respectively.

The complete range of potential mitigation measures evaluated by SFW as part of Project development for the SFEC – Interconnected Facility are detailed in the Historic Architectural Resources Survey and VRA report in Appendices T and U, respectively.

4.4.2 Marine Archaeological Resources

4.4.2.1 Affected Environment

Regional Overview

As part of cultural resources investigations for the Project, SFW commissioned a marine archaeological resources assessment for the SFWF and SFEC. The SFWF is located on the OCS in Rhode Island Sound, and the SFEC will run from the SFWF to the southern shore of Long Island, New York. The goal of the assessment was to identify NRHP-listed and -eligible submerged archaeological resources that may be affected by the SFWF or SFEC. Potential archaeological resources on the OCS fall into two broad categories: (1) post-contact period shipwrecks, or other lost warcraft, aircraft losses, or historic marine infrastructure, and (2) pre-contact period Native American sites. Pre-contact resources may include sites used by indigenous peoples prior to marine transgression or sites associates with post-transgression indigenous maritime activities, such as fishing and water transport. The SFWF and SFEC assessment was designed to identify geological features with pre-contact period archaeological sensitivity and remote sensing anomalies or targets potentially associated with post-contact period submerged cultural resources. The study encompassed areas subject to bottom-disturbing activities during the construction, O&M, and decommissioning of the SFWF and SFEC based on the project design in 2018.

SFW has completed a high resolution geophysical (HRG) survey and geotechnical investigations of the areas subject to seabed disturbance during Project construction, operations, and decommissioning. The survey was conducted in two phases. HRG and initial shallow geotechnical investigations along the SFEC and western half of the SFWF were completed in 2017. Subsequent to completion of the 2017 surveys and in response to stakeholder input, SFW identified an expanded work area extending to the east of 2017 study area that would accommodate a revised layout with wider spacing between WTGs. Supplemental G&G surveys and marine archaeological resources assessments of the expanded work area and deep geotechnical investigations of potential WTG and OSS foundations were completed in 2018 and incorporated in a revised Marine Archaeological Resources Assessment (Appendix R). All marine archaeological assessments were conducted in accordance with BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* and relevant lease stipulations.

The proposed APE for marine archaeological resources includes areas on the OCS, which is administered by BOEM, and areas of the SFEC extending west from the SFWF to the southern portion of eastern Long Island, where it turns north and enters New York State waters. Since Project activities will also occur in New York State waters, the report also complies with regulations outlined in the New York Historic Preservation Act of 1980.

In conjunction with detailed literature and site files research, G&G field investigations were conducted within the SFWF survey area, and along the approximately 61.5-mile (99-km) long SFEC corridor on the OCS and in New York State waters. Shallow geotechnical investigations in 2017 were conducted to characterize seabed sediments to depths of 20 feet (6 m) below the seafloor for the SFWF, and 10 feet (3 m) for the SFEC corridor. Supplemental vibracoring of paleochannel features in the SFEC conducted in 2018 targeted sediments within 20 feet (6 m) of the seabed surface. Deep borings at five potential foundation locations in the SFWF were advanced to a maximum depth of approximately 246 feet (75 m) in 2018.

The underwater survey employed a variety of remote sensing technologies deployed from survey vessels to examine the seabed and to locate anomalies and acoustic targets on or buried in submerged sediments that might be affected by Project activities. Vibracores were collected from suspected paleolandforms (relict terrestrial landforms that survived marine transgression). The vibracores were used to corroborate interpretations of geophysical data and evaluate the potential for archaeological deposits to be present within areas subject to sea bed disturbance. A detailed description of the methodology and results of this study is contained in Appendix R.

The proposed Area of Potential Effects (APE) for marine archaeological resources includes the maximum horizontal and vertical limits of anticipated seabed disturbance caused by Project construction, operations, or decommissioning. The horizontal limits of the APE for the SFEC are defined by a 591-foot (180 m) wide corridor along the proposed cable route. The maximum depth of disturbance in this section is 15 feet (4.7 m) based on potential vessel anchorage. Seabed disturbance from the cable lay will be confined to a maximum depth of 10 feet (3 m). The horizontal limit of the APE for the SFWF coincides with the Maximum Work Area (MWA) boundary based on potential vessel anchorage or mooring during construction staging. The vertical limit of the APE within the SFWF is 15 feet (4.7 m) based on anchorage for all areas except proposed foundation locations. Seabed disturbance from monopiles is expected to extend to a maximum depth of 164 feet (50 m). The APE includes a 500-foot (152 m) radius around foundation locations to allow for potential micrositing of piles. SFW also defined areas of potential seabed disturbance associated with specific construction activities. These areas are wholly contained within the APE and are intended to assist in planning for potential resource avoidance and protection. Further details are provided in Appendix R, including the specific APE boundaries for the Sea-to-Shore transition in New York State waters. The G&G survey of the entire APE has been completed and provides sufficient data for the identification of submerged archaeological sites that may be affected by the Project.

South Fork Wind Farm

Archival investigations of the SFWF Project area were conducted to identify previously documented pre- and post-contact period archaeological sites within the SFWF study area. Few archaeological studies have been conducted within Rhode Island or Block Island sounds, and data coverage is sparse relative to terrestrial contexts in the surrounding sections of Rhode Island, Massachusetts, and New York. Site file and shipwreck data were reviewed at the RIHPHC (Rhode Island SHPO) and the NYSOPRHP (New York SHPO). Additionally, archaeological reports and studies were used in conjunction with site files data to create a context for pre-contact cultural materials. NOAA, BOEM, and other shipwreck databases were accessed to identify potential post-contact period resources in the anticipated APE. Additional regional and maritime secondary histories, maps, and other resources were used to refine the historic contexts for pre- and post-contact use of the study area. The historic contexts provided a basis for assessing the types and ages of archaeological resources that might be present within the SFWF and SFEC, and where such resources would most likely be preserved.

No shipwrecks or pre-contact sites within are recorded within the SFWF area at RIHPHC or NYSOPRHP. Four shipwrecks were reported in the NYSOPRHP records, at the eastern end of Long Island (nearer to the SFEC), from East Hampton to Montauk Point. Data from NOAA's Automated Wreck and Obstruction Information System (AWOIS) and Electronic Navigational Charts (ENC) databases, as well as the proprietary BOEM shipwreck database, indicated three shipwrecks reported within the SFWF, and several others within 1 mile (1.6 km) of the SFWF and SFEC. Additionally, the OSAMP, which includes the vast majority of the SFWF area, indicates many potential shipwreck site locations, but none specifically identified within the APE. The OSAMP lists 26 military craft losses and 36 known shipwrecks and several hundred additional reported shipwreck losses in the waters off Rhode Island. Known or suspected wrecks are concentrated closer to shore, rather than in the open waters of Rhode Island Sound, where the SFWF would be constructed.

Although no pre-contact sites were documented in RIHPHC or NYSOPRHP site files, a number of recent studies were reviewed to assess the potential for submerged pre-contact sites within the APE, as well as appropriate methods to identify them. Importantly, the relevant geologic and archaeological contexts of the southern New England region were studied to assess where potential pre-contact sites may once have been located on the now-submerged landscapes of the OCS. SFW consulted with six federally-recognized tribes to address potential resource locations and site types that may not be reflected in the existing archaeological literature. For the marine archaeological assessment, an archaeological context was developed based on known geological conditions and previous archaeological research of terrestrial settings near the study area. Settlement patterns for the periods of potential pre-contact Native American use of the OCS were reviewed to identify landforms and environmental settings with an elevated potential to support habitations or other site types. A model of sea level rise within and around the SFWF was created to estimate the time range of potential Native American sites, and geophysical data were examined to identify potential relict geological features such as paleochannels, estuaries, deltas, coastal or riverine terraces, beach barrier complexes, paleolakes and lagoons, or other indications of habitable landforms that may be preserved within the APE. Using known pre-contact cultural chronology and settlement patterns, sea level data, geomorphic contexts, and geophysical data, an assessment of the potential for pre-contact sites or other resources to be present within the APE was completed.

G&G surveys were conducted to characterize shallow hazards, geological conditions, geotechnical characteristics, and to provide data for marine archaeological resource assessments. The survey area extended approximately 3,281 feet (1,000 m) beyond the potential WTG positions to provide coverage of the area where vessels may come into contact with and/or disturb the seafloor during construction, O&M, and decommissioning of the SFWF. A high-resolution geophysical (HRG) survey was conducted using a 98-foot (30-m) line spacing. Perpendicular tie lines were spaced at 1,640 feet (500 m). Survey transects ran in an east-west orientation, while tie lines were perpendicular, with a general north-south orientation.

The HRG survey included a magnetometer (2017) or gradiometer (2018), side-scan sonar, sub-bottom profiler (both Chirp and Sparker), and a multibeam sounding system. Sparker data were collected using two instrument configurations. Data were collected at 300 joules using a single hydrophone on 30 m spacing to corroborate Chirp data. Sparker data were also collected at 500 joules using a multi-hydrophone array on 150 m-spaced tracklines. 2018 Chirp data collection in 2018 included the use of a larger hydrophone array to reduce signal attenuation and enhance resolution of the shallow seabed. The variety of remote sensing methodologies were used to enhance the potential of identifying potential archaeological sites and locations warranting direct sampling for further evaluation. In addition to review of previous archaeological and geological research, SFW coordinated with tribal representatives to better understand the range of potential cultural resources that may be present within the study area. The marine archaeologist, on behalf of SFW, invited representatives of the Narragansett Indian Tribe, Mohegan Tribe, Mashantucket Pequot Tribal Nation, Mashpee Wampanoag Tribe, Wampanoag Tribe of Gay Head (Aquinnah), and the Shinnecock Tribal Nation to participate in a series of review sessions prior to geotechnical investigations during both phases of the survey. The purpose of the meetings was to identify potentially sensitive contexts represented in the geophysical data that warranted further investigation. Based on these meetings and analyses by the marine archaeologist, sampling locations were selected for geotechnical investigations with vibracores.

South Fork Export Cable

Consistent with the methods used for the SFWF, archival investigations of the SFEC were conducted to identify previously documented pre- and post-contact period archaeological sites or underwater archaeological resources within the SFEC study area. Site file data and published histories and maps were used to assess the potential for archaeological resources and to develop a context for interpretation of potential materials within the SFEC.

NYSOPRHP data indicate four shipwrecks at the eastern end of Long Island, from East Hampton to Montauk Point. Data from NOAA's AWOIS and ENC databases, as well as the proprietary BOEM shipwreck database, indicated several others within 1 mile (1.6 km) of the SFEC. Additionally, the various sources consulted during research for both the SFWF and SFEC indicate that a number of potential shipwrecks could be located within the vicinity of the SFEC, although accurate mapping of these locations is not available. As with the SFWF, a number of recent marine archaeological studies were reviewed to establish relevant geological and archaeological contexts for the SFEC and to develop formulations for testing and/or modeling for potential archaeological sites within the SFEC route.

As with the SFWF, G&G surveys were conducted to characterize conditions and to provide data for marine archaeological resource assessments. The SFEC survey corridor included a centerline and three offset lines on either side spaced 98 feet (30 m) apart, encompassing a 591-foot (180-m) wide corridor. Centerline Sparker data were collected at 500 joules with a multi-hydrophone array. The corridor, which was surveyed using the same methods and instrumentation as used for the SFWF area, was widened in three areas. These include:

- The section within approximately 6.8 miles (11 km) of the SFWF was widened, while maintaining a 98-foot (30-m) line spacing, to a variable width of approximately 2,296.5 to 3,281 feet (700 to 1,000 m), to allow room to route the cable through a boulder area.
- The shore approaches for the potential landing sites were widened to approximately 0.6 and 0.9 mile (1 and 1.5 km), respectively, from approximately 0.62 mile (1 km) offshore to the inshore survey limit. Survey tie lines along the SFEC corridor were spaced approximately 1,640 feet (500 m) apart.

Survey transects within the SFEC survey area ran in an east-west orientation (parallel to the SFEC corridor), while tie lines were perpendicular, in a north-south orientation. The only modifications to this methodology occurred around seabed obstructions and directly offshore Long Island. Vibracoring was conducted to evaluate potentially sensitive paleolandforms identified during the geophysical survey of the SFEC and in coordination with the above-listed tribes.

A complete description of the survey methodologies and results for both the SFWF and SFEC is provided in the full text of the marine archaeological assessment in Appendix R.

4.4.2.2 Potential Impacts

IPFs that could result in impacts to marine archaeological resources are indicated in Figure 4.4-2. Only those IPFs with anticipated impacts negligible or greater are included in the following discussion.

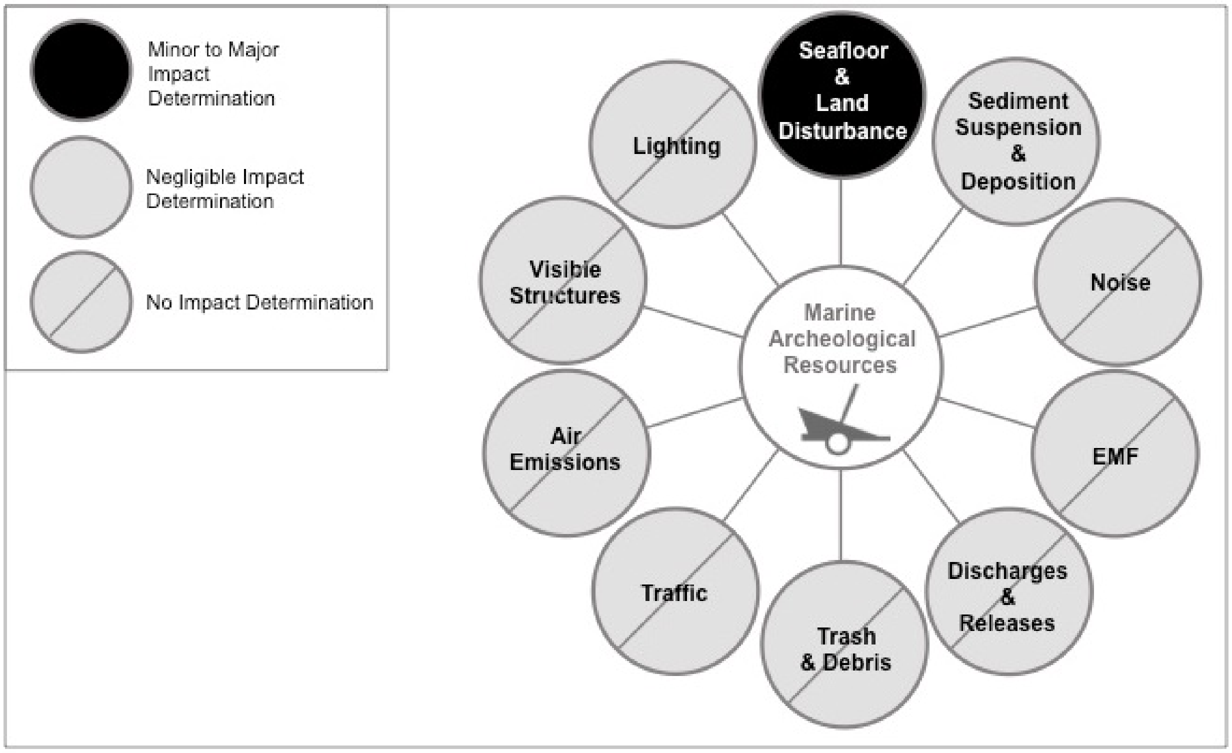

Figure 4.4-2. IPFs on Marine Archaeological Resources
Illustration of potential impacts to marine archaeological resources resulting from SFWF and SFEC activities

South Fork Wind Farm

Of the three phases of the SFWF, the construction phase is expected to pose the highest threat of adverse impacts to marine archeological resources. The O&M of the SFWF does not cause IPFs that would impact these resources. When and if removal of the SFWF occurs as a result of decommissioning, then it is expected that marine archeological resources encountered during construction have already been managed according to Tribal, federal, and state expectations and regulations.

Construction

Seafloor and Land Disturbance
SFW proposes to site WTGs and Inter-array Cables to avoid or minimize impacts to submerged cultural resources. Disturbance to submerged cultural resources may occur because of anchor drop and anchor sweep from the derrick barge associated with the installation of the WTGs or displacement of sediment for construction of WTG foundations or inter-array cabling. The approximately 3,281-foot (1,000-m) survey corridor around the WTGs was defined based on the anticipated maximum radius for the derrick barge anchors.

Side-scan sonar imagery indicated numerous natural and few cultural features on the seabed. Most cultural features appeared to be related to fishing, lobster traps, or isolated debris. Two shipwrecks were identified during the geophysical survey of the SFWF study area. Both wrecks are likely of modern age based on analysis of side-scan sonar images and associated magnetic anomalies. Two potential shipwreck sites of undetermined age were identified east of the study area. SFW will maintain a protective buffer extending 164 feet (50 m) from the maximum discernable extent of each shipwreck and 328 feet (100 m) from the maximum discernable extent of the potential shipwrecks during Project construction, O&M, and decommissioning.

Other anthropogenic magnetic anomalies and side-scan sonar targets identified during the HRG survey represent fishing equipment, modern debris, submarine cables, or features associated with fishing activities.

Sea-level modeling indicates that the SFWF would have been exposed, terrestrial lands (subaerial) for thousands of years following the last glaciation. Rising seas caused by the melting of ice sheets approximately 22,000 years ago inundated the area during the Paleoindian Period, which is the earliest period of Native American settlement defined by archaeologists. The SFWF was progressively submerged, with the highest elevations being inundated between 11,000 and 10,000 years ago. The archaeological assessment for pre-contact resources within the SFWF included a reconstruction of the now-inundated landscapes that would have been available to ancient Native Americans and an analysis of how those ancient landscapes have been altered by natural processes operating over the course of millennia. Marine transgression caused extensive erosion of former terrestrial surfaces. Previous research and the marine archaeological assessment completed for the SFWF and SFEC indicate that contexts with the potential to preserve archaeological sites are generally confined to areas that were deeply buried before transgression or topographic/bathymetric basins where marine sediments were deposited in low-energy settings during transgression.

Several prominent paleochannels identified in sub-bottom data cross-cut the SFWF. Analyses of G&G data indicate these large channels are tunnel valleys formed below the ice sheet during the last glaciation. The tunnel valleys are filled with varied outwash sediments likely deposited in the period immediately following local ice recession around 22,000 years ago. Smaller channels, largely conforming to the tunnel valley alignments and incising the earlier outwash deposits, were also identified in the sub-bottom data. These second-generation channels likely reflect subaerial drainage networks formed after ice recession, while the SFWF was a terrestrial landscape. The smaller channels or incised valleys would have contained rivers or streams during the potential period of pre-contact occupations of the SFWF, following deglaciation and ending with marine transgression of the SFWF about 11,000 years ago. The configuration of second-generation channels suggests they are associated with high-order stream or river channels on the subaerial landscape. Low-order channels associated with tributary streams that may have once extended to the morainal terrain are lacking. The absence of these features is consistent with extensive erosion of interfluves during marine transgression.

Both geophysical and geotechnical data indicate potentially sensitive contexts at depths greater than 20 feet (6 m) of the seafloor will be confined depositional surfaces within second generation channels, if extant. First generation channel fills, glacial tills, and glacio-tectonic morainal deposits have a low potential to contain intact paleosols or archaeological resources.

Analyses of vibracores suggest that the majority of the terrestrial sediments preserved beneath the erosional unconformity created by transgression (ravinement) are unweathered glacial deposits with a low potential to contain intact archaeological resources. No evidence of pedogenic development or landform preservation was identified outside of paleochannel features. Nine paleolandforms with the potential to contain archaeological resources were identified within second generation paleochannels on the SFEC and SFWF. These include three paleolandforms within the SFWF and five paleolandforms within the SFEC. These locations are associated with paleosols developed on alluvial or deltaic surfaces that were subsequently buried prior to marine transgression. Both radiocarbon (AMS) dating of associated organic materials and the interpreted stratigraphy indicate each of the relict landforms is associated with the post-glacial, pre-transgression interval (~ 17,000 to 10,000 years ago) when Native American use of the SFWF is most likely to have occurred.

Two intact shipwrecks and three diffuse scatters of potential ship debris were identified within the SFWF from geophysical data. The Qualified Marine Archaeologist (QMA) recommends a protective buffer of 164 feet (50 m) be maintained around the intact shipwrecks and a protective buffer of 328 feet (100 m) be maintained around the scatters to avoid any potential impacts to these resources. The QMA has delineated the vertical and horizontal boundaries of the archaeologically sensitive paleolandforms along the SFEC and within the SFWF APEs. The boundary delineations are based on both high-resolution subbottom geophysical data and direct sampling during the geotechnical investigations. The QMA recommends avoiding seabed disturbance within these limits. Based on the two proposed wind farm layouts, no potential impacts are anticipated to the identified shipwreck or shipwreck scatter sites. Two of the paleolandforms within the SFWF are located within the potential anchorage areas associated with Inter-array Cable. No conflicts with the potential foundations have been identified, inclusive of the proposed micrositing and temporary workspaces. SFW is assessing options to avoid potential impacts to the paleolandforms extending into potential anchorage areas along the Inter-array Cable routes. Options may include horizontal or vertical realignments of associated cable facilities and/or establishment of no-anchorage zones within anticipated workspaces. SFW anticipates further consultations with BOEM, the Tribes, and other consulting parties to assist in BOEM's determination of effects under Section 106 and any appropriate mitigation measures to avoid, minimize, or mitigate potential impacts to these resources.

SFW recognizes that TCPs associated with Native American communities may be present within the study area, and such properties would potentially be sensitive to seabed disturbance from Project construction. SFW coordinated with THPOs during the G&G surveys to identify areas of concern and evaluate potential paleo landforms that may retain cultural sites significant to Native American tribes. Based on analyses and coordination with the tribes, SFW does not anticipate adverse impacts to TCPs from offshore construction but recognizes that government-to-government consultation among BOEM and tribes under Section 106 may be beneficial to the consideration of such potential impacts.

Although SFW will make every effort to site WTGs and inter-array cabling away from marine archaeological resources and potential TCPs, unanticipated discoveries below the seafloor during construction remain a possibility. Based on the potential anchorage within the delineated paleolandform boundaries, construction of the SFWF has the potential to result in ***minor*** to ***moderate impacts*** to marine archaeological resources.

Sediment Suspension and Deposition

Potential sediment suspension and deposition during construction is unlikely to impact submerged archaeological resources. Deposition of suspended sediment is anticipated to be localized to areas of sea bed disturbance. Low energy deposition of sediments over archaeological resources buried beneath the sea bed is not expected to disturb or otherwise affect the integrity of those resources. The protective buffers recommended for shipwreck sites and archaeologically sensitive areas will minimize the potential impacts from construction-related suspension and deposition to cultural resources.

Sediment suspension and deposition will result in ***negligible impacts*** to marine archaeological resources, as no direct disturbances to these resources would occur.

South Fork Export Cable

Of the three phases of the SFEC – OCS and SFEC - NYS, the construction phase is expected to pose the highest threat of adverse impacts to marine archeological resources. The O&M of the SFEC does not cause IPFs that would impact these resources. When and if removal of the SFEC occurs as a result of decommissioning, then it is expected that marine archeological resources encountered during construction have already been managed according to Tribal, federal, and state expectations and regulations.

Construction

Seafloor and Land Disturbance

Sub-bottom profiler data indicated two general sub-seabed environments, a sheet of Holocene sands south of Long Island, and a more dynamic area beginning with the Block Island Channel and eastward toward the SFWF, on Cox Ledge. The sub-seabed contained no discernable gas pockets, salt domes, pipelines, or other buried materials. The majority of the SFEC study area was substantially altered by erosion during marine transgression. G&G evidence for paleo landforms with the potential to contain archaeological resources in SFEC are limited to paleochannel margins or terraces that were buried by relatively thick sediments prior to inundation.

The orientation of SFEC runs approximately parallel to the ancient shoreline prior to marine transgression. Analyses of seismic data suggests the SFEC will intersect multiple post-glacial stream or river valleys that once drained the area south of present-day Long Island. Vibracore sampling and supplemental analyses of geophysical data indicates portions of five paleochannels are archaeologically sensitive. These areas are associated with stable landforms pre-dating marine transgression. The QMA has recommended avoidance of seabed disturbance within the vertical and horizontal limits of these areas.

SFW will make every effort to site the SFEC away from potential submerged cultural resources. Disturbance to potential submerged cultural resources may occur because of anchor drop and anchor sweep from the derrick barge, or displacement of sediment for the burial of the export cabling during installation of the SFEC. The extended survey corridor for the SFEC was defined based on the anticipated maximum radius for the derrick barge anchors. The potential for archaeologically sensitive submerged resources was assessed within this area. A possible shipwreck with a low confidence in location was reported near the potential Beach Lane landing site (AWOIS 7248). No evidence of a wreck was detected during the geophysical survey of the area, and no further investigations of this location are recommended. No other shipwrecks or aircraft losses were identified in the area of anticipated sea bed disturbance for the SFEC.

Although SFW will make every effort to site the SFEC away from marine archaeological resources and potential TCPs, disturbance of archaeologically sensitive areas may occur during construction within SFEC corridor. SFW will evaluate feasible methods of avoiding or minimizing such potential impacts. Such methods may include horizontal or vertical realignments of the export cable to avoid the delineated spatial boundaries of the potential cultural resources and/or the establishment of no-anchor areas. Unanticipated discoveries in the paleochannel margins or terraces during construction also remain a possibility. Therefore, construction of the SFEC has the potential to result in ***minor*** to ***moderate impacts*** to marine archaeological resources.

Sediment Suspension and Deposition

As discussed in Section 4.2.3.2, deposition of suspended sediment during SFEC construction is expected to be localized to the cable corridor. Hydrodynamic and sediment dispersal modeling indicates up to 0.4 inch (1.1 cm) of sedimentation may occur in areas adjacent to the cable installation with the thickest deposits occurring within approximately 29 feet (9 m) of the burial route. Low energy deposition of sediments over archaeological resources buried beneath the sea bed are not expected to disturb or otherwise affect the integrity of those resources. The protective buffers recommended for archaeologically sensitive areas and potentially significant shipwrecks will minimize the potential impacts from construction-related suspension and deposition to cultural resources.

Thus, sediment suspension and deposition along the SFEC will result in ***negligible impacts*** on marine cultural resources.

The full text detailing the potential impacts identified as a result of the marine archaeological assessment for both the SFWF and the SFEC is contained in Appendix R.

4.4.2.3 Proposed Environmental Protection Measures

SFW will continue to consult with BOEM, the NYSOPRHP, Native American tribes, and other interested consulting parties regarding the recommendations and proposed avoidance measures made as a result of the marine archaeological assessment. If the identified submerged cultural resources cannot be avoided, SFW would again consult with BOEM, the NYSOPRHP, Native American tribes, and other interested parties, to provide BOEM with sufficient information to determine whether such resources are eligible for listing in the NRHP and to determine an appropriate approach to mitigate any adverse effects, if needed. Any mitigation of adverse impacts to significant archaeological sites would require additional consultation. Mitigation would be formalized in a Memorandum of Agreement that would be signed by BOEM, the NYSOPRHP, SFW, and other interested parties.

Several environmental protection measures will reduce potential impacts to marine archaeological resources.

- The SFWF and SFEC - Offshore will avoid or minimize impacts to potential submerged cultural sites, to the extent practicable.
- Native American tribes were involved, and will continue to be involved, in marine survey protocol design, execution of the surveys, and interpretation of the results.
- A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.
- G&G survey coverage is sufficient to support design changes, if minor refinement of SFWF facility locations is necessary to avoid paleolandforms.
- As appropriate, SFW will conduct additional archaeological analysis and/or investigation to further assess potential sensitive areas.

4.4.3 Terrestrial Archaeological Resources

4.4.3.1 Affected Environment

South Fork Export Cable - Onshore

Archaeological investigations of the onshore portion of the proposed Project have been conducted according to Article VII of the New York State Public Service Law, under the guidance of the NYSDPS. The information and recommendations in the terrestrial archaeological resources report (Appendix S) are intended to assist BOEM, the NYSDPS, the NYSOPRHP, and other interested stakeholders and consulting parties, in their review of the Project's potential impact on archaeological resources.

The APE for direct impacts is defined as the area containing all proposed soil disturbance or other alteration associated with the onshore components of the Project. The formal determination of the APE per 36 CFR 800.4(a)(1) will occur once BOEM accepts a COP for the onshore SFEC, consistent with 30 CFR 585 et seq.

Terrestrial archaeological surveys have included several phases of desktop and GIS analyses followed by field survey of proposed landing sites, SFEC – Interconnection Facility, and the viable SFEC-Onshore cable routes within the Project envelope. SFW initially considered five potential landing sites for the onshore SFEC (Figure 2.2-2 in Section 2), as well as associated potential cable routes from each landing site to the SFEC – Interconnection Facility (see Figure 2.2-3 in

Section 2). As depicted in Figure 1-2 of the terrestrial archaeological resources report (Appendix S), the Phase 1 archaeological survey for the terrestrial portions of the SFEC included the investigation of five landing site options, the SFEC-Onshore cable routes proposed within public roadways, a proposed route within the LIRR, and the SFEC – Interconnection Facility.

A literature review and background research for the proposed Project area was conducted using information available on NYSOPRHP's Cultural Resources Information System (CRIS). The GIS-based CRIS program includes NRHP-eligible and -listed properties and sites, previously conducted surveys, historic districts, previously recorded archaeological sites and districts, museum sites and areas, cemeteries, and archaeologically sensitive areas. For the onshore SFEC, a 1-mile (1.6-km) study radius, which included areas adjacent to the APE, was investigated. In addition to a review of the CRIS database, cultural resources reports for the area were also examined. Background research identified a total of 16 archaeological sites and seven previous cultural resources studies within 1 mile (1.6 km) of the Project. These are detailed in Appendix S.

Based on archival research, potential archaeological resources within the APE were expected to include pre-contact Native American sites with lithic debris (stone flakes) and or stone tools, ceramics, and possible shell or bone food refuse. Archaic and Woodland Period resources are most commonly reported in eastern Long Island, with far less evidence for sites pre-dating 5,000 before present day (BP). Several pre-contact shell middens have been identified within 1 mile (1.6 km) of the APE and present-day shorelines may retain additional examples of this site type. Two possible post-contact or contact period Native American forts are reported in the general vicinity, reflecting the turmoil and strife among tribes and between tribes and European colonists during the seventeenth century. Additional military sites may be located in the area, though the potential for encountering them within the APE is low relative to the commonly documented Native American site types. Post-contact Native American or Euro-American domestic sites reflecting small households dating from the eighteenth century and nineteenth centuries, and post-contact industrial sites primarily associated with fish meal/fish oil processing are located along the Napeague Bay shoreline.

The Phase 1 archaeological fieldwork was conducted under the supervision of a registered professional archaeologist in a manner consistent with the New York Archaeological Council's (NYAC's) 1994 *Standards for Cultural Resources Investigations and the Curation of Archaeological Collections in New York State* (the *NYAC Standards*; NYAC, 1994). The portions of the Phase 1 archaeological survey located within New York State Parks were conducted in accordance with approved Section 233 Permits from the New York State Education Department. Phase 1B archaeological survey fieldwork was conducted within the limits of proposed disturbance for each landing site option and the proposed SFEC – Interconnection Facility. Phase 1B fieldwork included pedestrian surface survey of the beach front (where present) between the low and high tide lines where ground surface visibility was 100 percent as well as excavation of shovel tests in areas where ground surface visibility was less than 70 percent. The methodology of archaeological survey is detailed in Appendix S. Importantly; no testing was conducted in paved areas. The results of shovel tests excavated immediately adjacent to these areas were interpreted to be indicative of the potential for archaeological resources to be located within paved areas. Also, no shovel testing was undertaken in portions of the APE situated within the LIRR ROW. The depth of disturbance for the proposed SFEC is 4 feet (1.2 m) below the existing ground surface, and a typical section of track would have been constructed on fill at least 3 to 4 feet (0.9 to 1.2 m) deep.

The archaeological survey did not identify any cultural materials or archaeological sites within the APE of: SFEC – Interconnection Facility; Beach Lane Landing Site; Hither Hills State Park Landing Site; Napeague Lane Landing Site (dismissed); Fresh Pond Landing Site (dismissed, located on the north shore); the LIRR ROW; and public highway ROW. As a result of these survey results, no further archaeological work is recommended in these areas. However, the survey resulted in the identification/documentation of three archaeological sites/historic properties located within the Napeague Lane Landing Site option:

- Napeague State Park Pre-Contact Site 1 is located within the now-dismissed Napeague Bay State Park landing site option. It is unlikely that the Project will use this potential landing site. If this landing site had been selected, the route of the SFEC would have been sited to avoid any potential impacts to this site. Therefore, the site will not be affected by the proposed Project.
- The Promised Land/Smith Meal Fish Factory Site (Unique Site Number [USN] 10303.000007) is located within the now-dismissed Napeague Bay State Park landing site option. It is unlikely that the Project will use this potential landing site. If this landing site had been selected, the route of the SFEC would have been sited to avoid any potential impacts to this site. Therefore, the site will not be affected by the proposed Project.
- The NRHP-eligible Amagansett Railroad Station Freight Depot (USN 10303.000339) is located adjacent to the APE within the LIRR ROW. The depot is located on the north side of the LIRR tracks, north of Montauk Highway and west of Abrahams Landing Road in the Village of Amagansett.

Finally, a scatter of historic-period debris identified within the APE of the Fresh Pond Landing Site was situated within a disturbed context; therefore, this material was noted but not collected for analysis, as it is not associated with a potentially significant, intact archaeological resource.

Neither the potential Napeague Lane or Fresh Pond landing sites are currently being considered for development. Neither area is within the current APE and no effects to identified resources are anticipated from the Project.

With the exception of the LIRR, primary routing of the terrestrial export cable will be within existing roadways. During SFW coordination with the Shinnecock Indian Nation, Mashantucket Pequot Tribal Nation, Mohegan Tribe, Mashpee Wampanoag Tribe, and Wampanoag Tribe of Gay Head (Aquinnah), several tribal representatives expressed a concern that archaeological resources could be preserved beneath paved roadways, particularly in coastal settings where limited grading was conducted during previous road construction. SFW commissioned an assessment of the potential cable routes, which included historical research of local road construction, analyses of historical aerial and other photographic records of road alterations, elevation modeling, and pedestrian survey of road margins. The completed studies include a sensitivity assessment of both viable onshore cable routes. Sections of roadways likely built at or near the original surface grade were identified and will be subject to further evaluation. Phase 1B archaeological testing of the SFEC-Onshore cable routes (Beach Lane and Hither Hills) is planned for Summer 2019. The survey will test potentially sensitive areas along road margins to identify archaeological resources adjacent to areas of potential roadway trenching. Appendix S includes detailed mapping of all areas recommended for subsurface testing along the SFEC-Onshore cable routes.

SFW will notify the coordinating Tribes of the proposed field surveys and invite tribal monitors to participate in the planned field studies. Although previous disturbance of soils beneath paved surfaces is expected to have reduced the potential for intact archaeological resources to be present within the APE, SFW is cognizant of the potential for preservation in some locations and of the Tribes' expressed concerns. The intent of the proposed field surveys is to reduce the potential for unanticipated discoveries during Project construction and to inform any decisions on potential design changes to avoid resources identified along the margins of the APE or protective measures that may be considered to further mitigate the risk of post-review discoveries.

4.4.3.2 Potential Impacts

IPFs that could result in impacts to terrestrial archaeological resources are indicated in Figure 4.4-3. Only those IPFs with anticipated impacts negligible or greater are included in the following discussion.

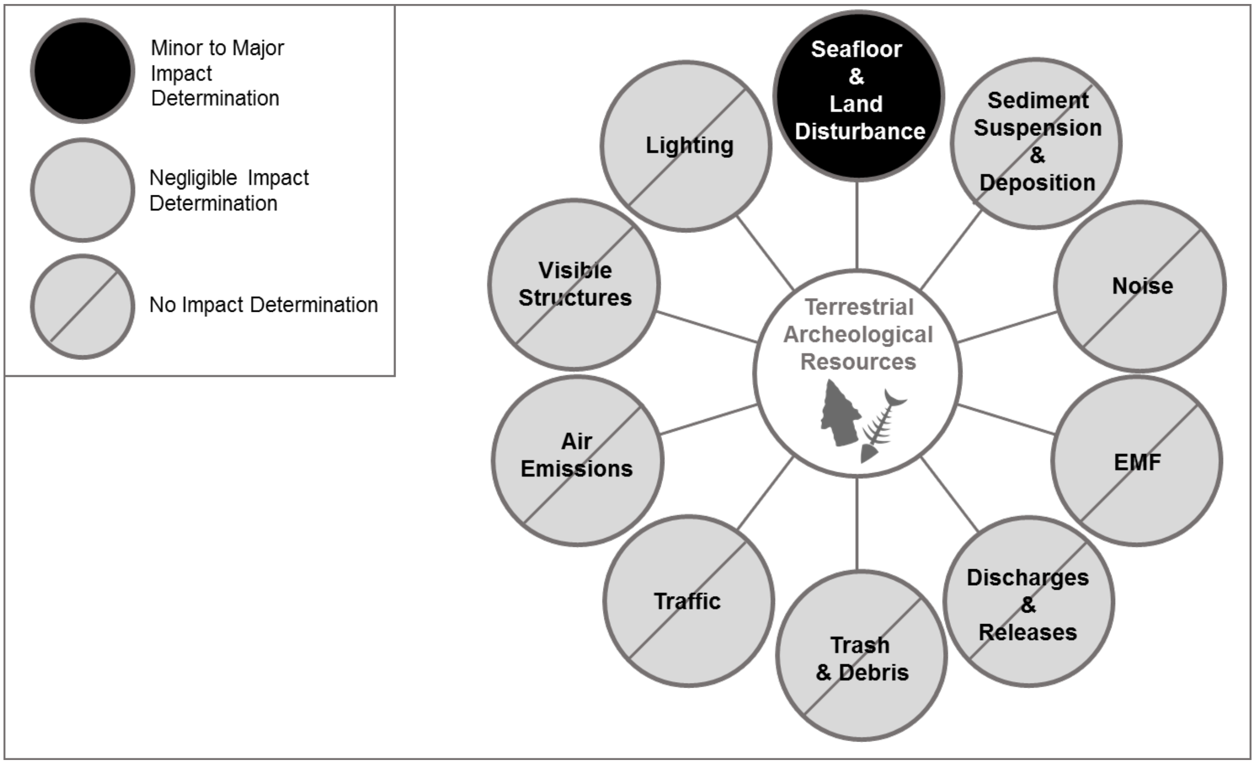

Figure 4.4-3. IPFs on Terrestrial Archaeological Resources
Illustration of potential impacts to terrestrial archaeological resources resulting from SFWF and SFEC activities

South Fork Export Cable – Onshore

Of the three phases of the SFEC – Onshore, the construction phase is expected to pose the highest threat of adverse impacts to terrestrial archeological resources. The O&M of the SFEC – Onshore does not cause IPFs that would impact these resources. When and if removal of the SFEC – Onshore occurs as a result of decommissioning, then it is expected that subsurface terrestrial archeological resources encountered during construction have already been managed according to Tribal, federal, and state expectations and regulations.

Construction

Land Disturbance

The Phase 1 archaeological survey identified no prehistoric sites that are potentially eligible for NRHP listing. The survey did identify the Promised Land/Smith Meal Fish Factory Site (USN 10303.000007). This site is within a landing site that is no longer under consideration; therefore, the site will not be affected by the Project. The survey identified the NRHP-eligible Amagansett Railroad Station Freight Depot (USN 10303.000339), which is located adjacent to a portion of the APE, within the LIRR ROW. The proposed cable is being sited to avoid direct impacts to this historic property and no indirect effects to the depot are expected to result from construction.

As noted above and as detailed in the terrestrial archaeology report in Appendix S, SFW will site the SFEC - Onshore within previously disturbed areas to the extent practicable and will avoid archaeological sites and/or historic properties. Additionally, SFW has considered the results of the terrestrial archaeological studies, as well as agency and tribal input, during development of the proposed Project. As a result, the Project design avoids direct impacts to all identified resources. Although SFW will make every effort to site the SFEC - Onshore away from known archaeological resources, sites may be identified during Phase IB survey of the SFEC-Onshore cable routes that cannot be feasible avoided and unanticipated discoveries during construction remain a possibility. Therefore, construction of the SFEC - Onshore maintains the potential to result in ***minor*** to ***moderate impacts*** to terrestrial archaeological resources.

4.4.3.3 Proposed Environmental Protection Measures

SFW will continue to consult with BOEM and the NYSOPRHP regarding the NRHP eligibility recommendations made as a result of the terrestrial archaeological resources survey, as well as proposed avoidance measures. If any sites would be affected by the Project, SFW would again consult with BOEM and the NYSOPRHP, as well as Native American tribes and other interested parties, to determine an appropriate mitigation of adverse impacts to significant archaeological sites. Mitigation would be formalized in a Memorandum of Agreement that would be signed by BOEM, the NYSOPRHP, SFW, and other interested parties.

Several environmental protection measures will reduce potential impacts to terrestrial archaeological resources.

- The route for the SFEC - Onshore will minimize impacts to, or avoid, potential terrestrial archeological resources, to the extent practicable.
- Native American tribes were involved, and will continue to be involved, in terrestrial survey protocol design, execution of the surveys, and interpretation of the results.
- Analysis shows that the majority of the SFEC - Onshore route has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits is minimized.
- An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation.
- SFW will conduct additional archaeological investigation to further assess potential sensitive areas.

4.5 Visual Resources

This section addresses the visibility and potential visual impact associated with the construction and operation of the SFWF and the above ground components of the SFEC. A Visual Impact Assessment (VIA) is a technical analysis used to determine whether an action diminishes the scenic quality or enjoyment of a landscape and the resources that exist within. The process broadly includes a description of the existing environment, the public resources that define the character of the visual environment and the users of the landscape. This information is then quantitively evaluated in order to define the scenic quality of the landscape. Next, several analyses are employed to assess the visibility and visual character of the project, allowing for a direct quantitative comparison of the landscape with and without the project in place. If a project is found to have visual impact, potential mitigation measures are also suggested.

To determine the extent of potential Project visibility and visual impact, SFW engaged Environmental Design & Research, Landscape Architecture, Engineering & Environmental Services, D.P.C. (EDR) to prepare a comprehensive VIA for the SFWF and a Visual Resource Assessment (VRA) for the above-ground portions of the SFEC. The purpose of these studies was to analyze potential Project visibility and determine its potential effect on scenic quality and the use/enjoyment of the landscape by viewers.

Based on SFW's experience on the BIWF Project, and guidance provided by BOEM and other involved agencies and tribes, the VIA utilized standard visibility assessment techniques, including viewshed analysis, cross section analysis, and field verification. The SFWF's visual impact was evaluated through the preparation of representative visual simulations and use of the USACE Visual Resource Assessment Procedure (VRAP). The VRAP defines discrete landscape similarity zones (LSZs) within the visual study area, characterizes the baseline scenic quality/sensitivity of each LSZ, and then determines if the proposed Project exceeds the threshold of acceptable visual change through a quantitative rating process conducted by a panel of visual professionals. The methodology and results for all visual analyses conducted for the SFWF are described in detail in the full text of the VIA report, in Appendix V.

To model the maximum design scenario for potential visual impacts associated with WTG visibility, the VIA considers a layout that extends for the width of the MWA. This layout includes WTG positions that could affect a larger percentage of the visible ocean horizon than the layout in Figure 3.1-1. As described in Appendix V, the analysis in the VIA is robust and representative of the layout proposed.

The VRA used the same visibility assessment methods as employed by the VIA (viewshed analysis, cross sections, field review, and visual simulations). However, visual impact contrast ratings were not completed for the SFEC substation. Rather, each view was qualitatively reviewed by a visual assessment expert. The methodology and results are described in detail in the full text of the SFEC VRA report, in Appendix U.

4.5.1 Affected Environment

To define and describe the affected environment, visual study areas for both the SFWF and SFEC were defined.

South Fork Wind Farm

Based on the height of the proposed WTGs, previous analyses conducted for the BIWF, guidance from BOEM, and the desire to address potential Project visibility from sensitive resources in New York, Rhode Island, Massachusetts, and Connecticut, a 40-mile (64.4-km) radius around the proposed WTG array was defined as the SFWF visual study area. This study area also approximates the theoretical limits of Project visibility based on the maximum height of the

WTGs, the screening effect of curvature of the earth, and atmospheric affects associated with distance.

The 40-mile (64.4-km) radius surrounding the SFWF includes approximately 5,133 square miles (13,294.9 km^2) of open ocean (i.e., 87 percent of the study area), 755 square miles (1,955.4 km^2) of land (including inland water bodies), and over 1,000 linear miles (1,609.3 km) of shoreline in New York, Rhode Island, Massachusetts, and Connecticut. The proposed visual study area includes all or portions of 1 town in New York, 19 towns in Rhode Island, 15 towns in Massachusetts, and 2 towns in Connecticut. The location and extent of the visual study area is illustrated in Figure 4.5-1 and in Figure 4 of the VIA, in Appendix V. However, within this study area, only a relatively small portion of the onshore locations would have open views toward the proposed Project. To further refine and accurately define an inclusive and reasonable Preliminary Area of Potential Effects (PAPE), the potential geographic areas of Project visibility were identified by running a preliminary lidar viewshed analysis within the 40-mile (64.4-km) study area.

The viewshed model considered vegetation, buildings/structures, and the curvature of the earth in order to delineate those areas that may have potential views of the highest portions of the proposed WTGs (i.e., blade tips in the upright position). The viewshed analysis results indicated that 16.1 square miles (41.7 km^2) of the land area within the 40-mile (64.4-km) study area could have potential views of the Project from ground-level vantage points. For the purpose of the VIA, the PAPE was used to define those areas where further analyses of Project visibility and visual impact was warranted.

Within the PAPE for the SFWF, 17 different LSZs were defined in accordance with the VRAP methodology (see Table 4.5-1). The sensitivity of each LSZ was classified by the rating panel as a means of defining their sensitivity to visual change. The definitions of the five distinct resource management classifications are detailed in Table 4.2-2 of the VIA, as is the process used to assign these classifications (Appendix V).

Table 4.5-1. LSZs within the SFWF Study Area

Management Classification System Zone	Classification
Shoreline Bluffs	Retention Class
Salt Pond Tidal Marsh	Retention Class
Maintained Recreation Area	Retention Class
Shoreline Beach	Retention Class
Inland Lakes and Ponds	Partial Retention Class
Coastal Dunes	Partial Retention Class
Open Water	Partial Retention Class
Rural Residential	Partial Retention Class
Shoreline Residential	Partial Retention Class
Developed Waterfront	Partial Retention Class
Coastal Scrub	Modification Class

Table 4.5-1. LSZs within the SFWF Study Area

Management Classification System Zone	Classification
Agricultural Open Field	Modification Class
Village or Town Center	Modification Class
Forest	Modification Class
Transportation	Modification Class
Suburban Residential	Rehabilitation Class
Commercial	Rehabilitation Class

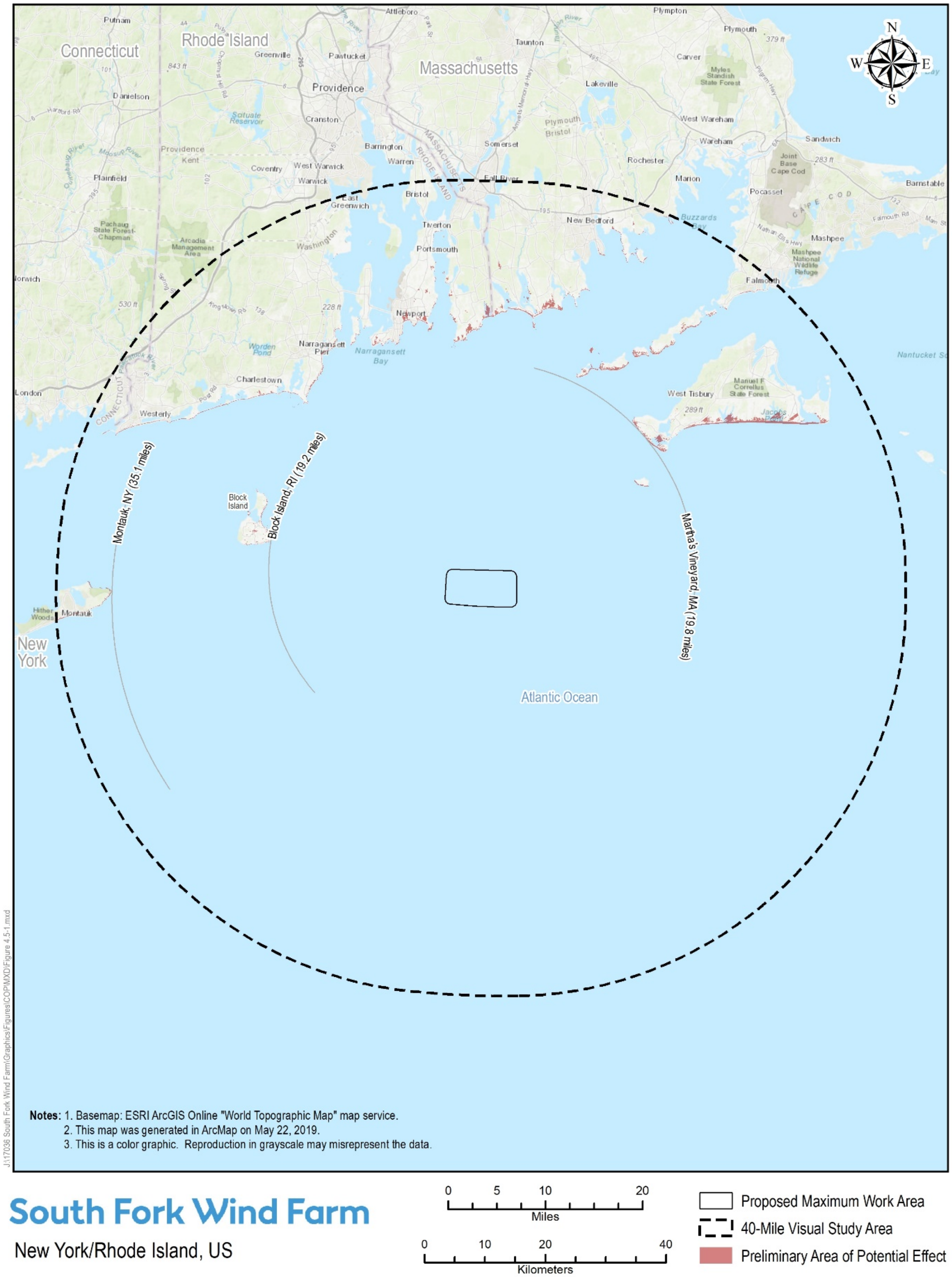

Figure 4.5-1. Visual Study Area
Illustration of WTG placement and onshore areas of visibility.

Viewers within the SFWF study area/PAPE include residents, through travelers, tourists/vacationers, and the fishing community. The sensitivity of these viewers to visual change is variable, but many are assumed to be sensitive to changes in views they value and/or are familiar with. In addition, the PAPE includes 332 visually sensitive public resources that have been identified by national, state, or local governments, organizations, and/or Native American tribes as important sites which are afforded some level of recognition or protection. A comprehensive inventory of the visually sensitive resources identified during the study is included in the VIA (Appendix V). A summary of the types of sensitive resources included in the SFWF PAPE is presented in Table 4.5-2, and the locations of these resources within the study area are illustrated in Figure 4.5-2, sheets 1 through 3.

Table 4.5-2. Visually Sensitive Resources within the PAPE.

Type of Resource	Occurrences of Resource Within PAPE			
	NY	RI	MA	Total
National Historic Landmarks (NHLs)	1	6	0	**7**
Properties Listed on or determined eligible for the National or State Registers of Historic Places	2	53	9	**64**
National Natural Landmarks	0	0	1	**1**
State Scenic Areas	2	40	3	**45**
State Scenic Overlooks	0	0	2	**2**
National Wildlife Refuges	0	5	1	**6**
State Wildlife Management Areas	0	2	6	**8**
State Parks	4	4	5	**13**
State Nature and Historic Preserve Areas	0	1	0	**1**
State Beaches	0	7	0	**7**
Highways Designated or Eligible as Scenic	0	2	0	**2**
National Recreation Trails	0	1	0	**1**
State Bike Routes	1	0	0	**1**
State Fishing and Boating Access	0	16	2	**18**
State Conservation Areas (one area is within both RI and MA)	1	36	1	**36**
Lighthouses (not NRHP-Listed or State Historic-Listed)	0	2	25	**27**
Public Beaches	3	19	56	**78**
Ferry Routes (Occur across multiple states)	2	4	6	**12**
Seaports (Commercial Maritime Facilities)	0	2	0	**2**
Total	**16**	**200**	**116**	**332**

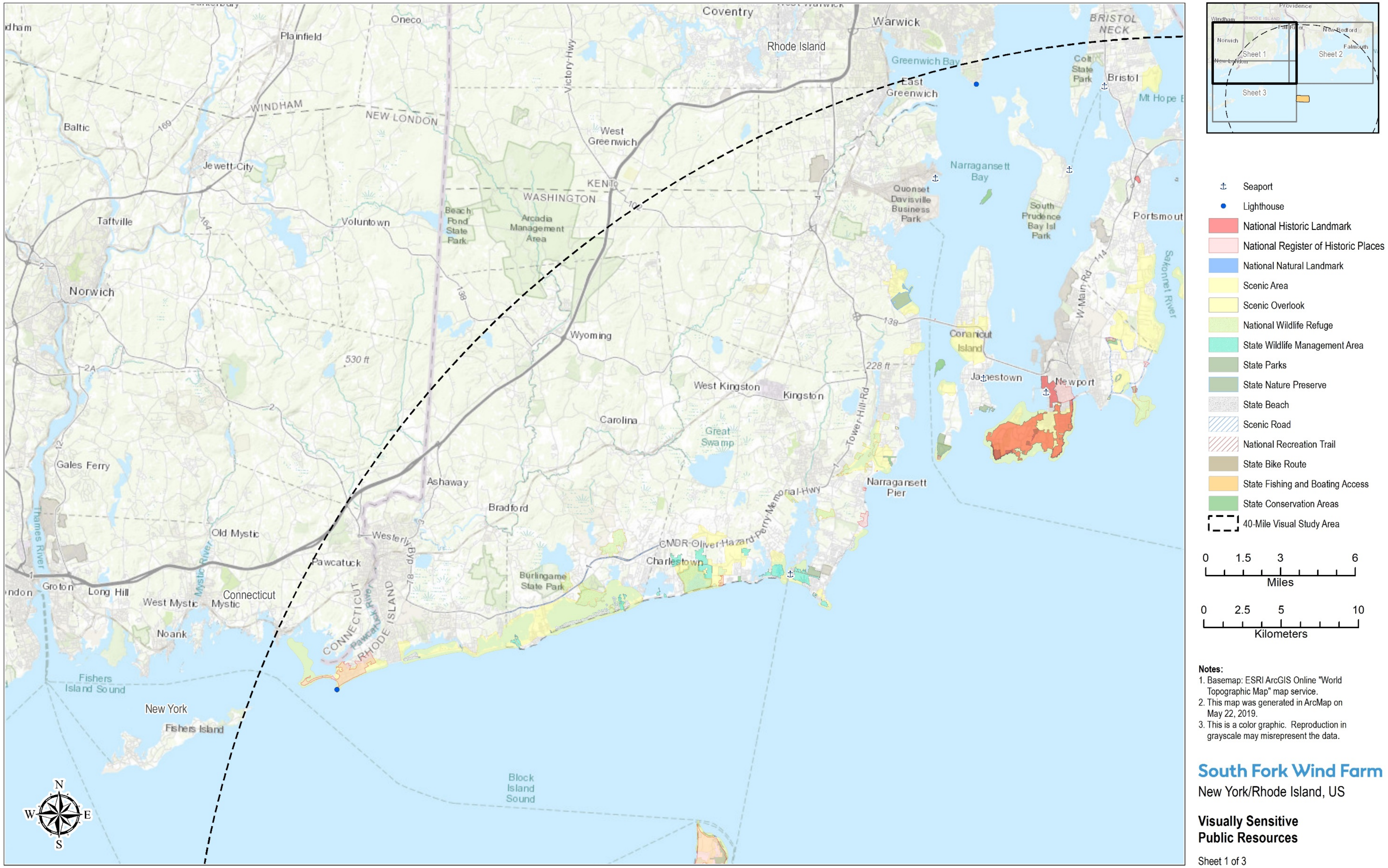

Figure 4.5-2 (Sheet 1 of 3). Visually Sensitive Public Resources within the SFWF Study Area
Illustration showing public resources identified during VIA depicted by resource type

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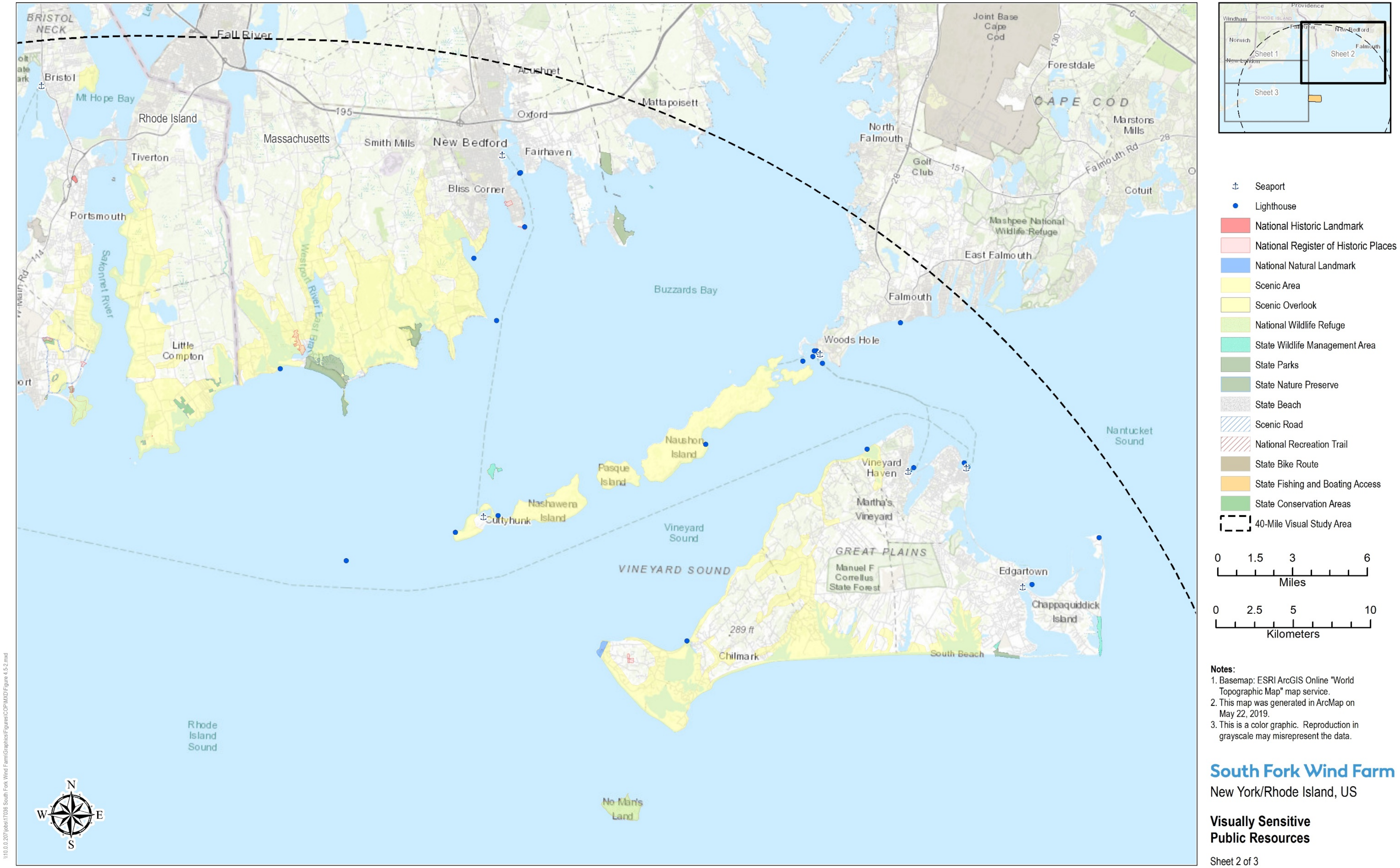

Figure 4.5-2 (Sheet 2 of 3). Visually Sensitive Public Resources within the SFWF Study Area

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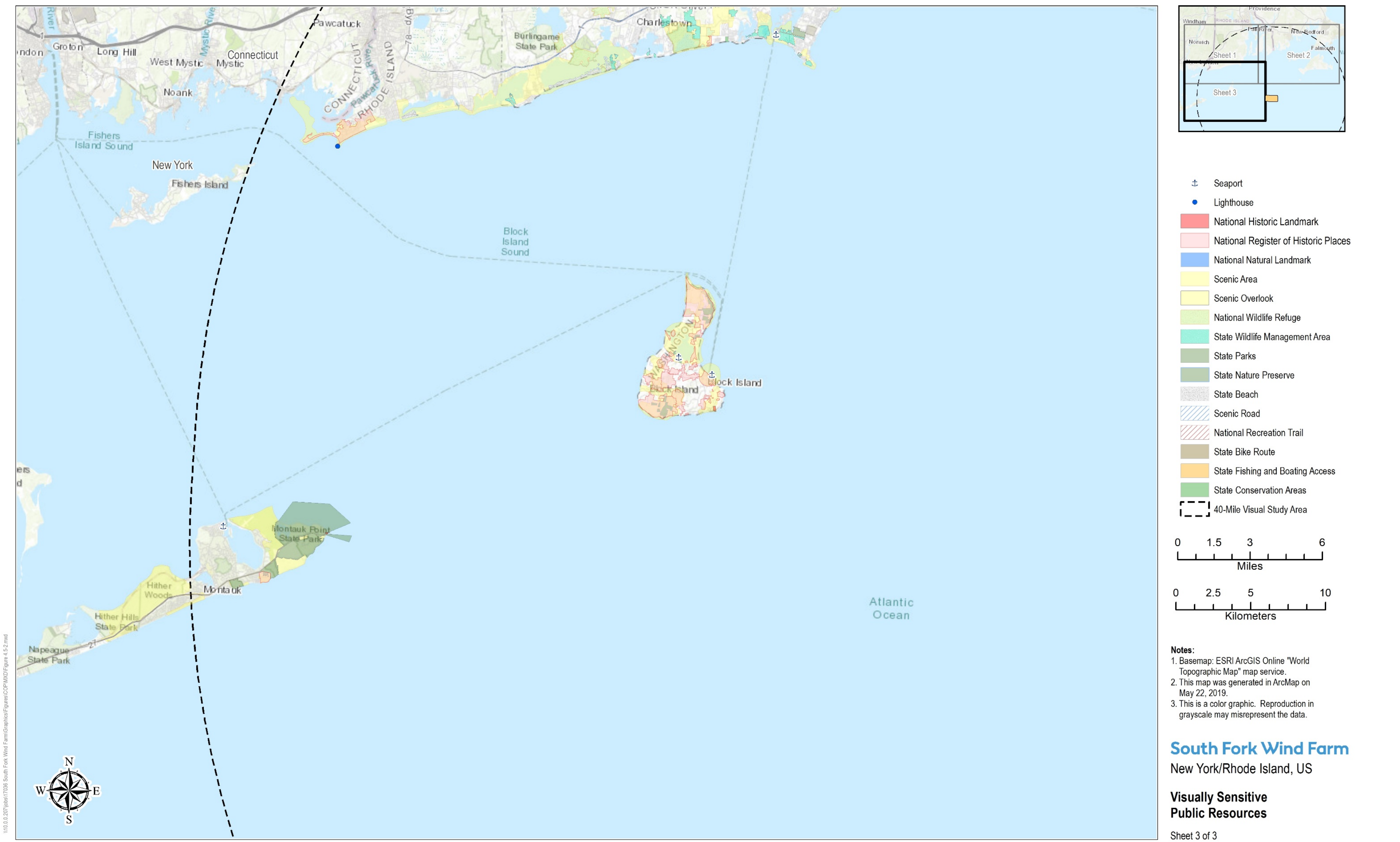

Figure 4.5-2 (Sheet 3 of 3). Visually Sensitive Public Resources within the SFWF Study Area

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South Fork Export Cable - Onshore

The onshore SFEC visual study area was defined as a 3-mile (4.8-km) radius around the SFEC – Interconnection Facility as depicted in Figure 4.5-3, and in Figure 5 of the VRA (Appendix U). This area contains several scenic resources of statewide significance, including 15 resources listed on the NRHP, 59 resources eligible or potentially eligible for listing on the NRHP, and the East Hampton Scenic Area of Statewide Significance (SASS). A complete list of inventoried visually sensitive resources by type, including their locations, is presented in the full VRA report in Appendix U.

Additionally, several resources of local significance were identified within the SFEC onshore visual study area based on their local designation as scenic resources (see Figure 4.5-4, and Figure 7 of the VRA in Appendix U). These include the East Hampton Village Scenic Area of Local Significance, which is largely made up of the portion of the Village of East Hampton that falls outside of the SASS, including Three Mile Harbor, East Hampton Marina, and Three Mile Harbor Marina, all located in the northeastern portion of the SFEC visual study area.

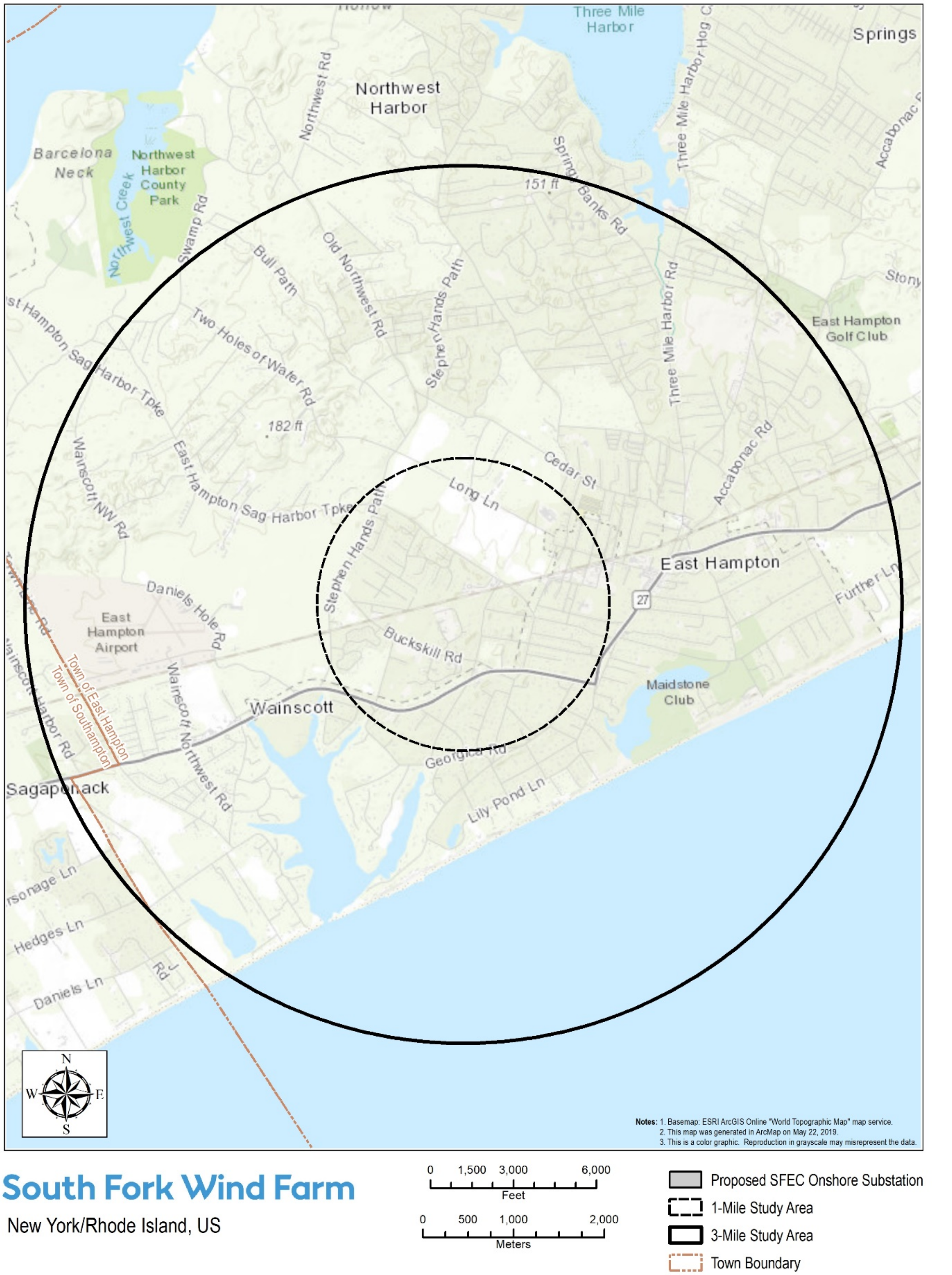

Figure 4.5-3. SFEC Visual Study Area

Illustration of 3-mile study area for onshore project components in East Hampton vicinity.

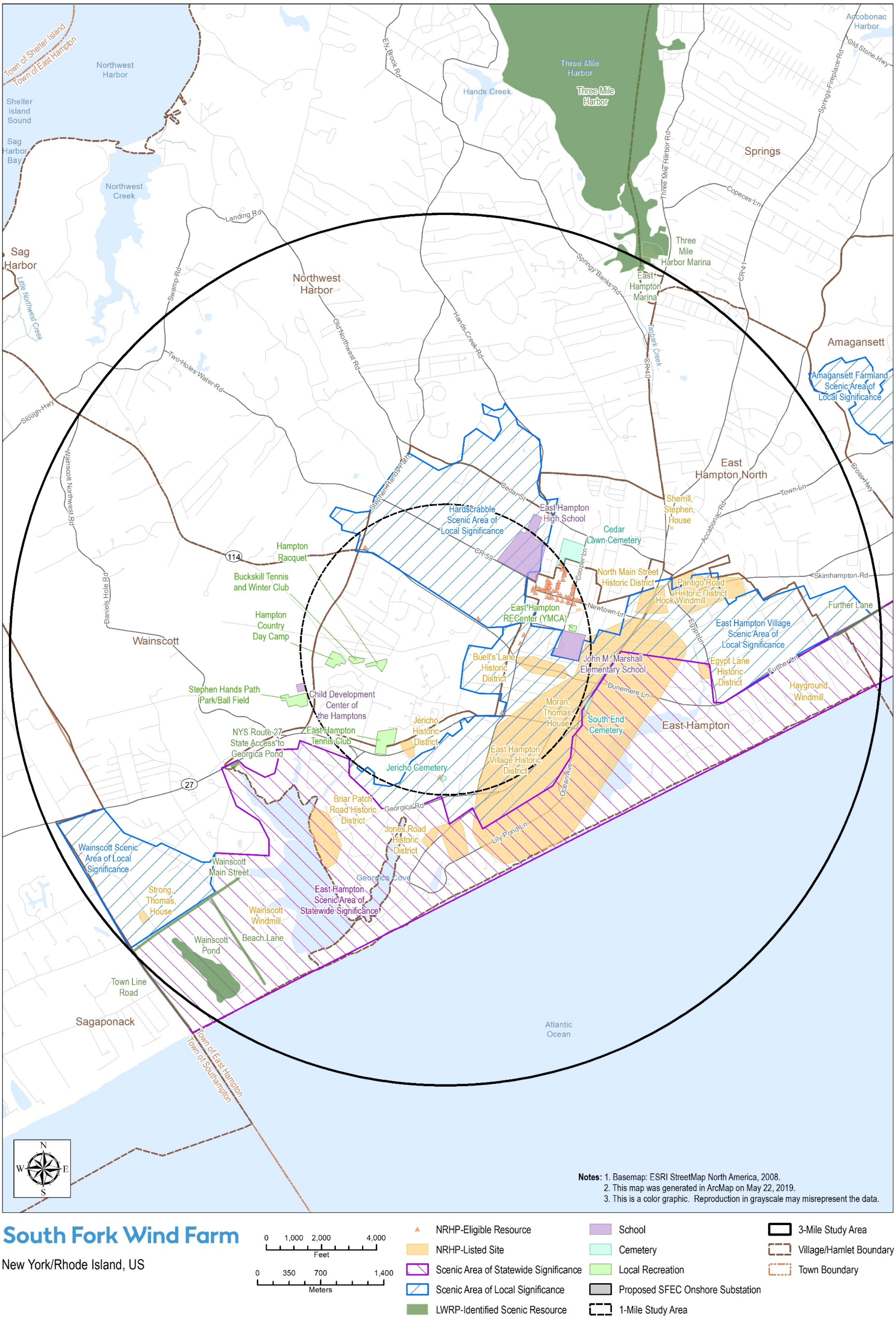

Figure 4.5-4. SFEC Visually Sensitive Resources within the SFEC Study Area

Illustration showing locations of identified visually sensitive resources in relation to onshore project components.

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4.5.2 Potential Impacts

IPFs that could result in impacts to visual resources are depicted in Figure 4.5-5. IPFs which will not impact visual resources are shown with slashes through the circle. For the IPFs that could impact visual resources but were found to be negligible in the analyses in Section 4.1, the circle is gray without a slash. IPFs that could impact visual resources based on the analyses included in the VIA and VRA, the circle is black.

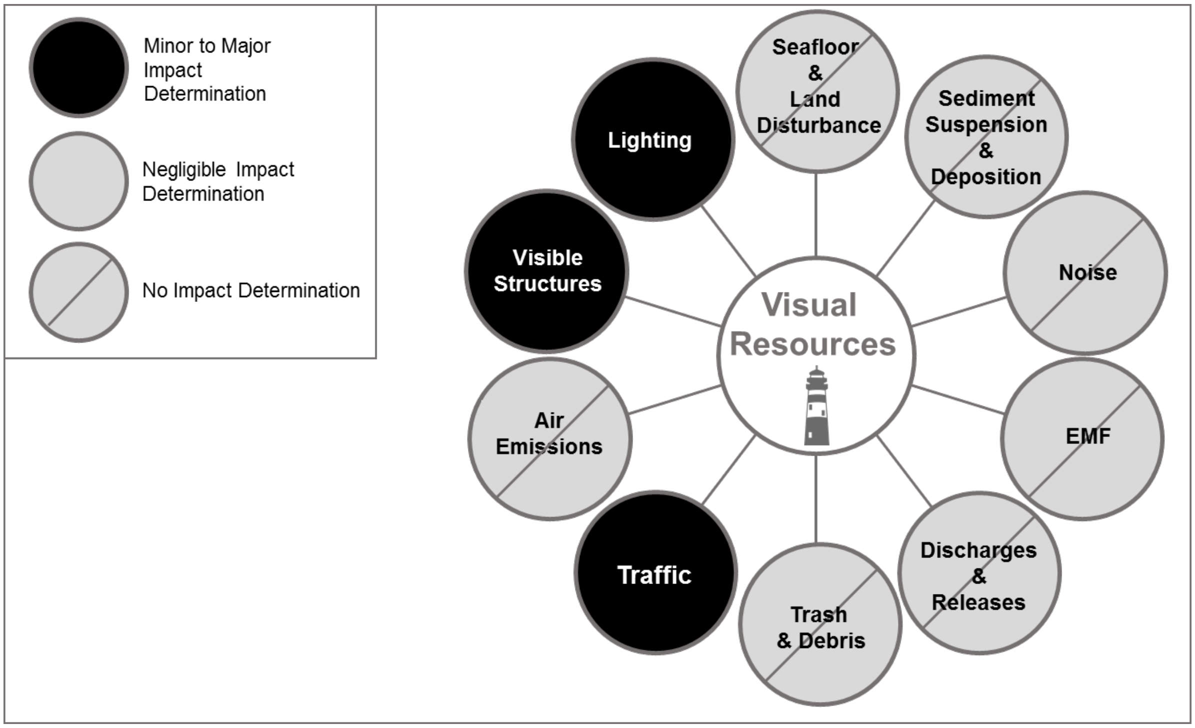

Figure 4.5-5. IPFs on Visual Infrastructure
Illustration of potential impacts to visual infrastructure resulting from SFWF and SFEC activities

As indicated on Figure 4.5-5, visual impacts associated with the Project could result from construction and operational vessel traffic, new visible structures, and new sources of lighting. Each of the IPFs for both the SFWF and SFEC is discussed below.

South Fork Wind Farm

<u>Construction</u>

Traffic
During construction of the SFWF, marine vessel traffic could potentially increase in Narragansett Bay, Buzzards Bay, Rhode Island Sound, and the open ocean. However, as discussed in Section 4.1.7, the construction vessels will not represent a significant increase over the existing vessel traffic in the area and accordingly will result in only ***short-term*** and ***minor*** visual impacts. Project operation is not anticipated to result in a noticeable increase in vessel traffic.

<u>Operations</u>

Visible Structures
To evaluate potential visual impacts during operation of the SFWF, the VIA included a viewshed analysis of the potential visibility of the proposed WTGs, which represent the tallest proposed structures. Utilizing USGS lidar data, a highly detailed DSM of the SFWF visual study area was created. The DSM included the elevations of buildings, trees, and other objects large enough to be resolved by lidar technology. Additionally, a digital terrain model (DTM) was created,

representing bare earth conditions. The analysis of potential SFWF visibility was based on 15 points representing the proposed WTGs, each with an assumed maximum blade tip height of 840 feet (256 m); one point representing the OSS, with a maximum height of 200 feet (61 m); and an assumed viewer height of 5.5 feet (1.7 m). The viewshed analysis was conducted using ESRI ArcGIS® software with the Spatial Analyst extension and considered curvature of the earth in the analysis.

Blade tip viewshed analysis results are summarized in Table 4.5-3. Viewshed mapping demonstrated that the SFWF WTGs have the potential to be visible from a relatively small portion of the 40-mile (64.4-km) radius visual study area (see Figure 4.5-1 and Appendix V, Figure 4). The lidar-based viewshed analysis indicates that approximately 2.1 percent of the land within the study area (the PAPE) could have potential views of some portion of the SFWF, based on the availability of an unobstructed line of sight. Open Water/Ocean is the dominant LSZ within the study area and, in most areas, offers an unobstructed line of sight toward the proposed Project. Other LSZs identified by the viewshed analysis as offering potential views of the Project include Shoreline Beaches and Bluffs, Coastal Dunes, Coastal Scrub/Shrub Forest, Salt Ponds/Tidal Marsh, Shoreline Residential, and Maintained Recreational Areas. Visibility will be eliminated in large portions of the visual study area, where buildings/structures and vegetation screen views toward the SFWF. Forest land, which covers approximately 53 percent of the land within the study area, will significantly reduce potential visibility of the SFWF throughout the inland portions of the study area. Additionally, buildings/structures will also significantly screen outward views in more developed portions of the study area. Considering the screening provided by buildings/structures, vegetation, and topography, potential SFWF visibility is largely restricted to the ocean shoreline and water bodies immediately inland of the shoreline.

Viewshed results suggest some minor areas of potential SFWF visibility in inland portions of the visual study area. These areas typically extend inland from undeveloped and unvegetated shorelines, especially along barrier beaches backed by salt marshes and ponds. Additionally, some areas of inland visibility occur at topographic highpoints that are devoid of dense vegetation and buildings/structures (Figure 4.5-6 and Appendix V, Figure 9).

Table 4.5-3. Blade Tip Viewshed Results Summary

Distance from Project Site	40-Mile Radius Study Area		
	Total Land Area (square miles) (square kilometers)	Land Area with Potential Visibility/PAPE (square miles [square kilometers])	Percent
0 to 10 Miles[a]	0	0	0.0%
10 to 20 Miles[b]	6.5 (16.8)	1.2 (3.1)	18.5%
20 to 30 Miles	196.9 (509.9)	10.8 (27.9)	5.5%
30 to 40 Miles	551.4 (1,428.1)	4.1 (10.6)	0.8%
Total 40 Mile Landward Study Area[c]	754.9 (1,905.2)	16.1 (38.1)	2.1%

[a] There is no significant land area within 10 miles of the Project Site.

[b] Block Island, Rhode Island and Nomans Land Island, Massachusetts are the only significant land masses within 20 miles of the Project site.

[c] Land area and percent totals may not add up to 100 percent or equal study area acreage reported elsewhere in this report due to rounding and/or raster-to-vector conversion.

Field review confirmed the results of the lidar viewshed analysis. Much of the inland portions of the visual study area were found to be screened from view of the SFWF by vegetation and buildings/structures. Open views toward the Project, as indicated by visibility of the ocean, were concentrated within 1 mile (1.6 km) of the shoreline, and were largely restricted to beaches, bluffs, dunes, open fields, salt ponds, road corridors, and cleared residential yards, where lack of foreground trees allowed for unscreened views of the ocean.

- From Block Island, views of the SFWF were largely restricted to beaches and bluffs along the south shore of the island. No views were documented from beaches and bluffs along the western and northern shorelines or the village/town center area of New Shoreham. Similarly, views toward the Project were not available from most interior roads. However, potential views were documented from beach areas along the eastern shoreline, the northwest side of Great Salt Pond, and the Block Island Ferry in transit. Although private roads, yards, and homes could generally not be accessed, many of these locations on the southern portion of the island and on areas of higher ground are also likely to have at least partial views of the Project.
- Views from Long Island were available from within Montauk State Park and Camp Hero State Park on the eastern edge of the South Shore, mainly from bluff overlooks along hiking trails or at designated bluff overlook parking areas. Views toward the Project further inland were completely obscured by topography and/or vegetation.
- From Conanicut and Aquidneck Islands, views towards the SFWF are restricted to the south-facing shorelines, including Beavertail State Park, Brenton Point State Park, the Newport Cliff Walk, Sachuest Beach, and Sachuest Point National Wildlife Refuge (NWR). As the viewer moves inland, views toward the Project are blocked by buildings/structures and vegetation, with the exception of topographic highpoints, such as Hanging Rock at Normans Bird Sanctuary and the inland portions of Brenton Point State Park.
- In the Elizabeth Islands chain, Cuttyhunk Island will have open views toward the SFWF along the southern and western shores, as well as from the topographic high point in the central portion of the island. This high point offers the potential for views of the full height of the WTGs, whereas shoreline views from the island toward the Project would be partially screened by curvature of the earth.
- Views from Martha's Vineyard were also generally restricted to the shoreline and bluffs on the western and southern sides of the island. The southern beaches of Martha's Vineyard, such as Lucy Vincent Beach and Squibnocket Beach, had partially or fully screened views, respectively. Screening at these locations was provided by the western headlands of Martha's Vineyard and intervening vegetation. Visibility was noted as far east as South Beach State Park but was fully obscured by curvature of the earth at Wasque Point in Edgartown. Inland views on Martha's Vineyard were located at the Peaked Hill Reservation, which is located atop a topographic high point. Other open views from inland locations will generally be partially screened, tightly enclosed, and/or of short duration due to the abundant screening provided by topography, vegetation, and buildings/structures.
- Open views from the mainland were available along the shoreline from Westerly, Rhode Island to Falmouth, Massachusetts. These views were generally restricted to the immediate shoreline and, based on the calculated effects of curvature of the earth, will typically only include the upper one-third to one-half of the WTGs. Throughout the extent of the visual study area, views toward the Project site were screened by vegetation, dunes, and buildings/structures.

Visually sensitive public resources with open views toward the SFWF included several historic sites, lighthouses, state parks/beaches, wildlife refuges, designated scenic areas, and a National Recreation Trail. The historic resources with the highest potential for Project visibility were those that were situated to take advantage of panoramic ocean views. No open views toward the site were documented from any mainland parks, historic sites, designated scenic areas, conservation lands, or village/town center areas that were over a mile inland from the ocean.

Moreover, open views toward the Project do not necessarily equate to actual Project visibility. A variety of other factors will limit visibility, including weather conditions, waves on the ocean surface, humidity, and air pollution. National Climatic Data Center (NCDC) weather data collected from the Newport and Block Island Stations over the six-year period from January 1, 2010 to December 31, 2016 indicate that clear skies (0-30 percent cloud cover) occur during daylight hours on average 42 percent of the time. While partly cloudy and cloudy skies do not preclude Project visibility, these data suggest that weather conditions could substantially reduce long distance visibility (i.e., from land-based viewpoints) during much of the year. Because, NCDC weather data only reports visibility to 10 miles (16.1 km), BOEM utilized a methodology to evaluate visibility at 20 and 30 nm using the observed visibility out to 10 miles (16.1 km) and a relational algorithm based on relative humidity (Wood et al, 2014). For data collected from the Newport Station, visibility to 20 nm occurred approximately 61 percent of the year during daytime hours, while visibility to 30 nm occurred approximately 35 percent of the year during daytime hours. These calculations indicate that weather will have a significant influence on visibility from most land-based viewpoints within the Project's PAPE.

To evaluate the visual impact of the SFWF, a total of 44 visual simulations were prepared from 29 selected key observation points (KOPs) throughout the PAPE (29 unique daytime views, 9 sunset views, 5 nighttime views, and 1 simulation depicting construction). These KOPs were identified based on studies prepared by BOEM (2012a and 2012b) that identified visually and culturally sensitive sites with views toward offshore lease areas along the entire Atlantic coast, including all of the coastline that falls within the visual study area for the SFWF. In addition, SFW and its technical team had multiple discussions with various agencies and stakeholders, including the Wampanoag Tribe of Gay Head (Aquinnah), the Shinnecock Indian Nation, the Mohegan Tribe of Indians in Connecticut, the Mashantucket Pequot Tribal Nation, the Mashpee Wampanoag Tribe, the Massachusetts Historical Commission (MHC, Massachusetts SHPO), the NYSOPRHP, RIHPHC, and the MassDEP, regarding the selection of KOPs of visual and cultural importance. Final KOPs were selected based upon the following criteria:

1. They were identified as KOPs by federal, state, local, or tribal officials/agencies as important visual resources, either in prior studies or through direct consultation.
2. They provide clear, unobstructed views toward the SFWF (as determined through field verification).
3. They illustrate the most open views available from historic sites, designated scenic areas, and other visually sensitive resources within the visual study area.
4. They are representative of a larger group of candidate KOPs of the same type or in the same geographic area.
5. They illustrate typical views from LSZs where views of the SFWF are most likely to be available.
6. They illustrate typical views of the SFWF that will be available to representative viewer/user groups within the visual study area.
7. They illustrate typical views from a variety of geographic locations and under different lighting conditions to illustrate the range of visual change that could occur with the SFWF in place.

Information regarding each selected viewpoint is detailed in the full text of the VIA in Appendix V. Additionally, graphic depictions showing locations of the selected KOPs are illustrated on Figure 4.5-7 and Appendix V, Figure 7.

Visual simulations of views of the proposed Project from the selected KOPs were prepared, as illustrated in Appendix C of the VIA (see Appendix V). The methodology for visual simulations is depicted on Figure 4.5-8. These simulations illustrate the full range of distances, lighting conditions, and landscape settings from which the SFWF will be viewed. However, all photos used for the development of simulations illustrate high visibility conditions where the proposed WTGs would not be significantly obscured by atmospheric haze or fog. All of the selected KOPs offered the most open, unobstructed views available toward the SFWF from each KOP. Consequently, the simulations from these viewpoints can be considered "worst case" representations of potential WTG visibility within the study area.

Evaluation of these simulations by a panel of visual professionals was conducted using the USACE VRAP. The evaluation process, which is described in detail in the VIA, indicated that the Project's overall contrast with the visual/aesthetic character of the area will be variable, with the most substantial visual impact documented at KOPs that are relatively close to the Project (such as on a ferry or passenger cruise ship in the Atlantic Ocean), offer largely unobscured views of the proposed WTGs, and include few other man-made/developed features. Impact evaluation results indicated relatively minor impact on mainland/more distant KOPs, where the WTGs are barely perceptible on the horizon. In the higher impact KOPs, the WTGs' contrast with water resources (open ocean) and sky conditions, user activity (residential and tourist-related), land use (undeveloped land and ocean), and/or a strong level of cultural importance at the land/sea interface generally were the greatest contributors to Project impact. However, from the majority of KOPs, the WTGs are barely perceptible under clear, daytime conditions, as supported by rating panel scores that indicated little or no visual change.

Even for those viewpoints where more appreciable visual impact was noted, there was generally a high degree of variability among the scores of individual rating panel members. In some cases, certain panel members indicated no impact for the same viewpoints where other panel members noted an adverse effect. This reflects the individual variability in the way people perceive landscapes and react to WTGs and is consistent with published studies of public reaction to wind projects. Several studies have documented variable, but generally positive, public reaction to views of operating wind projects (Ladenburg, 2008; Ladenburg, 2010; West, 2011; Firestone et al, 2017).

Using the USACE VRAP procedure, it was determined that with the proposed Project in place, the threshold of acceptable visual impact was not exceeded for any of the LSZs identified within the visual study area. The most appreciable impact was assigned to KOPs in the Shoreline Bluffs, Maintained Recreation Areas, and Open Water/Ocean Zones, but the cumulative scores received by all the KOPs within these LSZs were well below the threshold of acceptable visual impact. Therefore, visible structures will result in a ***minor impact***.

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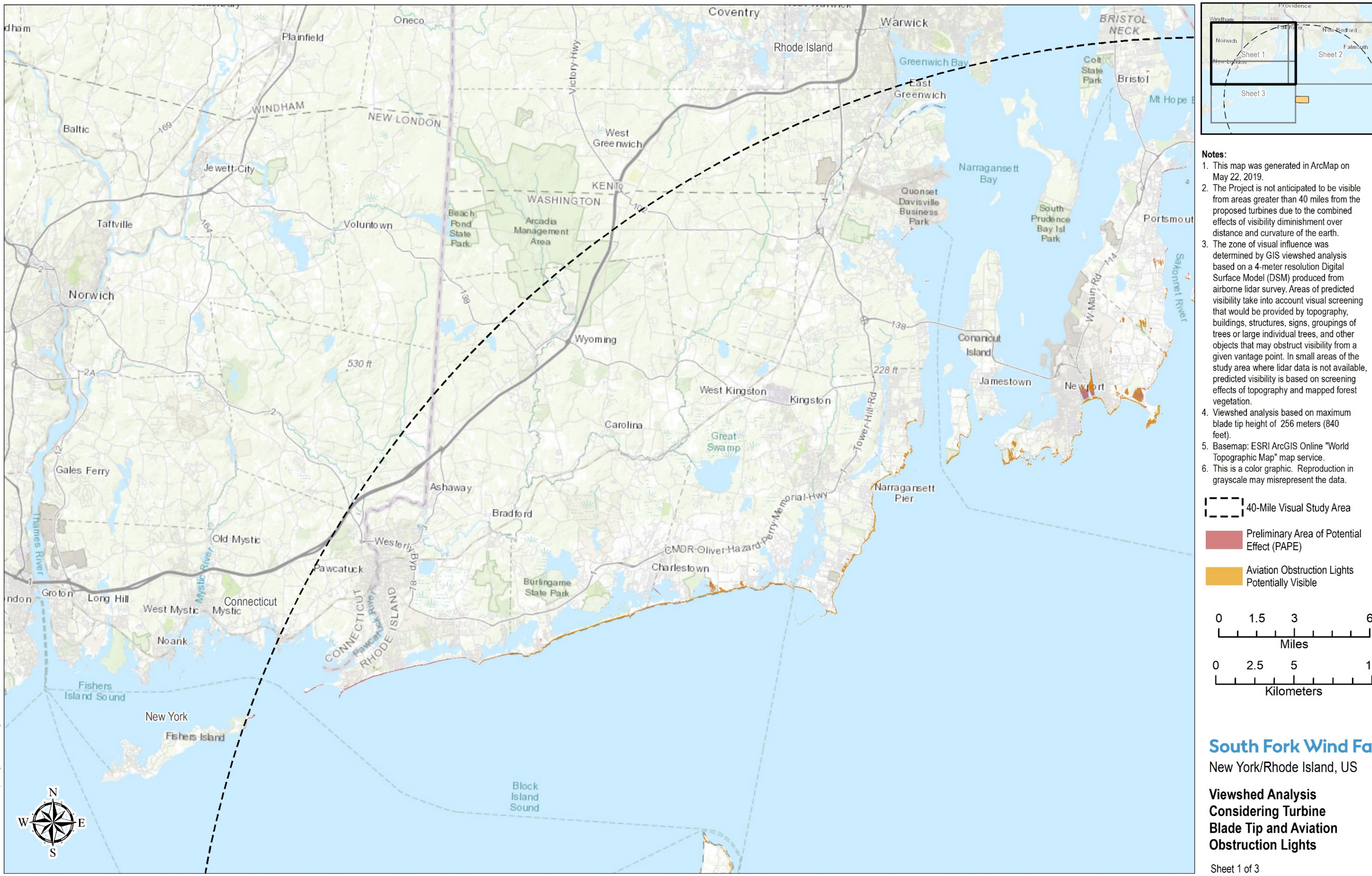

Figure 4.5-6 (Sheet 1 of 3). Viewshed Analysis of WTG Blade Tips and Aviation Obstruction Lights

Illustration showing public resources identified during VIA depicted by resource type.

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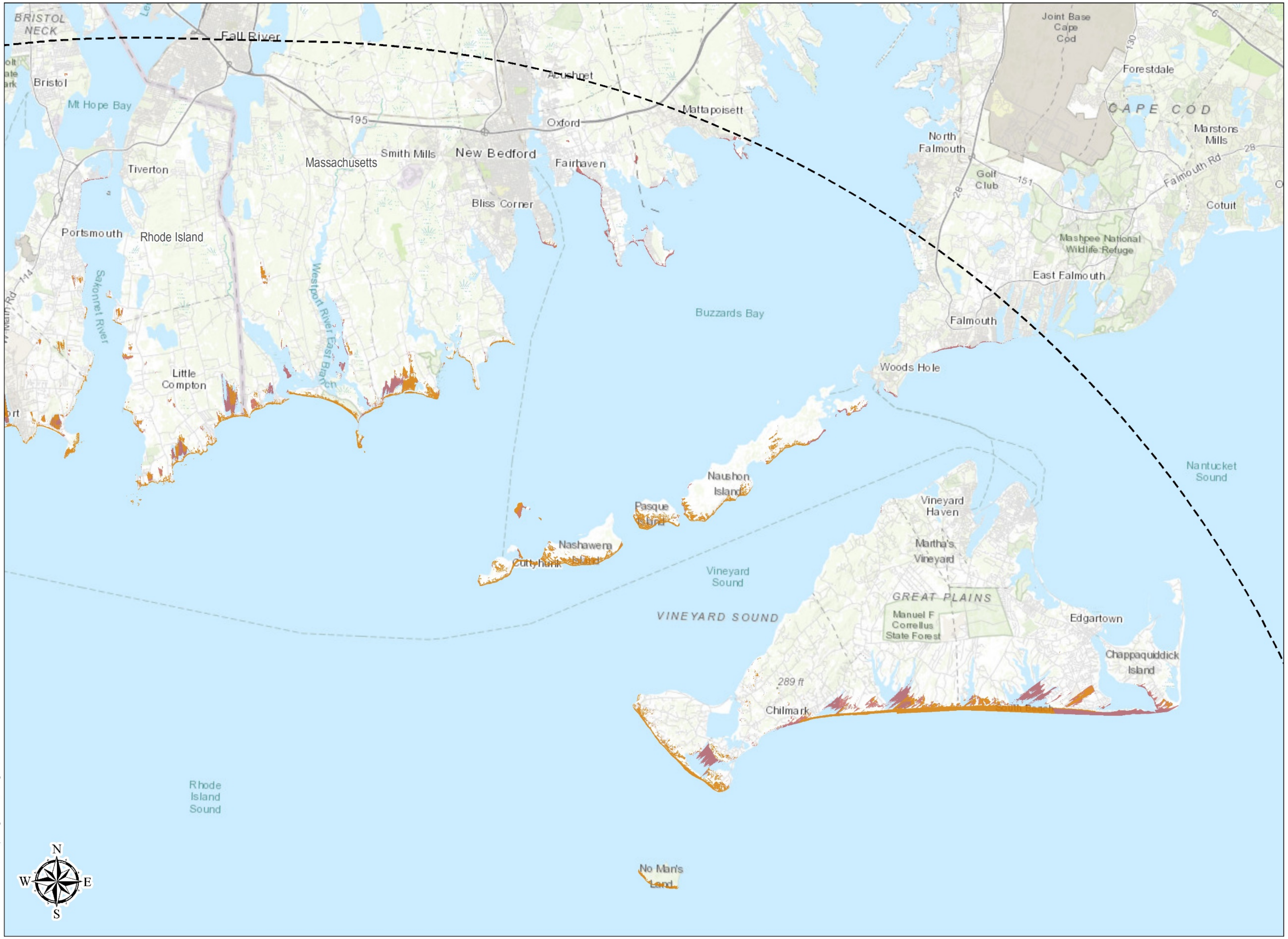

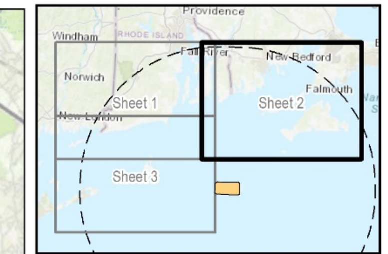

Notes:

1. This map was generated in ArcMap on May 22, 2019.
2. The Project is not anticipated to be visible from areas greater than 40 miles from the proposed turbines due to the combined effects of visibility diminishment over distance and curvature of the earth.
3. The zone of visual influence was determined by GIS viewshed analysis based on a 4-meter resolution Digital Surface Model (DSM) produced from airborne lidar survey. Areas of predicted visibility take into account visual screening that would be provided by topography, buildings, structures, signs, groupings of trees or large individual trees, and other objects that may obstruct visibility from a given vantage point. In small areas of the study area where lidar data is not available, predicted visibility is based on screening effects of topography and mapped forest vegetation.
4. Viewshed analysis based on maximum blade tip height of 256 meters (840 feet).
5. Basemap: ESRI ArcGIS Online "World Topographic Map" map service.
6. This is a color graphic. Reproduction in grayscale may misrepresent the data.

40-Mile Visual Study Area

Preliminary Area of Potential Effect (PAPE)

Aviation Obstruction Lights Potentially Visible

0 1.5 3 6
Miles

0 2.5 5 10
Kilometers

South Fork Wind Farm

New York/Rhode Island, US

Viewshed Analysis Considering Turbine Blade Tip and Aviation Obstruction Lights

Sheet 2 of 3

Figure 4.5-6 (Sheet 2 of 3). Viewshed Analysis of WTG Blade Tips and Aviation Obstruction Lights

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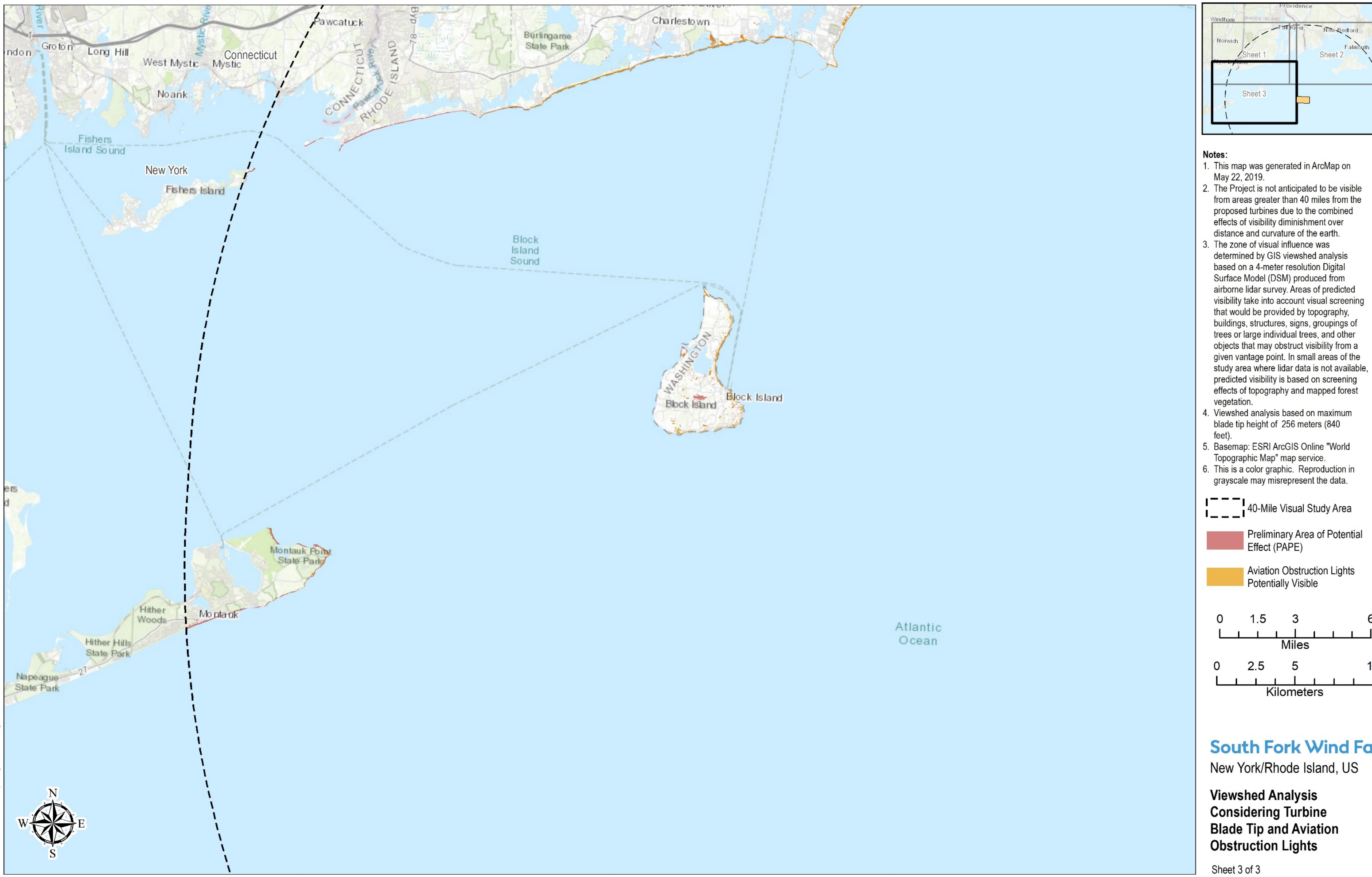

Figure 4.5-6 (Sheet 3 of 3). Viewshed Analysis of WTG Blade Tips and Aviation Obstruction Lights

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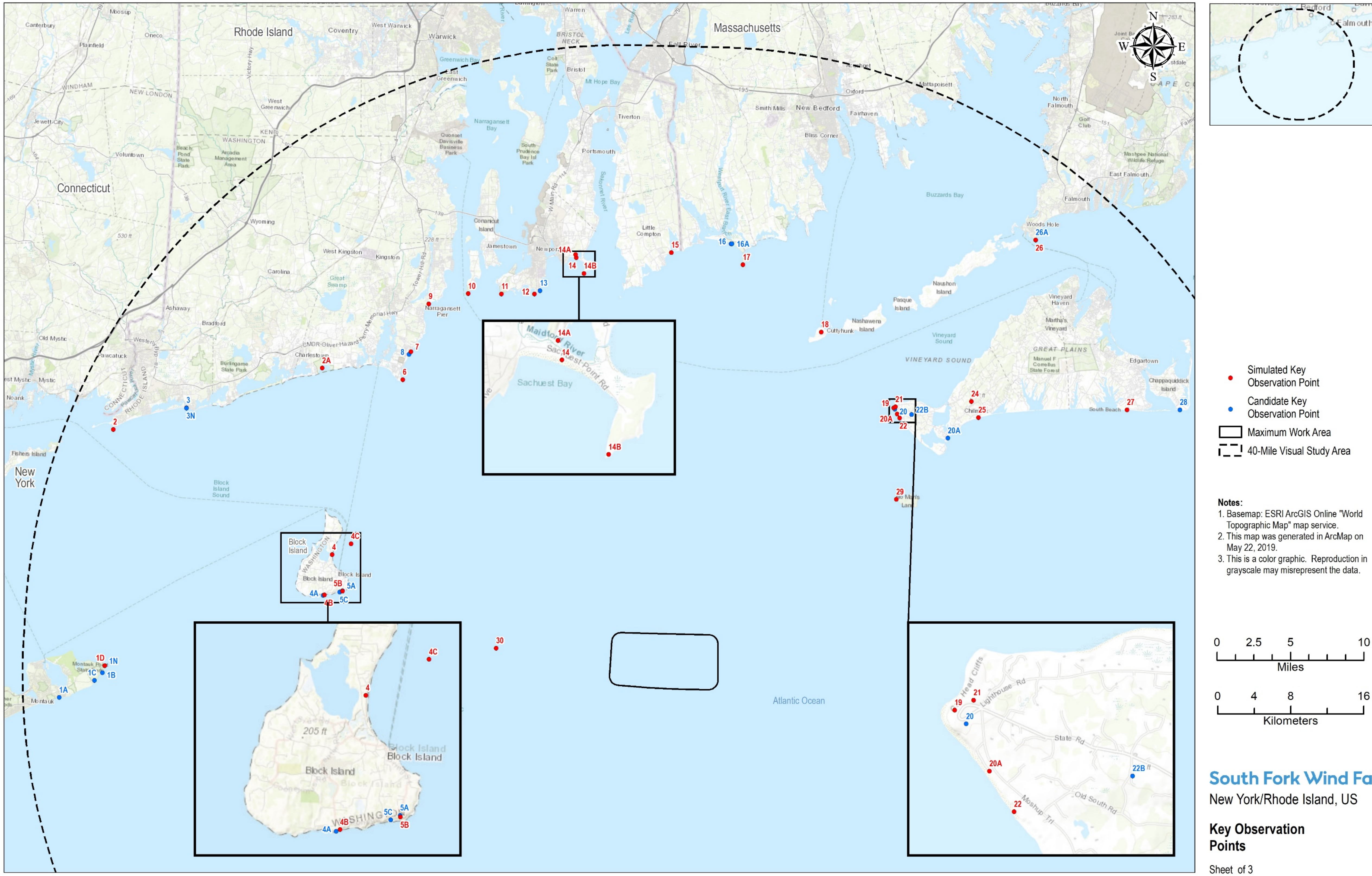

Figure 4.5-7. Key Observation Points

Illustration of locations of visual resources selected for visual simulations.

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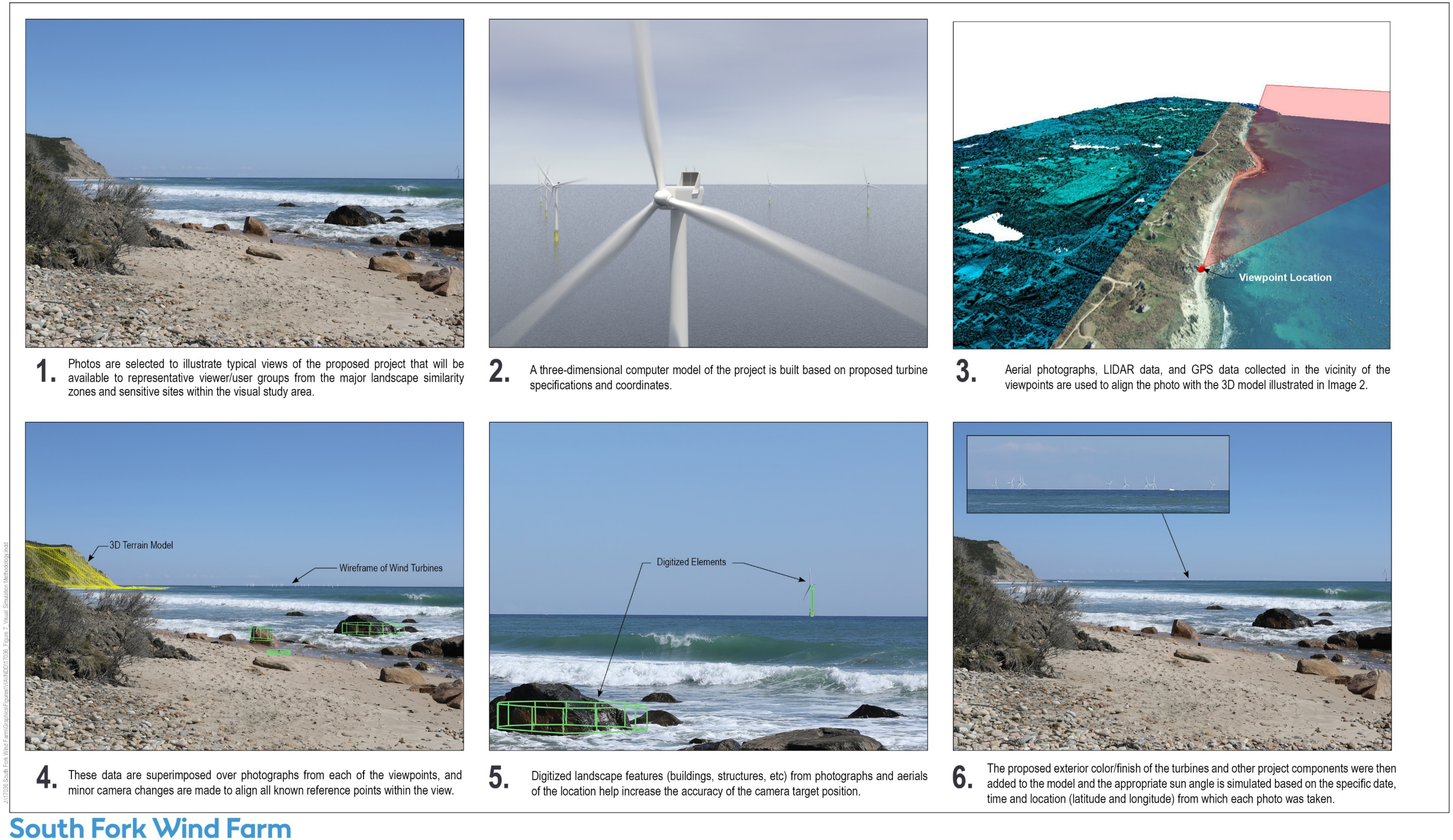

Figure 4.5-8. Visual Simulation Methodology
Illustration of steps involved in generating visual simulations from Key Observation Points.

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Lighting

The proposed SFWF WTGs will be equipped with both aviation obstruction warning lights on top of each nacelle and USCG navigation warning lights on the platform near the tower base. To evaluate the potential visibility and visual impact of these new lights, the VIA included a viewshed analysis based on the anticipated height and locations of the aviation warning lights, as well as nighttime visual simulations from selected KOPs where the aviation warning lights were anticipated to be visible.

The nighttime viewshed analysis was conducted in the same manner as the daytime analysis but was based on a height of 478 feet (145.7 m), where the aviation warning lights would be mounted on the nacelles. The nighttime viewshed analysis suggests that aviation lighting will be visible from approximately 1.3 percent of the land area in the 40-mile (64.4-km) SFWF visual study area (Table 4.5-4). This reduction in visibility can be attributed to the lower height of the aviation warning lights (relative to the turbine blade tips), combined with the screening effects of curvature of the earth. Areas in which the aviation warning lights are screened by curvature of the earth include Montauk Point and Ditch Plains Beach on Long Island, the south-central and southeastern beaches on Martha's Vineyard, and all the shoreline in the Town of Westerly, Rhode Island, on the mainland. In each of these areas, the blade tip analysis indicated potential visibility, but the nighttime viewshed indicated lack of visibility.

Table 4.5-4. Aviation Warning Light Viewshed Results Summary

Distance from Project Site	40-Mile Radius Study Area		
	Total Land Area (square miles) (square kilometers)	Land Area with Potential Visibility/PAPE[a] (square miles) (square kilometers)	Percent
0 to 10 Miles[b]	0	0	0.0%
10 to 20 Miles[c]	6.5 (16.8)	1.1 (2.8)	16.9%
20 to 30 Miles	196.9 (509.9)	7.5 (19.4)	3.8%
30 to 40 Miles	551.4 (1,428.1)	1.2 (3.1)	0.2%
Total 40 Mile Landward Study Area [a]	754.9 (1,955.1)	9.8 (25.4)	1.3%

[a] Land area and percent totals may not add up to 100% or equal study area acreage reported elsewhere in this report due to rounding and/or raster-to-vector conversion.

[b] There is no significant land area within 10 miles of the Project Site.

[c] Block Island, RI and Nomans Land Island are the only significant land masses within 20 miles of the Project site.

Nighttime visual simulations were prepared for five of the selected KOPs, as indicated in Table 4.5-5.

Table 4.5-5. Viewpoints Selected for Nighttime Visual Simulations.

Viewpoint Number	Viewpoint Name	Viewing Distance (miles) (km)
1N	Montauk Lighthouse, New York	35.3 (56.8)
5N	Southeast Lighthouse, Rhode Island	19.4 (31.2)
6N	Point Judith Lighthouse, Rhode Island	23.6 (37.9)
11N	Brenton Point State Park, Rhode Island	25.5 (41)
19N	Aquinnah Overlook, Massachusetts	20.4 (32.8)

To prepare nighttime simulations, data on the proposed aviation obstruction warning lights were collected from the FAA Advisory Circular 70/7460-1L, which provides guidelines for the lighting of WTGs (FAA, 2016). In addition, views of the operational BIWF were documented to determine the appearance of the aviation warning lights at night at distances beyond 20 miles (32.2 km). Computer modeling and camera alignment for the nighttime photos were prepared in the same manner described for the daytime simulations. It was assumed that all lights will flash in a synchronized manner, as currently recommended by FAA guidelines.[12] Nighttime simulations therefore show all WTGs with their lights on. Due to the effects of the curvature of the earth and refraction, USCG warning lights on the WTGs were only considered in views that had a direct line of sight to the foundation transition, which is approximately where the USCG lights will be located.

As with daytime viewpoints, the rating panel's evaluation of nighttime visual impacts was variable depending on other sources of lighting present in the view, the extent of screening provided by buildings/structures and trees, and nighttime viewer activity/sensitivity. Although the composite scores for these simulations did not exceed the threshold of acceptable visual impact for any of the affected LSZs within the SFWF visual study area, they were substantially higher than the daytime scores. While night lighting could potentially have an effect on residents and vacationers in settings where they currently experience dark nighttime skies, in many places, nighttime visibility/visual impact will be limited due to: (1) the abundance of trees that screen all or portions of the Project from the majority of homes within the study area, (2) the existing shoreline and offshore light sources that already impact nighttime ocean views, (3) the distance of the Project from mainland viewpoints, and (4) the concentration of residences in villages, town centers, and neighborhoods, or along highways, where existing lights already compromise dark skies and compete for viewer attention. Therefore, lighting will have a ***minor impact***.

South Fork Export Cable - Onshore

The SFEC onshore export cable has been sited and designed to minimize potential visual impacts. The cable will be installed underground, beneath existing roads or within other existing ROWs, from the landing site to the new Interconnection Facility adjacent the existing East Hampton substation. Minimal tree clearing will be required along the route of the terrestrial export cable, and therefore will not result in any permanent visual impacts. The SFEC - Interconnection Facility is the only proposed above-ground facility that will be built as part of the SFEC.

[12] The project is being proposed greater than 12 miles (19.3 km) offshore (the FAA jurisdictional limit). However, it is assumed that BOEM will adopt similar requirements.

Construction

Traffic
Installation of the SFEC and construction of the new interconnection facility on Long Island will result in short-term, ***minor impacts*** to the visual environment resulting from the presence of construction equipment and workspace signage on local roads and in the local landscape. Construction activity at the proposed substation site could also result in some visible disturbance, such as tree clearing, earth moving, and vehicle activity. Although traffic and other construction activity could temporarily alter the visual character of the landscape, these impacts will be ***short-term*** and ***localized***.

Visible Structures
Viewshed analysis was used to evaluate the potential visibility of the interconnection facility. A DSM of the onshore visual study area, created from lidar data, indicates that the interconnection facility could potentially be visible from 1.8 percent of the 3-mile (4.8-km) SFEC visual study area (see Figure 4.5-3 and Appendix U, Figure 8 of the VRA).

Field review indicated that the actual visibility of the interconnection facility is likely to be extremely limited due to densely situated buildings and houses in the villages, and dense, mature evergreen and deciduous forest in the surrounding areas. Potential visibility will generally be limited to a few areas within approximately 0.25 mile (0.4 km) of the interconnection facility. However, even in these nearby areas, the existing East Hampton substation, as well as the SFEC – Interconnection Facility, is screened from view by dense, mature vegetation that ranges in height from approximately 50 to 70 feet (15 to 21 m).

In the limited areas of potential visibility, it is expected that views of the interconnection facility will be restricted to the uppermost portions of the lightning masts (the tallest structures in the proposed station). In areas further removed, the lightning masts, even if visible, will be difficult to distinguish because of their narrow profile, gray color, and/or screening provided by intervening tree branches.

Field review of the interconnection facility confirmed that the station components will not be visible from, or have an adverse visual effect on, the aesthetic resources of statewide significance within the SFEC visual study area.

Visual simulations and line-of-sight profiles were prepared to illustrate the limited visual effect of the proposed substation on nearby visual receptors. These simulations illustrate that existing vegetation screens views of the SFEC - Interconnection Facility from nearby vantage points located in public ROWs. The only visible components of the proposed substation from these areas would be limited to the uppermost portions of the proposed lightning masts and a thinning of existing vegetation. Foreground vegetation that screens visibility of the substation from public vantage points would not be removed. From more distant vantage points, the SFEC interconnection facility would be even less visible and have even less of an effect on the visual environment. As a result, construction and operations of the proposed SFEC – Interconnection Facility is not anticipated to result in significant changes to the existing visual character or scenic quality of the SFEC visual study area and will therefore have a ***minor impact***.

Lighting
Lighting at the SFEC - Interconnection Facility will be kept to the minimum necessary to ensure safety and security. It is anticipated that all lights at the station will be turned on only as needed, by manual switch or motion detector. As a result, lighting will have ***minor*** to ***no impact***.

4.5.3 Environmental Protection Measures

South Fork Wind Farm

In accordance with the USACE VRAP methodology, because the threshold of acceptable visual impact was not exceeded for any identified LSZ within the SFWF visual study area, no mitigation is required to reduce or offset the visual impact of the SFWF.

Several measures that will reduce visual impact have already been incorporated into the design of the SFWF. These include:

- The location of SFWF, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive public resources and population centers to the "seldom seen" distance zone.
- WTGs will have uniform design, speed, height, and rotor diameter.
- The color of the SFWF WTGs (less than 5 percent grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips.
- Use of Aircraft Detection Lighting Systems (ADLS) will mitigate nighttime visual impacts.

The results of the VIA concluded that the visual impacts associated with the Project will be minimal, and no additional visual mitigation is necessary. However, the nighttime simulation evaluations (Section 4.5.2) resulted in slightly elevated visual impacts associated with the aviation obstruction lights. Therefore, if mitigation is required, SFW will consider implementing technically feasible mitigation measures, such as Aircraft Detection Lighting Systems (ADLS), which allows for the obstruction lighting to be active only as necessary when aircraft are approaching and within the airspace[13] of the wind farm during nighttime hours.

A recent study completed by Capitol Airspace Group used historical aircraft tracking data to determine the frequency of aviation obstruction light activation. This activation occurs as an aircraft enters the airspace of the Project. This study concluded that the aviation obstruction lights would be active for approximately 3 hours and 49 minutes per year. Analyzed on a monthly basis, the activation times ranged from 2 minutes to 46 minutes per month (Capitol Airspace, 2018). Review of the Capitol Airspace Group study suggests that if an ADLS was implemented on the SFWF, broadly comparable reductions in the activation time of the aviation obstruction lights would be achievable. Use of the SFWF airspace is expected to be less frequent than along the southern perimeter of Nantucket Island and over the northern sections of Block Island (e.g. Capitol Airspace, 2018: Figure 5).

South Fork Export Cable Onshore

Visual impact has been avoided and minimized by burying the onshore cable and through careful site selection and design for the interconnection facility. The SFEC – Interconnection Facility will not be visible from, nor will it have a negligible visual effect on, aesthetic resources of statewide or local significance within the SFEC visual study area.

In addition, several measures that will reduce or mitigate visual impact have already been incorporated into the design of the SFEC – Interconnection Facility. These include:

- The SFEC - Interconnection Facility will be located adjacent to an existing substation on a parcel zoned for commercial and industrial use.

[13] The Project airspace is defined as 3 nautical miles from the obstruction or perimeter of a group of obstructions and vertically 1000 feet above the highest part of the group of obstructions.

- At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise.

4.6 Socioeconomic Resources

The overall socioeconomic region of influence (ROI) includes the states, counties, and communities that may be impacted by potential Project activities. The overall ROI is the same for both the SFWF and SFEC, and, as summarized in Table 4.6-1, includes the states of New York, Rhode Island, and Massachusetts; four counties; and the seven communities where Project construction, O&M, or decommissioning activities will occur. The potential for conflicts with nearshore (e.g., beach recreation, wildlife viewing) and offshore activities (e.g., sailing and other recreational boating, recreational fishing, charter boat fishing, or commercial fishing) were also considered in the selection of the communities in the ROI. Table 4.6.-1 also highlights those specific communities considered within the ROI for potential impacts on Housing and Property Values, as well as Recreation and Tourism and based on their location within the potential viewshed of the SFWF (see Section 4.6.2, Housing and Property Values, Section 4.6.4, Recreation and Tourism, Section 4.5, Visual Resources, Appendix U, Visual Resource Assessment, SFEC Onshore Substation, and Appendix V, Visual Impact Assessment, SFWF).

Table 4.6-1. Socioeconomic Region of Influence Communities

ROIs		State	County	Communities or Shoreline	Potential Project Components, Supporting Activities, or Impacts
Overall Socioeconomic	Property Value / Tourism				
•	•	New York	Suffolk	Montauk Census-designated place (CDP)	• SFEC – Onshore • SFWF O&M Facility potential location
•	•	New York	Suffolk	East Hampton North CDP	• SFEC – NYS sea-to-shore transition • SFEC – Onshore
•	•	New York	Suffolk	Town of East Hampton	• SFEC – Onshore • SFEC - Interconnection Facility
•		New York	Suffolk	Wainscott CDP	• SFEC – Onshore
	•	New York	Suffolk	Eastern and southeastern shoreline	• Within potential viewshed of the SFWF • Potential for impacts to property values and tourism
•		Rhode Island	Washington	Town of North Kingstown	• SFWF O&M Facility potential location
	•	Rhode Island	Washington	Southern shoreline of coast (Port of Galilee in Point Judith) and Block Island	• Within potential viewshed of the SFWF • Potential for impacts to property values and tourism

Table 4.6-1. Socioeconomic Region of Influence Communities

ROIs		State	County	Communities or Shoreline	Potential Project Components, Supporting Activities, or Impacts
Overall Socioeconomic	Property Value / Tourism				
•		Rhode Island	Providence	City of Providence	• Potential port for assembly, staging and logistics
	•	Rhode Island	Newport	Southern shoreline	• Within potential viewshed of the SFWF • Potential for impacts to property values and tourism
					•
	•	Massachusetts	Bristol	Southern shoreline	• Within potential viewshed of the SFWF • Potential for impacts to property values and tourism
	•	Massachusetts	Dukes	Southern and western shoreline	• Within potential viewshed of the SFWF • Potential for impacts to property values and tourism

4.6.1 Population, Economy, and Employment

4.6.1.1 Affected Environment

The affected environment for population, economy, and employment are the same for the SFWF and SFEC and are presented together in this subsection; impacts are described separately in Section 4.6.1.2.

South Fork Wind Farm and South Fork Export Cable

Population

This subsection describes the population characteristics and trends in the socioeconomic ROI to provide a basis for evaluating potential impacts from Project-related changes. Table 4.6-2 summarizes the area of each geography in square miles; its population in 2000, 2010, and 2015; and the estimated overall population change between 2000 and 2015 (USCB, 2000, 2010a, 2010b, 2015a).

Among the four counties, Suffolk County, New York, had the largest population (greater than the state of Rhode Island). In 2015, Suffolk County had 1.5 million residents and a population density of 1,646 people per square mile. However, the four communities noted in Table 4.6-2 are located further away from the New York City metropolitan area and tend to be smaller and less dense. In 2015, these four communities had a combined population of 30,282 residents, or approximately 2 percent of Suffolk County's total population.

The city of Providence, Rhode Island, with a population of 178,680 people and 9,707 residents per square mile in 2015, was by far the densest community in the study area. The city of New Bedford, Massachusetts, was also densely populated. It had 4,761 people per square mile in 2015.

Table 4.6-2. SFWF and SFEC Population Characteristics

Entity	Land Area (square miles)	USCB 2000	USCB 2010	Population Estimate ACS 2015	2015 Population Density (persons per square mile)	USCB 2000 - 2015 Change	Median Age ACS 2015
New York	***47,126***	***18,976,457***	***19,378,102***	***19,673,174***	***417***	***4%***	***38***
Suffolk County	*912*	*1,419,369*	*1,493,350*	*1,501,373*	*1,646*	*6%*	*41*
Town of East Hampton	74	19,719	21,457	21,844	294	11%	51
East Hampton North CDP	6	3,587	4,142	3,979	713	11%	44
Montauk CDP	18	3,851	3,326	3,495	199	-9%	54
Wainscott CDP	7	628	650	753	112	20%	45
Rhode Island	***1,034***	***1,048,319***	***1,052,567***	***1,053,661***	***1,019***	***1%***	***40***
Washington County	329	*123,546*	*126,979*	*126,405*	384	*2%*	43
Town of North Kingstown	43	26,326	26,486	26,310	610	0%	43
Providence County	*410*	*621,602*	*626,667*	*630,459*	*1,540*	*1%*	*37*
City of Providence	18	173,618	178,042	178,680	9,707	3%	29
Massachusetts	***7,801***	***6,349,097***	***6,547,629***	***6,705,586***	***860***	***6%***	***39***
Bristol County	*553*	*534,678*	*548,285*	*552,763*	999	*3%*	*41*
City of New Bedford	20	93,768	95,072	94,909	4,761	1%	37

Sources: USCB, 2000, 2010a, 2010b, 2015a
ACS = American Community Survey
USCB = U.S. Census Bureau

From a trend perspective, the percent change between USCB decennial census taken in 2000 and the USCB 2015 ACS estimate is provided in Table 4.6-2. At the state and county level, population change has been modest since 2000, with growth ranging from a low of 1 percent in Rhode Island and 4 percent in New York to 6 percent in Massachusetts. Among the counties, Suffolk County experienced the highest percent change in population (6 percent), followed by Bristol County with 3 percent growth. The changes in population were more dramatic at the community level. Within Suffolk County, New York, population change varied from a decline of 9 percent in Montauk to increases of 11 percent each in the town of East Hampton and the East Hampton CDP, and 20 percent in Wainscot CDP. Each of these Long Island communities is relatively unpopulated such that small changes in the number of residents result in large percentage changes, especially for Wainscott CDP, a with population of 753 people.

The median age in the study area ranged from a high of 54 in the Montauk CDP in Suffolk County, New York, to a low of 29 in the city of Providence. Overall, the communities on the eastern end of Suffolk County tend to be noticeably older, with a median age of 54 in Montauk and 51 in the town of East Hampton (USCB, 2015a).

Economy

This section characterizes the overall economy of the socioeconomic ROI, by describing the gross domestic product (GDP) of each state, its contribution to the overall national GDP, and the distribution of the civilian workforce by major industry sector. In addition to state information, data are presented for the subset of coastal communities from the ROI that BOEM identified as potentially vulnerable to the impacts of offshore wind development in the RI-MA WEA (ICF, 2012).

General Economy

The GDP represents the market value of goods and services produced by the labor and property located within a geography and is influenced to a large degree by size (geographic area). However, it serves a relative indicator of the size of the economies within the region, particularly when viewed as a percentage of the overall national economy. Table 4.6-3 summarizes the GDP for Massachusetts, New York, and Rhode Island for the first quarter of 2016 and 2017 (BEA, 2017). The GDP of New York was $1.5 billion in the first quarter of 2017, representing approximately 8 percent of the national GDP. The GDP of Massachusetts was $520 million at the beginning of 2017, or 2.7 of the national GDP, while Rhode Island had a GDP of $59 million, representing 0.3 percent of the national GDP (BEA, 2017).

Table 4.6-3. Current-Dollar Gross Domestic Product by State for the First Quarters of 2016 and 2017

	GDP (in Millions of Dollars Seasonally Adjusted at Annual Rates)		2016 – 2017 % Change	Percent of the U.S.	
	2016	2017		2016	2017
United States	18,170,091	18,911,981	4%		
Massachusetts	500,418	519,970	4%	2.8	2.7
Rhode Island	56,087	58,884	5%	0.3	0.3
New York	1,481,479	1,500,994	1%	8.2	7.9

Source: BEA, 2017

Table 4.6-4 demonstrates that despite their broad geographic distribution, the economies of the counties in the overall ROI are very similar. Based on the 2011 to 2015 ACS, over a quarter (26 to 28 percent) of the civilian population is employed in the “educational services, and health care and social assistance” industry sector (USCB, 2015b). Retail trades also are an important industry representing 11 to 14 percent of employment. Meanwhile, careers in “professional, scientific, and management, and administrative and waste management services” represent 9 to 13 percent of employment. Providence County, Rhode Island, and Bristol County, Massachusetts, tended to have slightly more manufacturing jobs, 12 percent, as compared to 7 to 9 percent for the other states and communities in the region. The agriculture, forestry, fishing and hunting, and mining industrial sector employed less than 1 percent of the civilian workforce in the region. The town of East Hampton’s Hamlet Business District Plan (2017), which is based upon 2014 employment data to capture self-employed workers, notes a modestly higher percentage 4 percent of its workforce in this sector (Town of East Hampton, 2017).

Table 4.6-4. Distribution of Civilian Employed Population (16 Years and Over) by Industry

Subject	NY	Suffolk County, NY	RI	Providence County, RI	Washington County, RI	MA	Bristol County, MA
Educational services, and health care and social assistance	28%	27%	27%	28%	28%	28%	26%
Retail trade	11%	12%	12%	13%	11%	11%	14%
Professional, scientific, and management, and administrative and waste management services	11%	11%	10%	10%	10%	13%	9%
Arts, entertainment, and recreation, and accommodation and food services	10%	7%	11%	10%	13%	9%	9%
Manufacturing	7%	8%	11%	12%	9%	9%	12%
Construction	6%	8%	5%	5%	6%	5%	7%
Finance and insurance, and real estate and rental and leasing	8%	7%	7%	6%	7%	8%	6%
Other services, except public administration	5%	4%	5%	5%	4%	4%	4%
Public administration	5%	5%	4%	4%	5%	4%	4%
Transportation and warehousing, and utilities	5%	5%	4%	4%	3%	4%	4%
Wholesale trade	3%	3%	3%	3%	2%	2%	4%
Information	3%	3%	2%	2%	1%	2%	2%
Agriculture, forestry, fishing and hunting, and mining	1%	0%	0%	0%	1%	0%	1%

USCB, 2015b

Recreation and Tourism Economy

BOEM's *Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development: Impacts of Offshore Wind on Tourism and Recreation Economies* identified the coastal areas (that is, counties) within each WEA by their potential to encounter both beneficial and detrimental socioeconomic impacts from each phase (planning, construction, and deconstruction) of wind facility development (ICF, 2012).

Factors included:

- Ocean recreation and tourism account for a large percentage of the location's tourism economy.
- Ocean recreation and tourism account for a large percentage of the location's marine economy.

- Tourism accounts for a large percentage of the location's economy.
- The location has many establishments related to coastal and water recreation.
- The location has a high percentage of natural or historic and cultural areas.
- The location has significant development along the coast (ICF, 2012).

Of the 113 geographic areas assessed by BOEM along the Atlantic seaboard, 20 are in Massachusetts, New York, or Rhode Island, and 7 are part of the ROI for the SFWF and SFEC (Table 4.6-5). The assessment also identified Block Island as a "hotspot," meaning it has unique economic, social, or physical characteristics that distinguishes it from Washington County, Rhode Island, overall (ICF, 2012). It also tabulated the recreation and tourism industry employment for these coastal communities. Because the Bureau of Economic Analysis (BEA) does not have a single North American Industry Classification System (NAICS) code for the tourism industry, it compiled those coastal industries that play a significant role in providing services that cater to tourists. Table 4.6-5 summarizes the share of the ocean jobs connected to tourism to indicate the significance of tourism to each corresponding geography. Within the SFWF and SFEC region, this ranged from a low of 40 percent (Bristol County, Massachusetts) to a high of 96 to 97 percent in Providence County, Rhode Island, and Dukes County, Massachusetts. There were 4,115 tourism-related establishments in Suffolk County, New York in 2010 (ICF, 2012).

Table 4.6-5. Summary of Ocean-related Tourism Indicators[a]

State and Communities	Ocean Jobs Related to Tourism, 2010	Tourism-related Establishments, 2010	Ocean-related Establishments/ Employment, 2009	Tourism Expenditures, 2010 (in millions)
RHODE ISLAND				
Newport County	75%	447	462 / 7,616	$790
Providence County	96%	1,733	496 / 7,175	N/A
Washington County	62%	574	469 / 7,500	$751
Block Island, Washington County	N/A	58	N/A	$259
NEW YORK				
Suffolk County	82%	4,115	2,021 / 23,825	N/A
MASSACHUSETTS				
Bristol County	40%	1,436	512 / 6,471	$384
Dukes County	97%	179	165 / 1,398	$112

Source: ICF, 2012
[a] Portions of the counties summarized in this table are within the 40-mile (64.4-km) viewshed of the SFWF.
N/A = not available

Employment

The employment characteristics of the SFWF and SFEC region are summarized in Table 4.6-6 to provide a basis for evaluating potential impacts from Project-related changes. Among the four counties, Suffolk County, New York, has the largest labor force with 778,550 workers (in 2017). Meanwhile, Washington County, Rhode Island, had the smallest labor force with 68,279 (Rhode Island Department of Labor and Training, 2017). The unemployment rate was low throughout the region with each county only being modestly higher or lower than their respective state. Per capita personal income in 2015 was lowest in Providence County, Rhode Island, at $44,399, while Suffolk County, New York, had the highest at $59,484. Workers in Bristol County, Massachusetts, had a per capita income of $48,294 while workers in Washington County, Rhode Island, had a per capita income of $58,274 in 2015.

Table 4.6-6. SFWF and SFEC Employment Characteristics

Entity	Labor Force 2017	Employment 2017	Unemployment 2017	Unemployment Rate 2017	Per Capita Personal Income 2015
NEW YORK	9,619,000	9,208,300	410,700	4.3	$58,670
Suffolk County	778,500	747,600	30,900	4.0	$59,484
RHODE ISLAND	550,225	530,162	20,063	3.6	$50,018
Washington County	68,279	66,132	2,147	3.1	$58,274
Providence County	321,738	308,922	12,816	4.0	$44,399
MASSACHUSETTS	3,686,700	3,534,100	152,600	4.1	$ 62,603
Bristol County	296,608	281,809	14,799	5	$ 48,294

Source: New York State Department of Labor, 2017; Rhode Island Department of Labor and Training, 2017; Massachusetts Executive Office of Labor and Workforce Development, 2017

4.6.1.2 Potential Impacts

Project-related activities and infrastructure that could potentially result in direct or indirect impacts to population, economy, and employment resources were identified as part of the IPF analysis in Section 4.1. An overview of the IPFs for population, economy, and employment is presented on Figure 4.6-1. IPFs that will not impact population, economy, and employment are depicted with slashes through the circle and are not discussed further. IPFs with potential impacts negligible and greater are evaluated in this section.

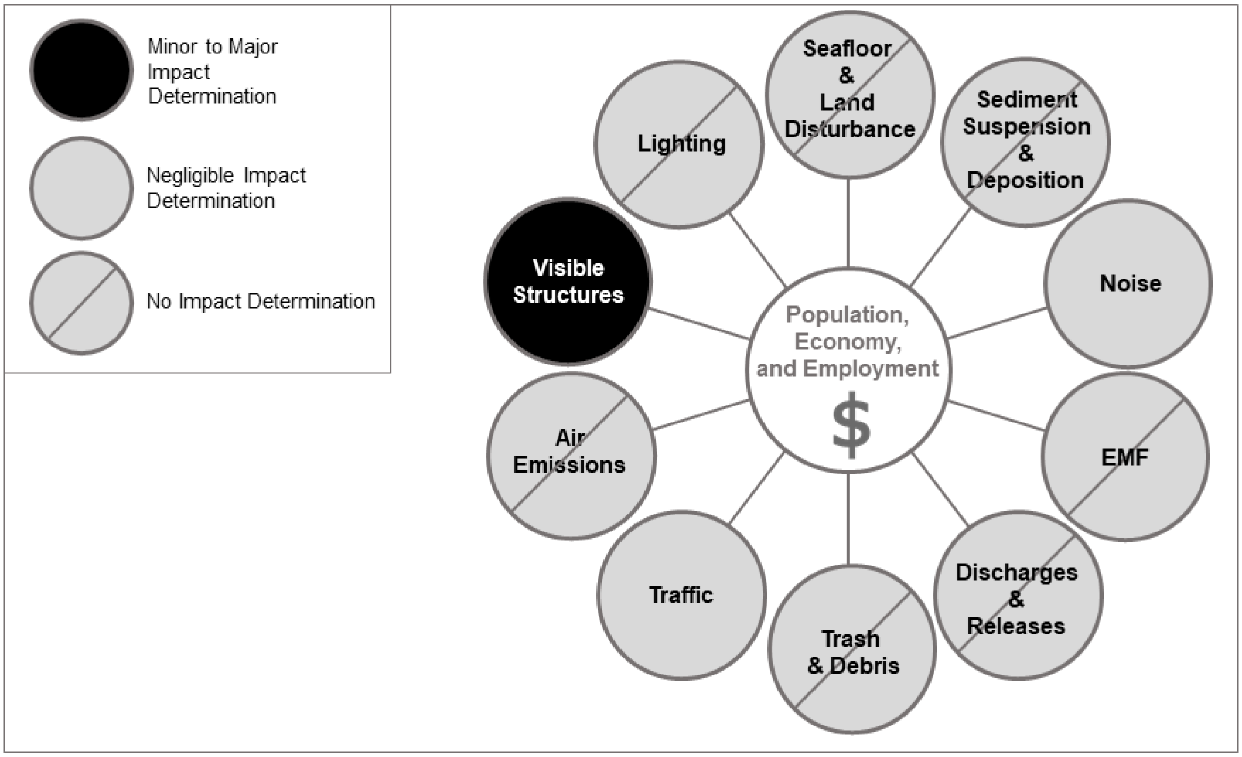

Figure 4.6-1. IPFs on Population, Economy, and Employment

Illustration of potential impacts to population, economy, and employment resources resulting from SFWF and SFEC activities.

Table 4.6-1 summarizes the local communities, counties, and states in the overall Socioeconomic ROI, which includes Population, Economy, and Employment; impacts to these resources will result from the need for varying levels of local and nonlocal workers, goods, and services during each phase. Further, those local economies dependent on recreation and tourism (see Table 4.6-1) could be impacted by visible structures.

Navigant Consulting Inc. conducted an economic development and jobs analysis for the SFWF and SFEC (Appendix AA). That analysis found that the SFWF and SFEC will support an estimated 1,741 local job-years (full-time equivalent jobs multiplied by the number of construction years) during the construction phase and approximately 87 additional local annual jobs during the operations phase. During construction, this includes 166 direct jobs each lasting 2 years, 790 indirect jobs, and 620 jobs. During operations, this includes 10 direct annual jobs, 48 indirect jobs, and 29 induced jobs.

Expected job creation from development of the offshore wind industry in the Northeast was also recently described in the report, U.S. Job Creation in Offshore Wind, that was prepared for the NYSERDA and reflected collaboration with representatives of the Massachusetts Department of Energy Resources, the MassCEC, and the Rhode Island Office of Energy Resources (BVG, 2017). SFW will hire local workers to the extent practical for SFWF and SFEC management, fabrication, and construction. Non-local construction personnel typically include mariners, export cable manufacturing personnel, and other specialists who may temporarily relocate during the construction and decommissioning. Population impacts to the communities in the socioeconomic ROI could result primarily from the short-term influx of construction personnel. The total population change will equal the total number of non-local construction workers plus any family members that may accompany them. However, because of the short duration of construction activities, it is unlikely that non-local workers will relocate families to the area.

Table 4.6-7 summarizes the potential impacts to population, economy, or employment during the construction, O&M, and decommissioning phases of the SFWF and SFEC that are described in further detail in the following sections.

Table 4.6-7. SFWF and SFEC Population, Economy, and Employment Impact Summary

Resource Area	Population	Economy	Recreation and Tourism Economies	Employment
SFWF				
Construction / Decommissioning	Negligible	Negligible	Short-term, Negligible to Minor	Short-term, Minor
Operation and Maintenance	Long-term, Negligible	Negligible	Negligible	Negligible
SFEC – OCS / NYS				
Construction / Decommissioning	Negligible	Negligible	Short-term, Negligible	Short-term, Negligible
Operation and Maintenance	Negligible	No impact	No impact	Negligible
SFEC – NYS ONSHORE				
Construction / Decommissioning	Negligible	Negligible	Short-term, Negligible to Minor	Short-term, Minor
Operation and Maintenance	Long-term, Negligible	Negligible	Negligible	Negligible

South Fork Wind Farm

Construction and decommissioning activities may result in ***short-term, negligible*** to ***minor impacts*** to the population and local economies. There is the potential for ***long-term, negligible impacts*** from noise and visible structures during O&M. Section 4.1.3 discusses noise that could be generated, and Section 4.1.7 discusses marine vessel and land traffic that could be generated.

<u>Construction</u>

Noise and Traffic

Short-term, negligible impacts to the population from noise during construction could occur; however, these impacts will be localized and limited to construction of the O&M facility. There will be increased marine vessel (e.g., tugs and barges transporting construction materials and smaller support vessels carrying supplies and crew) and vehicular traffic (e.g., delivery trucks carrying construction equipment and supplies, and automobiles used for daily commuting to various work sites). It is anticipated that all large project components (e.g., WTG blades, foundation segments, nacelle, etc.) will be transported at sea, and not overland therefore not impacting land-based traffic. However, the number of additional trips during the construction phase of the SFWF are expected to be ***negligible*** relative to the existing conditions and ***short-term*** in duration; therefore, impacts to the population and economy because of traffic will be ***short-term*** and ***negligible***.

Visible Structures

Short-term, negligible to ***minor impacts*** to the economy and employment of the region are anticipated because of the size of the non-local construction workforce relative to existing conditions and because the SFWF will be constructed using multiple ports and access locations in different states (Table 4.6-1). Section 4.5, Visual Resources, and Appendix V, Visual Impact Assessment, SFWF, characterize the visible structures associated with construction of the SFWF. Visibility of the WTG construction activities will generally be limited to those recreating or working offshore, which is not expected to impact the overall population, economy, or employment. Construction of the O&M facility in either the town of East Hampton, New York, or in Quonset Point in the town of North Kingstown, Rhode Island, have the potential to change existing visual resources in a measurable fashion. However, depending on the timing and location of the staging and construction activities, there could be ***short-term, negligible*** to ***minor impacts*** on the local economies dependent on recreation and tourism.

Operations and Maintenance

Noise and Traffic
There would be periodic ***negligible impacts*** to the population from support O&M activities at the staging ports used for significant maintenance activities.

Visible Structures
Similarly, the ***long-term impacts*** to economy and employment will be ***negligible*** because of the limited number of staff and goods and services needed to operate and maintain the SFWF. ***Negligible, long-term impacts*** on the local economies dependent on recreation and tourism are anticipated because it is assumed the O&M facility will be sited and designed to be consistent with adjacent land uses to minimize the visible structures seen by visitors.

Decommissioning

Decommissioning of the SFWF could have similar ***short-term, negligible impacts*** as construction in terms of increased traffic, noise, and visible structures impacts.

South Fork Export Cable

SFEC – OCS and SFEC – NYS

The SFEC – OCS and SFEC – NYS are not expected to have long-term impacts on population, economy, and employment during construction or decommissioning.

Construction

Noise
Impacts from noise are expected to be ***short-term*** and ***localized***, generally resulting from vessel traffic or construction equipment near the construction areas along the southeast coast of Long Island. ***Short-term, negligible impacts*** to the population and local tourism and recreation economies from noise during construction could occur; however, these impacts will be local to the vicinity of the landing site. There may be ***short-term, negligible impacts*** associated with construction depending on the duration and timing of these activities with the local tourism season and the location of the landing site.

Traffic
Short-term, negligible impacts to the economy and employment of the region may occur from construction of the SFEC because of the size of the non-local construction workforce relative to existing conditions (Table 4.6-1). Section 4.1.7 discusses marine vessel traffic that could be generated by the SFEC – OCS and SFEC – NYS construction. There will be increased marine vessel (e.g., tugs and barges) transporting construction materials, export cable laying barges, and smaller support vessels carrying supplies and crew.

Visible Structures
Short-term, negligible impacts to the economy and employment of the region are anticipated because of the size of the non-local construction workforce relative to existing conditions.

Operations and Maintenance

No long-term impact on the population, economy, and employment will result from O&M because limited maintenance activities are expected.

Decommissioning

Decommissioning of the SFEC – OCS and SFEC – NYS could have similar impacts as construction, depending on the duration and timing of these activities with the local tourism season and location of the landing site.

SFEC – Onshore

The SFEC – Onshore is not expected to have long-term impacts on population, economy, and employment during construction or decommissioning; however, there may be the potential for limited ***long-term, negligible impacts*** from noise and visible structures associated with O&M at the SFEC - Interconnection Facility. Construction and decommissioning activities associated with the SFEC – Onshore will result in ***short-term, negligible*** to ***minor impacts***.

Construction

Noise
Impacts from noise will be short-term, generally resulting from traffic or construction equipment. ***Short-term, negligible impacts*** to the population from noise during construction could occur; however, these impacts will be limited to the construction areas along the SFEC - Onshore cable installation route, the sea-to-shore transition vault area, and near the SFEC – Interconnection Facility construction site.

Traffic
There will be ***short-term, negligible impacts*** to the economy and employment of the region from construction of the SFEC - Onshore because of the size of the non-local construction workforce relative to existing conditions. There will be increased vehicular traffic (e.g., delivery trucks carrying construction equipment and supplies, construction and export cable-laying equipment, and automobiles used for daily commuting to various work sites) traffic. This may result in ***short-term, negligible impacts*** because of increased traffic during the construction of the SFEC - Interconnection Facility and the SFEC - Onshore cable installation. The scale of these impacts will depend on the location of the landing site and whether construction is timed to avoid traffic associated with the summer tourism season.

Visible Structures
Impacts to the economy and employment of region are anticipated because of the size of the construction workforce relative to existing conditions. Depending on the timing of the construction activities associated with construction of the SFEC – Onshore would be ***short-term, negligible*** to ***minor*** and will be limited to the SFEC - Interconnection Facility construction area and the activities along the SFEC - Onshore cable installation route. The scale of these impacts will depend on the SFEC - Onshore cable landing site and whether construction is timed to avoid impacts on the local economies dependent on recreation and tourism.

Operations and Maintenance

There may be ***long-term, negligible impacts*** to the population from the limited amount of noise generated from the SFEC - Interconnection Facility in Suffolk County, New York. However, this noise is not expected to be above the level of the existing LIPA substation.

The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.

Decommissioning

Decommissioning of the SFEC – Onshore could have similar ***short-term, negligible*** to ***minor impacts*** as construction in terms of increased traffic, noise, and visible structures impacts, assuming the SFEC – Onshore components are removed by similar methods and equipment as construction. Potential ***short-term, negligible*** to ***minor impacts*** will be associated with decommissioning of the sea to shore transition vault area and will be dependent on the timing of these activities to avoid the summer tourism season.

4.6.1.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to population, economy, and employment.

- Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning.
- The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers.
- The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.
- At the SFEC - Interconnection Facility, additional screening will further reduce potential visibility and noise.
- New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.

4.6.2 Housing and Property Values

The potential impacts of the SFWF and SFEC on housing and property values are described in this section. Housing and property value information for those communities potentially impacted by the construction, O&M, or decommissioning of the SFWF and SFEC is also presented in this section. The affected environment is the same for the SFWF and the SFEC (Table 4.6-1) although impacts will be described separately. Data on the number of housing units, their vacancy status, and median housing values and gross rent from the 2015 ACS (5-year average of 2011 to 2015) are described. The vacancy status of the region's housing serves as a good indicator of the housing market and whether nonlocal construction workers will be able to find short-term accommodations. The USCB defines a housing unit as "a house, an apartment, a mobile home, a group of rooms or a single room that is occupied (or, if vacant, intended for occupancy) as separate living quarters" (USCB, 2015c). Boats, recreational vehicles (RVs), vans, tents, and other similar quarters are only included if they are occupied as a current place of residence.

4.6.2.1 Affected Environment

Regional Overview

The socioeconomic ROI for housing and property values includes those communities that could be impacted by the construction, O&M, or decommissioning of the SFWF and SFEC (Table 4.6-8). The socioeconomic ROI for property values also includes Newport County in Rhode Island and Bristol and Dukes Counties in Massachusetts (included in the VIA, SFWF, Appendix V) because each is between 20 and 30 miles from the SFWF and SFEC. Literature reviewed by BOEM indicates that geographies with significant residential development along their coasts may be particularly sensitive to changes in property values because of an offshore wind development (ICF, 2012).

South Fork Wind Farm and South Fork Export Cable

Housing

Table 4.6-8 summarizes the total number of housing units, vacant units, vacancy rates for rentals and ownership, as well as their corresponding median value or gross rent. Suffolk County, New York, had 570,194 housing units in 2015 – 76,345 of which were vacant (USCB, 2015d). Homeowner vacancy rates were consistently low, 3 percent or less. Meanwhile, rental vacancy rates were generally higher and more varied, with 34 percent in the Montauk CDP, 10 percent in the town of East Hampton, and 0 percent in East Hampton North and Wainscott CDP. In 2015, there were 62,722 housing units in Washington County, Rhode Island – 13,158 of which were vacant (USCB, 2015d).

Table 4.6-8. SFWF and SFEC Housing Characteristics

Entity	Total Housing Units	Vacant Housing Units	Homeowner Vacancy Rate	Rental Vacancy Rate	Median Value (dollars)	Median Gross Rent (dollars)
NEW YORK	8,171,725	909,446	1.8	4.3	283,400	1,132
Suffolk County	570,194	76,345	1.4	4.6	375,100	1,544
Town of East Hampton	21,841	12,410	2	10.4	812,700	1,598
East Hampton North CDP	2,578	921	0	0	742,300	1,228
Montauk CDP	4,685	2,951	0.7	33.9	792,400	1,342
Wainscott CDP	1,036	712	0	0	1,178,200	1338

Table 4.6-8. SFWF and SFEC Housing Characteristics

Entity	Total Housing Units	Vacant Housing Units	Homeowner Vacancy Rate	Rental Vacancy Rate	Median Value (dollars)	Median Gross Rent (dollars)
RHODE ISLAND	462,900	52,298	1.9	6.2	238,000	925
Washington County	62,722	13,158	1.7	3	311,600	1,050
Town of North Kingstown	11,133	846	0.7	0	313,100	964
Providence County	263,890	25,606	2.2	7	211,200	887
City of Providence	71,080	9,599	3	7.4	177,100	913
MASSACHUSETTS	2,827,820	278,099	1.2	4.2	333,100	1,102
Bristol County	230,986	18,957	1.4	4.7	273,100	820
City of New Bedford	43,291	4,150	1.1	6.8	206,900	771

Source: USCB, 2015d

Table 4.6-9 summarizes the 2015 vacancy status in the SFWF and SFEC region by type for those units that could be available to nonlocal construction workers, that is, not those units already rented or sold. Because of the region's popularity as summer vacation destination, the coastal counties of Suffolk, New York, Washington, Rhode Island, and (to a lesser extent) Bristol County, Massachusetts each had large percentages of seasonal units (e.g., beach cottages) used for sports or recreation. Table 4.6-10 illustrates that there are many other vacant units in the study area, particularly in Bristol and Providence counties where they represent almost half of the vacant housing supplies. These other vacant units do not fall within the other USCB categories and are included in the housing analysis as a potential latent housing supply.

Table 4.6-9 summarizes only those vacant units that will be available to non-local construction workers; that is, not those units already rented or sold. However, it also illustrates the important role that "seasonal, recreational, or occasional use" and "other vacant" units play in the local housing supply of the Socioeconomic ROI. Approximately 85 percent of the vacant units in Suffolk County overall and 95 percent of the vacant units in the local communities are classified as one of these two uses (USCB, 2015b). Both are associated with seasonal tourism or secondary vacation homes, with other vacant units often used by a caretaker or janitor, while the availability of seasonal units would typically be quite limited during peak summer construction periods. Similarly, of the 846 vacant units noted in Table 4.6-8 for North Kingston, Rhode Island, a negligible number were reported "for rent", 56 units were "for sale," and the balance were split between seasonal and "other vacant" housing. North Kingston is aware of these shortages in its housing supplies and produced an Affordable Housing Plan in 2005 to address these issues going forward (BC Stewart & Associates/Bay Area Economics, 2005).

Table 4.6-9. SFWF and SFEC Vacant Housing Characteristics

Entity	Total	For Rent	For Sale Only	For Seasonal, Recreational, or Occasional Use	For Migrant Workers	Other Vacant
NEW YORK	**831,486**	**153,504**	**70,718**	**321,733**	**1,440**	**284,091**
Suffolk County	72,940	4,986	5,763	47,804	254	14,133
Suffolk County % distribution		7%	8%	66%	0%	19%
Town of East Hampton	12,327	220	152	11,543	114	298
East Hampton North CDP	906	-	-	805	49	52
Montauk CDP	2,941	191	9	2,708	-	33
Wainscott CDP	709	-	-	673	14	22
Suffolk County, NY Community Subtotal	17,408	411	174	16,232	177	414
Suffolk County, NY Community % distribution		2%	1%	93%	1%	2%
RHODE ISLAND	**48,979**	**10,876**	**4,746**	**17,919**	**35**	**15,403**
Washington County	12,849	415	624	10,529	35	1,246
Washington County % distribution		3%	5%	82%	0%	10%
Town of North Kingstown	766	-	56	343	-	367
Providence County	23,526	8,521	2,914	1,285	-	10,806
Providence County % distribution		36%	12%	5%	0%	46%
City of Providence	8,809	3,275	666	444	-	4,424
MASSACHUSETTS	**254,123**	**42,605**	**19,230**	**123,040**	**160**	**69,088**
Bristol County	17,745	4,048	1,837	3,399	17	8,444
Bristol County % Distribution		23%	10%	19%	0%	48%
City of New Bedford	3,960	1,665	186	161	-	1,948

Source: USCB, 2015d

Other housing options will be short-term accommodations, which for purposes of this COP, are defined as hotel and motel rooms, and sites for RVs. Only a limited need for these short-term housing units is anticipated, primarily near the staging ports since the SFWF workforce will be housed offshore.

Property Values

Median home values in these communities were indicative of their reputation as part of the Hamptons, ranging from a high of $1,178,200 in Wainscott in 2015 to a low of $742,300 in East Hampton North. Overall, the median sales price in the Hamptons as of second quarter of 2017 was $1.1 million (408 sales); however, the town of East Hampton experienced a median sales price of $3,187,500, representing 13 sales (Town & Country, 2017). Housing and rental values tended to be more modest in Providence County, Rhode Island, and Bristol County, Massachusetts, than the balance of the study area. The median value of a housing unit in the city of Providence, Rhode Island, was $177,100. Meanwhile, the median value in New Bedford, Massachusetts was $206,900 in 2015. Similarly, the median gross rent was $913 in Providence, Rhode Island, and $771 in New Bedford (USCB, 2015d).

Table 4.6-10 summarizes the number of owner-occupied housing units across the SFWF and the SFWF region, and the percent distribution of their corresponding housing values in 2015 (USCB, 2015e). Of the 392,390 units in Suffolk County, New York, 4 percent were valued at under $99,999, compared to 17 percent of the overall housing in New York State. However, the number of units valued at greater than $500,000 was comparable at 24 percent and 23 percent, respectively. Dukes County in Massachusetts had the lowest percent (1 percent) of homes valued under $99,999 and highest percentage of units valued at greater than $500,000, 75 percent. Providence County, Rhode Island, and Bristol County, Massachusetts, had 6 to 7 percent of their owner-occupied units valued under this threshold and 4 to 8 percent at a value greater than $500,000.

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Table 4.6-10. SFWF and SFEC Housing Values

	New York	Suffolk County, NY	Rhode Island	Newport County, RI	Providence County, RI	Washington County, RI	Massachusetts	Bristol County, MA	Dukes County, MA
Total Number of Owner- Occupied Housing Units	3,894,722	392,390	246,909	21,571	127,215	36,223	1,583,667	131,608	4,802
Less than $99,999	17%	4%	6%	4%	7%	4%	4%	6%	1%
$100,000 to $124,999	6%	1%	4%	1%	6%	2%	2%	2%	0%
$125,000 to $149,999	5%	1%	6%	2%	8%	1%	3%	2%	0%
$150,000 to $174,999	6%	2%	11%	3%	14%	3%	5%	6%	0%
$175,000 to $199,999	4%	2%	9%	3%	11%	4%	5%	7%	0%
$200,000 to $249,999	7%	7%	18%	12%	20%	14%	12%	19%	2%
$250,000 to $299,999	7%	11%	14%	14%	13%	18%	13%	19%	1%
$300,000 to $399,999	14%	29%	16%	22%	13%	25%	22%	22%	9%
$400,000 to $499,999	11%	18%	7%	12%	5%	11%	13%	10%	11%
$500,000 to $749,999	13%	15%	6%	15%	3%	11%	14%	6%	39%
$750,000 to $999,999	5%	5%	2%	5%	1%	3%	4%	1%	19%
$1,000,000 to $1,499,999	2%	2%	1%	3%	0%	1%	2%	0%	9%
$1,500,000 to $1,999,999	1%	1%	0%	1%	0%	0%	1%	0%	3%
$2,000,000 or more	2%	1%	1%	2%	0%	1%	1%	0%	5%
Greater than $500,000	*23%*	*24%*	*9%*	*27%*	*4%*	*17%*	*22%*	*8%*	*75%*

Source: USCB, 2015e

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4.6.2.2 Potential Impacts

Impacts to housing are evaluated based on the pressure on housing resources that could result from an influx of non-local employees. During construction and decommissioning, housing for offshore workforce will be available on some of the offshore vessels. In addition, because of the availability of vacant housing as shown in Table 4.6-10, there should be adequate housing available within the socioeconomic ROI.

Based on the findings of Section 4.5 (Visual Resources), visibility of the SFWF and SFEC will be limited to approximately 2 percent of the land area within the 40-mile visual study area. Additionally, in locations where views of the SFWF may be available from land, the Project will be approximately 19 miles (30.6 km, 16.6 nm) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York, suggesting that the Project will be visible to a casual observer under clear conditions, but not the focus of attention (Sullivan, 2017). BOEM notes that degrading the natural resources that draw tourists and recreational users can result in negative economic impacts, particularly because of a change in the public's perception of the aesthetics of a location. However, this change in public perception is highly site-specific and can be negative, positive, or a mix of both (ICF, 2012). Recent studies in the United States vary, with most finding that study participants do not expect impacts to property values or substantial changes in coastal visitation:

- A study of approximately 1,000 respondents assessed the potential impact of offshore wind on property rentals in New Jersey (Schulman and Rivera, 2009). The majority of those responding, 76 percent, indicated that a wind facility would not impact rental properties, 13 percent thought it would be harder to rent properties while 10 percent believed it would be easier to rent properties with an offshore wind facility in the vicinity (Schulman and Rivera, 2009).
- A Goucher Poll of 671 Maryland residents conducted from September 14 to 17 of 2017 had similar results. It asked whether seeing wind turbines on the horizon from the beach in Ocean City make visitors less likely to vacation in Ocean City, more likely to vacation in Ocean City or no difference. Three-quarters, 77 percent, of these residents said that seeing wind turbines on the horizon would "make no difference" to them (Goucher, 2017).
- Another study conducted a choice experiment with individuals that recently rented vacation properties along the North Carolina coastline to assess the impacts of a utility-scale wind farm on their rental decisions (Lutzeyer et al., 2017). Their findings indicated that rental value losses of up to 10 percent are possible if a utility-scale wind farm is placed within 8 miles (12.8 km) of shore. Their results also indicated there is not a scenario where respondents would be willing to pay more to rent a home with turbines in view, and a substantial portion of the survey population would change their vacation destination if wind farms were placed within visual range of the beach.
- A recent BOEM report (2018) documented an effort to estimate the potential impact of offshore wind power on recreational beach use on the East Coast of the United States. Respondents fell into three groups: those unimpacted, those reporting that a project would have made their experience worse, and those reporting that a project would have made their experience better. The results indicated that, generally, the closer the wind power project was to shore, the more respondents reported that their experience would have been worsened. People were questioned about their reaction to wind power projects from distances ranging from 2.5 to 20 miles (4.0 to 32.2 km) offshore. At 12.5 miles (20.1 km) offshore, 20 percent of the respondents reported that their experience would have been worsened by the turbines, 13 percent reported that it would have been improved, and 67 percent reported no impact. At 20 miles (32.2 km), the shares were 10 percent worse, 17 percent better, and 73 percent no impact. The dominant reason reported for why an offshore wind power project would have made a beach experience worse was the visual disruption of the seascape. The dominant reason for why it would have made a beach experience better was knowing something good was being done for the environment.

While the findings in the Lutzeyer et al. (2017) study indicated that rental value losses are possible if a utility-scale wind farm is placed reasonably close to the shoreline, the SFWF will be over 19 miles (30.6 km, 16.6 nm) from Block Island, Rhode Island, over 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, Massachusetts, and from mainland Massachusetts and Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. Further, the white color planned for the turbines generally blends well with the sky at the horizon and eliminates the need for daytime FAA warning lights or red paint marking of the blade tips.

Project-related activities and infrastructure that could potentially result in direct or indirect impacts to housing and property values were identified as part of the IPF analysis in Section 4.1. Those IPFs that could result in impacts to housing and property values are indicated on Figure 4.6-2.

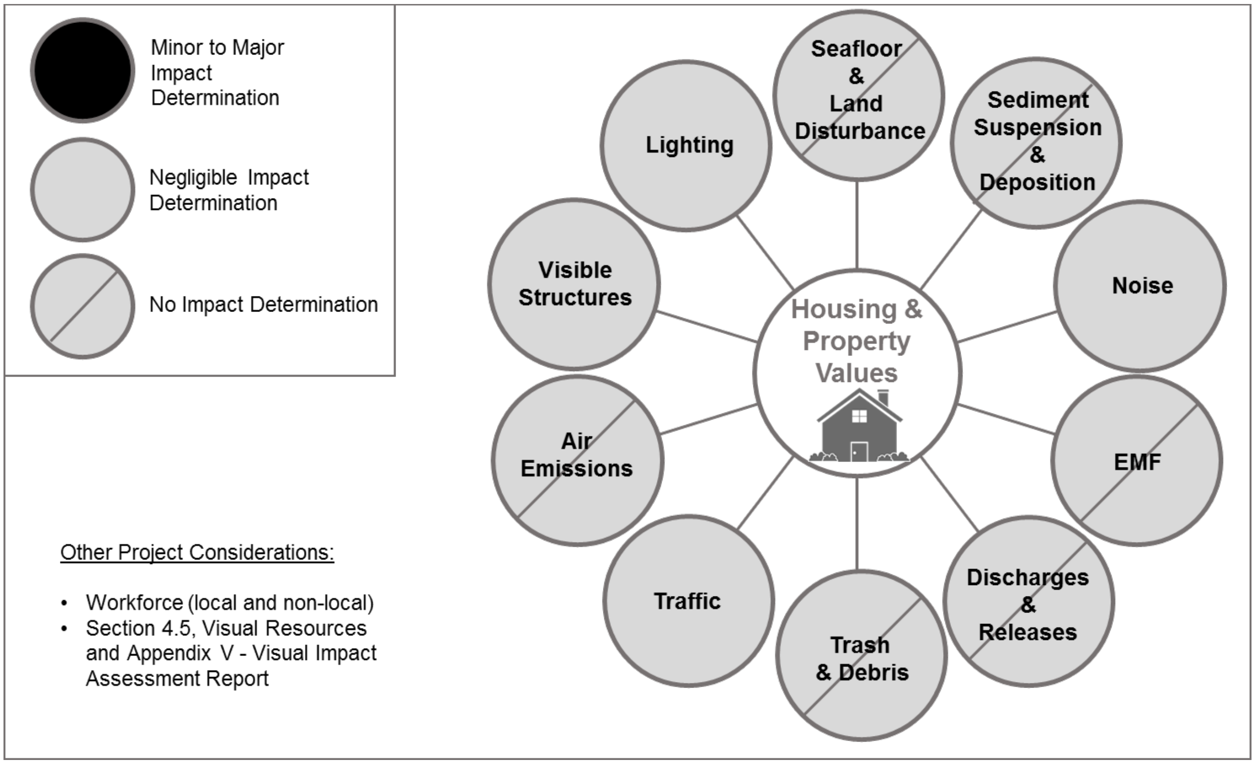

Figure 4.6-2. IPFs to Housing and Property Values

Illustration of potential impacts to housing and property values resulting from SFWF and SFEC activities

South Fork Wind Farm and South Fork Export Cable

The potential impacts on housing and property values are primarily associated with changes in the aesthetics of the marine viewshed and are summarized in Table 4.6-11. The results of the IPF analysis for Visible Structures, Section 4.1.9; the results of the visual resources assessment in Visual Resources, Section 4.5; and Appendices U, VRA, SFEC Onshore Substation; V, VIA, SFWF; and W, HRVEA, SFWF, are used as a basis of the property value impact assessment.

Table 4.6-11. SFWF and SFEC Housing and Property Value Impact Summary

Resource Area	Housing	Property Value
SFWF		
Construction / Decommissioning	Short-term, negligible	Short-term, negligible
Operation and Maintenance	No impact	Negligible
SFEC – OCS / NYS		
Construction / Decommissioning	Short-term, negligible	Short-term, negligible
Operation and Maintenance	No impact	No impact
SFEC – ONSHORE		
Construction / Decommissioning	Short-term, negligible	Short-term, negligible
Operation and Maintenance	No impact	Negligible

Housing

Based on plans to house most of the nonlocal construction and decommissioning workforce in short-term accommodations offshore (Section 3), sufficient short-term housing is available in each of the port options to meet the balance (Table 4.6-10, SFWF and SFEC Vacant Housing Characteristics). Therefore, impacts on the housing of the region could be ***short-term*** and ***negligible*** during construction and decommissioning of the SFWF. Similarly, the operation of the SFWF and SFEC will require a small, full-time, onshore staff over the 25-year life of the SFWF. The housing needs of these staff are minor relative to the overall size of the housing market in Suffolk County, New York; therefore, the Project will result in ***no impacts*** on the housing stock of the region during operation.

Property Values

As discussed, the potential for impacts to property values from the SFWF are limited by its distance from coastal residential properties and associated potential visibility. The SFWF will be over 19 miles (30.6 km, 16.6 nm) from Block Island, Rhode Island, which already has the BIWF within its viewshed, and 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard and the mainland coasts of Massachusetts and Rhode Island, and approximately 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. Therefore, the overall impact of the SFWF visible structures on property values is determined to be **negligible** in all phases. Similar ***negligible, localized, short-term impacts*** are possible from the construction and decommissioning of the SFEC for those residential properties adjacent to the new SFEC – Interconnection Facility and SFEC – Onshore installation. ***Negligible, localized, long-term impacts*** are possible to the property values of those residential properties near the new SFEC – Interconnection Facility due to noise and the potential for limited visibility.

4.6.2.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to housing and property values.

- The SFEC - Onshore cable will be buried; therefore, minimizing potential impacts to adjacent properties.

- The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers.
- The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.
- At the SFEC - Interconnection Facility, additional screening may be considered to further reduce potential visibility and noise.
- New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.

4.6.3 Public Services

Public services for those communities potentially impacted by the construction, O&M, or decommissioning of the SFWF and SFEC are presented in this section. A wide range of public services exist in each of the geographies listed in Table 4.6-1 because of the density of the existing population and proximity of other land uses that necessitate such services (Table 4.6-1). Therefore, this section is focused on those fire, emergency medical services (EMS), and law enforcement services that will either support one of the potential staging ports, onshore construction of the SFEC or will serve the SFWF O&M facility in Suffolk County, New York or Washington County, Rhode Island.

4.6.3.1 Affected Environment

The affected environment is the same for the SFWF and the SFEC; the impacts for each of these Project components are discussed in separate subsections. Each of the following Multi-Hazard Mitigation Plans, or strategies, was also referenced to identify the public service providers for the region:

- Suffolk County's municipalities, tribes, and Water Authority updated its 2008 Multi-Jurisdictional Multi-Hazard Mitigation Plan in 2014, providing a recent inventory of public services in the county (TetraTech, 2014).
- Public services for the Quonset Business Park – Port of Davisville port facility are characterized in the corresponding Multi-Hazard Mitigation Strategy for North Kingston, which was developed with input from a stakeholder committee that included the Harbormaster and a member of the Quonset Development Corporation (North Kingston and RIEMA, 2013).
- Public services for the ProvPort port facility are characterized in the corresponding Multi-Hazard Mitigation Strategy for the City of Providence (PLHMC and Maguire, 2013).
- Public services for the New Bedford Marine Commerce Facility are described in the City of New Bedford Local Multi-Hazard Mitigation Plan Update (New Bedford, 2016).

Regional Overview

The socioeconomic ROI for public services includes those communities that could be impacted by the construction, O&M, or decommissioning of the SFWF and SFEC (Table 4.6-1).

South Fork Wind Farm and South Fork Export Cable

Multiple hospitals serve the communities in the ROI. Table 4.6-12 identifies those facilities either closest to anticipated Project construction and operation activities, or those serving as trauma centers for emergency response purposes. The eastern portion of Suffolk County, New York near Montauk is served by multiple hospitals. University Hospital (State University of New York) in Stony Brook is the closest large trauma center and has approximately 600 beds (U.S. News & World Report, 2017). Both Southampton Hospital to the east of East Hampton and Eastern Long Island Hospital to the north in Greenport have 80 to 90 beds and offer emergency room access (Table 4.6-12). The Quonset Business Park – Port of Davisville port facility is primarily served by the Kent County Memorial Hospital in Warwick and has 318 beds. Meanwhile, ProvPort is served by Rhode Island Hospital, which offers 650 beds. St. Luke's Hospital (Southcoast Hospitals Group) is the closest hospital to the New Bedford Marine Commerce Facility and has approximately 290 beds. New Bedford EMS transports most of its patients to St. Luke's during peak periods; and for high-level trauma and cardiac care, cases are transported to Providence (FACETS Consulting, 2015).

Table 4.6-12. Hospitals in the Study Area: Selected Statistics

	East Hampton, NY	East Hampton, NY	East Hampton, NY	North Kingston, RI	Providence, RI	New Bedford, MA
	Construction of the SFEC and SFWF O&M Facility			*SFWF Construction – Fabrication, Assembly, and Logistics*		
Hospital	Southampton Hospital	Eastern Long Island Hospital	University Hospital State University of New York	Kent County Memorial Hospital	Rhode Island Hospital	St. Luke's Hospital
Address	240 Meeting House Lane Southampton, NY 11968	201 Manor Place Greenport, NY 11944	101 Hospital Road Health Sciences Ctr Stony Brook, NY 11794	455 Tollgate Road Warwick, RI 02886	593 Eddy Street Providence, RI 02903	101 Page Street New Bedford, MA 02740
Phone	631-726-8200	631-477-1000	631-444-1077	401-737-7000	401-444-4000	844-744-5544
Beds	80	90	603	318	650	293
Admissions	5,124	2,581	33,891	14,560	35,372	N/A
Emergency Room Visits	24,251	8,642	99,165	70,177	147,232	90,000

Source: U.S. News & World Report, 2017

The Suffolk County, New York, Department of Fire, Rescue, and Emergency Services (FRES) is responsible for providing emergency services (Suffolk County FRES, 2017). The eastern end of Suffolk County is served by three fire departments and an EMS association (Table 4.6-13). Volunteer fire and EMS services are provided by the Montauk Fire District, which is comprised of six companies (Montauk Fire District, 2017). Law enforcement services in Suffolk County overall are provided by the Suffolk County Police Department (PD). In 2014, the Suffolk County PD had more than 2,500 sworn officers and 500 civilian members (TetraTech, 2014). Precinct 7, located in Shirley, New York, is the closest Suffolk County PD and serves the town of Brookhaven (Suffolk County PD, 2017). Suffolk County communities further to the east are served by 11 independent police forces. The town of East Hampton PD has a precinct in Montauk as well as a Public Safety Dive Team that trains and coordinates with associated agencies such as the Town Marine Patrol, Town Wide Dive Team, Town Ocean Rescue Team, and the USCG Group Montauk (East Hampton PD, 2017). The East Hampton Fire Department (FD) provides fire response in the town with 6 companies and 145 volunteers (East Hampton FD, 2017). Emergency medical services in East Hampton are provided by two ambulance services, one in Sag Harbor and one in East Hampton Village. The East Hampton Village EMS is staffed by 36 members and utilizes 9 on-call (not in-house) squads to serve the southern and eastern portions of the Village (East Hampton Village Ambulance, 2017). The Amagansett FD serves 12 square miles (31 km^2) of land and more than 18 miles (47 km) of ocean and bay shoreline with six companies that include an Ambulance Squad, Rapid Intervention Team for structure fires, and Heavy Rescue Squad (Amagansett FD, 2017).

Table 4.6-13. Fire and EMS Services in Eastern Suffolk County, New York: Selected Statistics

Responsible Entity	Montauk Fire District	East Hampton Fire Department	East Hampton Village EMS	Amagansett Fire Department
Address	12 Flamingo Avenue Montauk, NY 11954	1 Cedar Street East Hampton, NY 11937	1 Cedar Street East Hampton, NY 11937	439 Main Street Amagansett, NY 11930
Phone	631-668-5695	631-324-0124	631-907-9796	631-267-3300
Department (Type)	Volunteer	Volunteer	Paid	Volunteer
Number of Companies or Squads / Personnel	5/117	6/145	9/36	5/100
Number of EMS Units	1	0	3	1

Source: Montauk Fire District, 2017

Fire and EMS services specific to the three SFWF and SFEC port options are summarized in Table 4.6-14. Fire and EMS services for the Quonset Business Park – Port of Davisville are provided by the town of North Kingston under a memorandum of agreement with Quonset Development Corporation. The North Kingstown PD maintains a staff of approximately 45 officers divided into 4 squads as well as 1 full-time harbormaster and 2 part-time assistant harbormasters. These harbormasters access a patrol boat berthed at the town wharf and an office located at PD headquarters (North Kingstown PD, 2017). ProvPort at the Port of Providence, Rhode Island, is operated by Waterson Terminal Services (WTS), which is responsible for general management and safety. Because of it being a maritime port, WTS has a security plan for ProvPort with detailed procedures, while the Providence FD and PD provide emergency response (WTS, 2017). The New Bedford FD serves the New Bedford Marine Commerce Terminal. The New Bedford FD is responsible for protecting the port, helping prevent fires, and providing services to recover from fires, spills, severe weather events, and other circumstances (Port of New Bedford, 2017). The New Bedford FD is also responsible for administrative matters, such as ensuring tradesmen using the port have current permits. The Port of New Bedford is served by multiple layers of law enforcement, including the New Bedford PD, Massachusetts Environmental Police, USCG, and USACE. The New Bedford PD provides a marine detachment while the harbormaster's onsite agent is responsible for laws, rules, and regulations governing the harbor.

Table 4.6-14. Fire and EMS Services associated with the SFWF / SFEC Port Options

Port Option	Quonset Business Park – Port of Davisville	ProvPort	New Bedford Marine Commerce Terminal
Address	2574 Davisville Road North Kingstown, RI 02852	35 Terminal Road Providence, RI 02905	16 Blackmer Street New Bedford, MA 02744
Local Government	North Kingston, RI	Providence, RI	New Bedford, MA
Responsible Entity	Quonset Development Corporation	Waterson Terminal Services (Private Corporation); ProvPort (Quasi-public Agency)	New Bedford Harbor Development Commission (City Agency); MassCEC (Quasi-public Agency)

Table 4.6-14. Fire and EMS Services associated with the SFWF / SFEC Port Options

Port Option	Quonset Business Park – Port of Davisville	ProvPort	New Bedford Marine Commerce Terminal
Provider of Fire Services	North Kingston Fire Department, Station 6	Providence Fire Department, Broad Street Station	New Bedford Fire Department, Station 2
Phone	401-294-3346	401-274-3348	508-991-6105
Provider of EMS Services	North Kingston Fire Department	Providence Fire / EMS	New Bedford EMS Office
Phone	401-294-3346	401-243-6050	508-991-6390
Provider of Law Enforcement Services	North Kingstown Police Department	Providence Police Department	New Bedford Police Port Security
Phone	401-294-3316	401-243-6401	508-989-2925

Sources: Montauk Fire District, 2017; MassCEC, 2017

4.6.3.2 Potential Impacts

Potential impacts on public services are discussed in this section with impacts driven by the potential for an increased demand for emergency response services because of the construction of the SFWF and SFEC and by the presence of non-local workers in the region. IPFs that could result in impacts to public services are indicated on Figure 4.6-3. Of these, only the traffic (vessels, vehicles, and air) IPF was evaluated for public services. Section 4.1.7 discusses marine vessel and land traffic that could be generated by construction, which could include earthmoving equipment for the onshore export cable installation, small materials delivery trucks, and commuter vehicles.

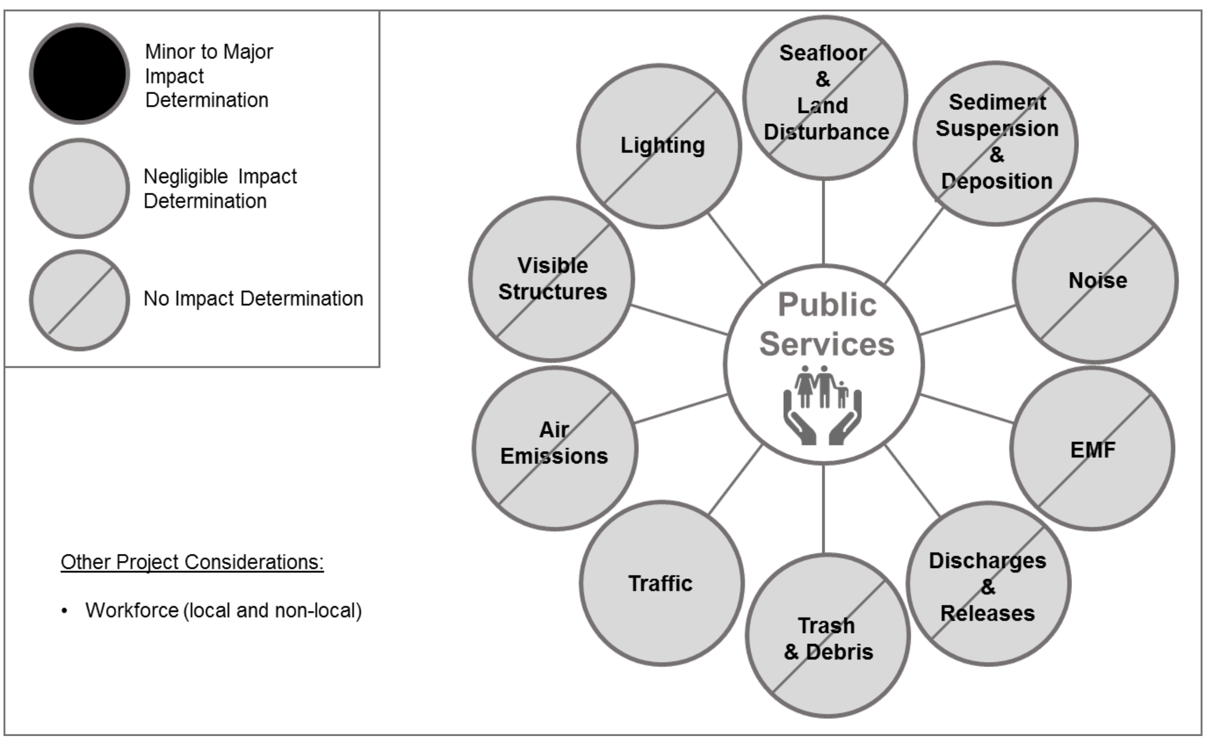

Figure 4.6-3. IPFs on Public Services

Illustration of potential impacts to public services resulting from SFWF and SFEC activities

South Fork Wind Farm

Construction, Operations and Maintenance, and Decommissioning

Traffic
Construction and decommissioning of the SFWF is not expected to impact the level of public services provided in the region given public services offered at each of the port options and SFW's plans to house most non-local workers in short-term accommodations offshore. Therefore, ***short-term, negligible impacts*** on the public services of the region are anticipated during construction and decommissioning of the SFWF.

The operation of the SFWF will require a small, full-time, onshore staff over the 25-year life of the SFWF. The needs of these staff would be minor relative to the overall size of the demand for public services in Suffolk County, New York; therefore, the SFWF will result in ***long-term, negligible impacts*** on the public services during operation.

South Fork Export Cable

SFEC – OCS and SFEC - NYS

Construction, Operations and Maintenance, and Decommissioning

Traffic
While construction and decommissioning of the SFEC – OCS and SFEC – NYS is expected to generate localized marine vessel or vehicular traffic, this increase is not expected to generate the need for additional public services in the region nor interrupt existing services. Similarly, by providing short-term accommodations offshore for the workforce, the demand for additional local public services such as EMS will be short-term and limited. Therefore, there could be ***short-term, negligible impacts*** on public services during construction and decommissioning of the SFEC – OCS and SFEC – NYS. After the SFEC is decommissioned, the area is expected to recover to pre-Project conditions.

The SFEC is not expected to have maintenance needs unless a fault or failure occurs. Export cable failures are only anticipated because of damage from outside influences, such as unexpected digs from other parties. If repair is needed, spare submarine export cable and splice kits will be used to replace the impacted area. Therefore, public services are not expected to be impacted during O&M unless repairs are needed; therefore, the operation of the SFEC – OCS and SFEC – NYS could have ***negligible impacts*** on public services.

SFEC – Onshore

Construction, Operations and Maintenance, and Decommissioning

Traffic
There may be a short-term increase in truck and construction equipment traffic on routes used for the SFEC – Onshore as well as limited number of nonlocal workers. Therefore, there may be localized, ***short-term, negligible impacts*** on public services such as EMS or police during construction and decommissioning. After the SFEC is decommissioned, the area is expected to recover to pre-Project conditions.

O&M of the SFEC – Interconnection Facility is expected to be similar to the O&M of the existing LIPA substation in East Hampton. Therefore, the operation of the SFEC – Onshore may have ***negligible impacts*** on public services.

4.6.3.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to public services.

- The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.

- New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
- SFW will also coordinate with local authorities during SFEC – Onshore construction to minimize local traffic impacts.
- A comprehensive communication plan will be implemented during offshore construction. SFW will submit information to the USCG to issue Local Notice to Mariners during offshore installation activities.

4.6.4 Recreation and Tourism

This section describes the recreation and tourism resources that could be impacted by construction, O&M, or decommissioning of the SFWF and SFEC. Recreation and tourism in the socioeconomic ROI include both onshore activities, such as beach visitation and wildlife viewing, and offshore activities from or on a boat. Recreation and tourism can be inconvenienced by onshore and offshore construction activity and vessel movements. Enjoyment can be increased or decreased by the aesthetics of the SFWF and SFEC. Recreational activities, such as diving, can be enhanced by the colonization of the SFWF structures that act like fish-aggregating devices.

4.6.4.1 Affected Environment

Regional Overview

The socioeconomic ROI for recreation and tourism includes those communities that could be impacted by the construction, O&M, or decommissioning of the SFWF and SFEC (Table 4.6-1). This includes the coastal and port communities where construction activities will occur, where the O&M facility could be located, and those ports that support offshore recreational boating trips that frequent the waters near the RI-MA WEA. The socioeconomic ROI for tourism also includes Newport County in Rhode Island and Bristol and Dukes counties in Massachusetts based on the findings of the Visual Impact Assessment, SFWF, Appendix V, and the relative contribution tourism makes to the local economy (Table 4.6-5).

South Fork Wind Farm and South Fork Export Cable

Onshore Recreation and Tourism

Table 4.6-15 provides a synopsis of the major features that make these onshore communities recreation and tourism destinations, including major tourist attractions and festivals. The synopsis notes the coastal features adjacent to the community, how it is accessed, and whether its population varies seasonally. Block Island, part of Washington County, Rhode Island, is the community closest to the SFWF and SFEC and is accessible only by air or boat, primarily for day trips. Ferry access is available from New London, Connecticut, Montauk on Long Island, New York, Newport, Rhode Island, and Point Judith, Rhode Island (ICF, 2012). Newport County, located on the eastern side of the entrance to Narragansett Bay from Rhode Island Sound, is world-renowned as a sailing and yachting destination, as well as for its jazz and folk music festivals. Further to the west, Suffolk County, New York, is the outermost county on Long Island with multiple summer vacation destinations including Montauk and the Hamptons. Montauk is most easily accessed by ferry from the north from Bridgeport and New London, Connecticut, as well as to Block Island, Rhode Island, from Montauk and Bay Shore-Fire Island, New York.

Table 4.6-15. Summary of Recreation and Tourism Resources by Community

	Community Synopsis	Resources	Festivals
RHODE ISLAND			
Block Island	Serves as general boundary for Rhode Island and Block Island sounds Town of New Shoreham has seasonal population influx; however, majority of tourism is day trips only Ferry and air access only; ferries to Block Island arrive from New London, CT, Montauk on Long Island, NY, Newport, RI, and Point Judith, RI (Washington County)	Undeveloped beaches, Block Island NWR, New Shoreham waterfront	Block Island Race Week, Block Island Music Festival, 15k Run Around the Block, Clam Bake

Table 4.6-15. Summary of Recreation and Tourism Resources by Community

	Community Synopsis	Resources	Festivals
Newport County	Eastern side of Narragansett Bay and northern edge of Rhode Island Sound and Atlantic Includes City of Newport with ferries to Block Island and Point Judith World renowned sailing and yachting destination	Touro Synagogue National Park, Sachuest Point NWR, Newport Mansions, Fort Adams State Park, Second Beach and Easton Beach (Aquidneck Island), South Shore, Sakonnet Point, and Fogland beaches (mainland)	Newport Kite Festival, Black Ships Festival, Newport Folk and Jazz Festivals, multiple boating races
Providence County	Northernmost shoreline along the Narragansett Bay City of Providence Coastline is almost entirely industrial, including ProvPort	Roger Williams National Memorial	Waterfire
Washington County	Western side of Narragansett Bay and northern edge of Rhode Island Sound and Atlantic Includes Block Island Hotspot Point Judith, RI, ferry serves Block Island and Montauk, NY	Ninigret, Block Island, Trustom Pond and John H. Chafee NWRs, Westerly Armory Museum	Wickford Art Festival, Americas Cup
NEW YORK			
Suffolk County	Outermost county on Long Island, on Long Island Sound, Block Island Sound, and the Atlantic Ocean Location of multiple summer vacation destinations, including Montauk and the Hamptons Ferry access from Bridgeport and New London, CT, and to Block Island, RI, from Montauk and Bay Shore-Fire Island	Fire Island National Seashore and Conscience Point National Park, Amagansett, Wertheim, and Elizabeth Morton NWRs, Montauk Point Lighthouse, Vanderbilt Museum	Seafood Festival and Craft Fair
MASSACHUSETTS			
Bristol County	Segments of shoreline on Narragansett and Buzzards Bays (Rhode Island Sound) and on the Atlantic Ocean to the south City of New Bedford, historical whaling port Ferry route to Cuttyhunk in Dukes County, MA	New Bedford Whaling Museum, Battleship Cove in Fall River	Whaling City Festival, Feast of the Blessed Sacrament

Table 4.6-15. Summary of Recreation and Tourism Resources by Community

	Community Synopsis	Resources	Festivals
Dukes County	Adjacent to Nantucket Sound and Buzzards Bays (Rhode Island Sound) Highly dependent on marine tourism, seasonal population influx Access by boat and plane only; ferry routes from two locations in Barnstable County, one to Bristol County, another to Washington County, RI, and a final weekend service from New York City.	Noman's Land Island NWR	Striped Bass and Bluefish Derby, Oak Bluffs Monster Shark Tournament, JawsFest

Source: ICF, 2012

Table 4.6-16 provides a summary of the major resources each community offers to attract and support its recreation and tourism economy. There is a total of 148 public beaches within the region – 40 percent in New York, 45 percent in Rhode Island, and 15 percent are in Massachusetts. In Rhode Island, public beaches are prevalent on Block Island (Washington County) and in Newport County, which has a major tourism industry based on its beaches and sailing and yachting reputation. Suffolk County, New York, has more than half of the harbors, marinas, and yacht clubs found in the region.

Table 4.6-16. Summary of Recreation and Tourism Resources by Community

	Harbors	Marinas	Yacht Clubs	Public Beaches	National Parks	Description
Rhode Island-portion of ROI	**8**	**35**	**12**	**68**	**2**	
Block Island*	2	2	0	10	0	Aquatic activities include swimming, surfing, snorkeling, and parasailing; fishing, sailing, and boating; wildlife viewing; kayaking along the beaches and through the tidal zones. Onshore activities include hiking, horseback riding, and bicycling on 32 miles (51.5 km) of hiking trails.
Newport County	4	13	3	18	1	Beaches for sunbathing, walking, and swimming. Tourism draw is boating and yachting.
Providence County	0	6	3	0	1	Coastal recreation is minimal because the industrial waters of the inner bay provide for poor swimming and ocean recreation activities; adjacent parkland and East Bay Bicycle Path.
Washington County	4	16	6	50	0	Kayaking, sailing, and harbor cruises in Narragansett Bay; and sunbathing, beachcombing, swimming, and surfing on the Atlantic coast

Table 4.6-16. Summary of Recreation and Tourism Resources by Community

	Harbors	Marinas	Yacht Clubs	Public Beaches	National Parks	Description
New York-portion of ROI	**20**	**72**	**38**	**60**	**2**	
Suffolk County	20	72	38	60	2	980 miles (1,577 km) of coastline; the majority is white sand beach for sunbathing, swimming, and beachcombing; popular among sportsmen and surfers
Massachusetts-portion of ROI	**7**	**22**	**8**	**20**	**1**	
Bristol County	2	20	5	5	1	Mostly private beach; while parts of the shore are rocky, approximately half is sand beach and caters to activities such as sunbathing and beachcombing
Dukes County	5	2	3	15	0	Popular activities include swimming, beachcombing, and sunbathing; surfing, diving, and boat- and shore-fishing. Several wooded trails for biking and hiking, as well as several areas (including two wildlife refuges) for bird and nature watching
Total in ROI	**35**	**129**	**58**	**148**	**5**	
Distribution by State						
Rhode Island	22%	27%	20%	45%	40%	
New York	54%	55%	63%	40%	40%	
Massachusetts	24%	18%	17%	15%	20%	

Source: ICF, 2012
* Block Island counts are included for reference and are already represented in the Washington County counts.

The NPS administers the following sites in the region:

- Roger Williams National Memorial in Providence, Rhode Island, with 65,588 recreation visitors in 2016
- New Bedford Whaling National Historical Park in New Bedford, Massachusetts, with 145,500 visitors in 2016
- Fire Island National Seashore in Suffolk County, New York, with 431,303 visitors in 2016 (NPS, 2017)

The USFWS administers the following NWRs in the region:

- Amagansett NWR
- Conscience Point NWR
- Elizabeth Alexandra Morton NWR
- Seatuck NWR

- Trustom Pond NWR
- Wertheim NWR
- Block Island NWR (USFWS, 2017)

Offshore Recreation and Tourism

Offshore recreation within Rhode Island Sound and further offshore near the SFWF within the RI-MA WEA are described in detail in the OSAMP and the 2012 Northeast Recreational Boater Survey (RI CRMC, 2010 and Starbuck et al., 2013). The 2012 Northeast Recreational Boater Survey characterized the boating patterns and economic activity of the 373,766 qualified registered boaters from coastal counties and towns in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York, and included maps from the survey of 5,114 boating routes and 4,635 activity points (Starbuck et al., 2013). The survey estimated approximately 907,400 boating trips in ocean and coastal waters during 2012 for the registered and documented marine boaters of the six Northeast states (Table 4.6-17). Most of these trips, or 74 percent, were made by vessels registered in one of the three states in the SFWF and SFEC region. Of the 675,370 estimated boating trips in the study area in 2012, 10 percent were made by vessels registered in Rhode Island, 51 percent were registered in New York, and 39 percent in Massachusetts. Over half (52 percent) of these boating trips occur within 1 mile (1.6 km) of the coastline with higher levels of boating activity occurring in semi-protected bays and harbors near major cities, such as Narragansett Bay (Starbuck et al., 2013).

Table 4.6-17. 2012 Boating Trips by State of Vessel Registration

	2012 Estimated Boating Trips	% of Total	% of Study Area Total
Rhode Island	65,042	7%	10%
New York	347,679	38%	51%
Massachusetts	262,649	29%	39%
Maine	67,605	7%	
New Hampshire	22,430	2%	
Connecticut	141,998	16%	
Northeast Boater Survey Total	**907,403**		
SFWF and SFEC Study Area Total	***675,370***	***74%***	

Source: Starbuck et al., 2012

The OSAMP provided offshore recreational maps of Rhode Island Sound based on stakeholder feedback, USCG event permits, and racing event instructions (RI CRMC, 2010). Rhode Island Sound, and the adjacent waters of Block Island Sound, Narragansett Bay, Buzzards Bay, Long Island Sound, and the Atlantic Ocean provide a wide range of marine recreation and tourism opportunities (Table 4.6-16). Specifically, these waters are used for a variety of boat-based activities such as recreational boating, offshore sailboat racing, offshore diving, offshore wildlife viewing, and cruise ship tourism.

As described in Section 4.6.8, Other Marine Uses, Rhode Island Sound experiences a substantial amount of traffic of which sailing, and cruising are only one component. Both the OSAMP and the Northeast Boater Survey identified commonly known boating routes of which the following either transect or are near the SFWF:

- Narragansett, Rhode Island, to Block Island, Rhode Island
- New London, Connecticut, to Block Island, Rhode Island
- Narragansett, Rhode Island, to Cuttyhunk, Massachusetts (Starbuck et al., 2013)

- Transatlantic, Caribbean, and Bermuda to Newport, Rhode Island
- Newport, Rhode Island, to Long Island Sound, New York, Vineyard Sound and Cape Cod Canal, Massachusetts (RI CRMC, 2010)

Table 4.6-18 provides a characterization of the sailboat, distance, and buoy races that generally occur within the SFWF and SFEC region. Most of the races occur from May to September and have under 100 participants. The largest event is the Newport to Bermuda Yacht Race, which occurs in June and can have over 250 participants. The Off Soundings Club Spring Race Series often hosts up to 150 participants at its event in June off Block Island (ICF, 2012). The New York Yacht Club hosts multiple large race events each year, including its Annual Regatta, Race Week, and an Annual Cruise.

Table 4.6-18 Sailboat, Distance, and Buoy Races in or Near Rhode Island Sound

Event	Organizer	Month	Frequency	Course Description	Avg. No. of Vessels	Avg. Vessel Length (feet [m])
Block Island Race Week	Storm Trysail Club (odd years); Ted Zuse (even years)	June	Annual	Week of buoy races west of Block Island[a]	100+	30-90 (9-27)
New York Yacht Club Annual Regatta	New York Yacht Club	June	Annual	Buoy races south of Brenton Point	110	30-90 (9-27)
New York Yacht Club Invitational Cup	New York Yacht Club	Sept.	Biennial	Buoy races south of Brenton Point	20	42 (12.8)
New York Yacht Club Race Week	New York Yacht Club	Sept.	Biennial	Buoy races south of Brenton Point	150	30-90 (9-27)
Swan 42 National Championship	New York Yacht Club	July	Annual	Buoy races south of Brenton Point	20	42 (12.8)
Sail Newport Coastal Living Newport Regatta	Sail Newport	July	Annual	Buoy races south of Brenton Point	Varies	Varies
World championship regattas (vary) b	Various	Sept.	Annual	Buoy races south of Brenton Point	Varies	Varies
Annapolis to Newport Race	Annapolis Yacht Club	June	Biennial	Annapolis, MD, to Newport	61	34+ (10.3+)
Bermuda One-Two	Goat Island Yacht Club and Newport Yacht Club	June	Biennial	Singlehanded (one crew member): Newport to Bermuda; Doublehanded (two crew members): Bermuda to Newport	38	28-60 (8.5-18.2)

Table 4.6-18 Sailboat, Distance, and Buoy Races in or Near Rhode Island Sound

Event	Organizer	Month	Frequency	Course Description	Avg. No. of Vessels	Avg. Vessel Length (feet [m])
Block Island Race	Storm Trysail Club	May	Annual	Stamford, CT, around Block Island and back to Stamford	60	30-75 (9.1-22.8)
Corinthians Stonington to Boothbay Harbor Race	Corinthians Association, Stonington Harbor Yacht Club, and Boothbay Harbor Yacht Club	July	Biennial	Stonington, CT, to Boothbay, ME	14	
Earl Mitchell Regatta	Newport Yacht Club	Oct.	Annual	Newport to Block Island	15	30-50 (9.1-15.2)
Ida Lewis Yacht Club Distance Race	Ida Lewis Yacht Club	August	Annual	Multi-legged course through Rhode Island Sound and adjacent offshore waters	40	30-90 (9.1-27.4)
Marion to Bermuda Cruising Yacht Race	Marion-Bermuda Cruising Yacht Race Association	June	Biennial	Marion, MA, to Bermuda	48	32-80 (9.7-24.3)
New England Solo-Twin Championships	Newport Yacht Club and Goat Island Yacht Club[b]	July	Annual	Multi-legged course through Rhode Island Sound and adjacent offshore waters; starts and ends in Newport	35	24-60 (7.3-18.2)
Newport Bucket Regatta	Bucket Regattas/ Newport Shipyard	July	Annual	Three multi-legged courses off Brenton Point	19	68-147 (20.7-44.8)
Newport to Bermuda Race	Cruising Club of America	June	Biennial	Newport to Bermuda	265	30-90 (9.1-27.4)
New York Yacht Club Annual Cruise	New York Yacht Club	August	Annual[c]	Varies	100	30-90 (9.1-27.4)
Offshore 160 Single-Handed Challenge	Newport Yacht Club and Goat Island Yacht Club	July	Biennial	Multi-legged course through Rhode Island Sound and adjacent offshore	15	28-60 (8.5-18.2)

Table 4.6-18 Sailboat, Distance, and Buoy Races in or Near Rhode Island Sound

Event	Organizer	Month	Frequency	Course Description	Avg. No. of Vessels	Avg. Vessel Length (feet [m])
				waters; starts and ends in Newport		
Off Soundings Club Spring Race Series	Off Soundings Club	June	Annual	Day 1: Watch Hill to Block Island Day 2: Around Block Island	120-150	23-62 (7-18.8)
Owen Mitchell Regatta	Newport Yacht Club	May	Annual	Newport to Block Island	31	24-44 (7.3-13)
Vineyard Race	Stamford Yacht Club	Aug./Sept.	Annual	Stamford, CT, to entrance of Vineyard Sound and back to Stamford	77	30-90 (9.1-27.4)
Whaler's Race	New Bedford Yacht Club	Sept.	Annual	New Bedford, MA, around Block Island, to Noman's Island, and back to New Bedford	22	25+ (7.6+)

Source: ICF, 2012

Note: Races start and/or end in Newport unless otherwise noted.

[a] Event may also include one around-the-island race.

[b] The Newport sailing community hosts at least one "world championship" regatta each September. In Meter World Cup and the Twelve Meter World Championships.

[c] Course varies widely; event is held within the OSAMP area waters approximately 3 out of every 5 years.

In addition to the recreational boating discussed, the offshore portion of the SFWF and SFEC region is used for offshore diving and wildlife viewing. The OSAMP identified 12 offshore recreational dive sites. None of these areas are near the SFWF and two, the U.S.S. Bass and a sulfur barge site, are near the SFEC route (RI CRMC, 2010). Offshore wildlife viewing near the region includes whale watching (peak season in June and August) and bird watching (year-round but particularly after storm events).

Relative to the waters around Block Island, DWSF is in the process of conducting a multi-year study of recreational boating near the BIWF before, during, and after construction (INSPIRE, 2017). A preconstruction recreational boating survey was conducted in the summer of 2015, while a 2016 survey represented conditions during construction. The 2016 survey was conducted over the 2016 Fourth of July weekend (July 1 to 6) during which the Annual Block Island Race week was cancelled. A total of 1,030 vessel observations were recorded and the following data were obtained:

- Motorized recreational fishing vessels represented 72 percent of the total vessels observed.
- Sailboats were observed 26 times over all survey days, representing 3 percent of the total observed.
- Scuba diving and freediving activities were observed 8 times, less than 1 percent of the total observed.
- Five jet ski-style personal watercrafts (PWCs) were observed.

- Swimming, kayaking, and stand-up paddle boarding (SUP) were not observed (INSPIRE, 2017).

4.6.4.2 Potential Impacts

IPFs that could result in impacts to recreation and tourism values are indicated on Figure 4.6-4. Potential impacts of the SFWF and SFEC on recreation and tourism are evaluated in this section.

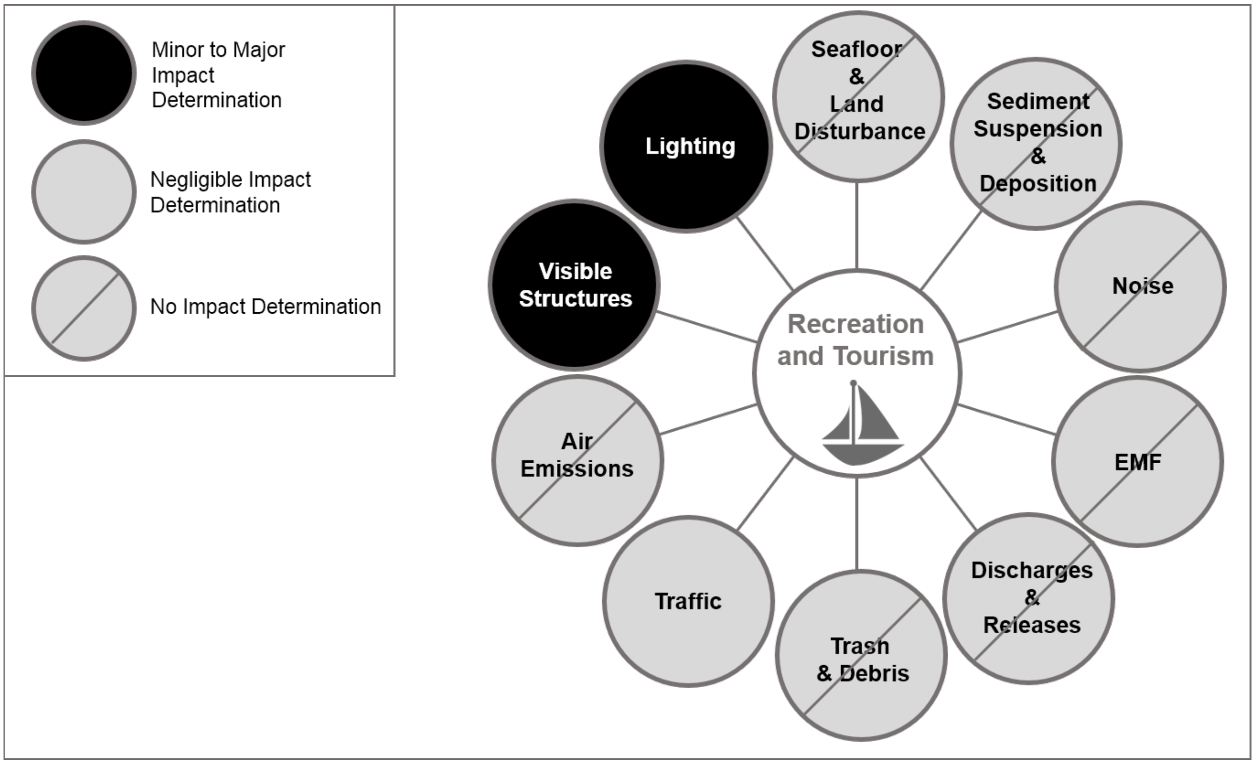

Figure 4.6-4. IPFs on Recreation and Tourism
Illustration of potential impacts to recreation and tourism resulting from SFWF and SFEC activities

The potential for impacts from these IPFs results from changes to the natural resources (e.g., altered fishing, scuba diving, or sight-seeing conditions) or from the public perception of offshore wind facilities (e.g., interest in facility tours and preference for undeveloped landscapes) (ICF, 2012). As discussed in Section 4.6.2, Housing and Property Values, the scale of these impacts varies widely and can be positive or negative. Potential negative impacts could cause tourists to avoid a destination, such as a State Park, or could provide a new source of coastal tourism and draw new visitors, as demonstrated by Block Island. The Block Island Ferry now offers hour-long high-speed cruises with a narrated tour of the BIWF for $20 per adult and $10 per child (Block Island Ferry, 2017). The literature about potential and existing offshore wind projects also suggested that the anticipated impacts do not necessarily correspond with actual impacts (ICF, 2012).

South Fork Wind Farm
The potential impacts on recreation and tourism resources from the construction and decommissioning of the SFWF will be limited to the vessel/vehicle traffic, visible structures, and lighting of these activities both onshore and offshore.

<u>Construction, Operation and Maintenance, and Decommissioning</u>

Traffic
Onshore impacts could be experienced adjacent to the ports selected for the SFWF construction, O&M, and decommissioning activities and near the O&M facility. Offshore impacts could be experienced by those recreating near the SFWF and by boaters traversing Rhode

Island Sound. However, because of the relatively small area being impacted relative to the expansive surrounding waters of the Rhode Island Sound and the OCS, the construction schedule, and SFW's commitment to implement a communication plan, which will coordinate its construction activities with potentially impacted recreational events (e.g., organized sailboat races), impacts to recreation and tourism resources in the region could be ***short-term*** and ***negligible***.

Visible Structures / Lighting
USCG-approved navigation lighting is required for all vessels, for the OSS platform, and for WTGs during construction and O&M so that the vessels and structures are visible to other vessels. Impacts of navigational lighting on recreation and tourism during O&M are considered ***long-term*** and ***negligible***. In fact, the lighting serves as a required safety feature for navigating vessels.

Long-term, negligible impacts during operation of the SFWF are anticipated offshore because no navigation exclusion areas are planned for vessels and because of the relatively small area being impacted relative to the expansive surrounding waters of the Rhode Island Sound and the OCS. However, for safety, it is anticipated that the USCG will implement a temporary safety zone (potentially 1,642 ft [500 m]) around construction-related vessels and activities (Appendix X).

Long-term potential impacts from the SFWF O&M facility onshore in either Montauk, New York or North Kingston, Rhode Island are expected to be ***negligible*** because it could be located and designed to be consistent with adjacent land uses.

South Fork Export Cable

Potential impacts on recreation and tourism resources from the SFEC will generally be limited to construction and decommissioning and could be minimized because of the scheduling of most of the activity to avoid the peak tourist season.

<u>Construction, Operation and Maintenance, and Decommissioning</u>

SFEC – OCS and SFEC – NYS

Visible Structures / Lighting
Impacts to recreation and tourism during construction and decommissioning of the SFEC – OCS and SFEC – NYS will relate to the lighting of these activities, which could represent a ***short-term impac***t to the offshore natural resources (e.g., altered fishing, scuba diving or sight-seeing conditions) in a localized area. Therefore, impacts could be ***short-term*** and ***negligible*** to ***minor***, with ***long-term, negligible impacts*** anticipated during O&M of the SFEC – OCS and SFEC – NYS because it will be buried unless repairs are needed.

SFEC – Onshore

Traffic
There will be a short-term increase in truck and construction equipment traffic on area routes used for the SFEC – Onshore.

Visible Structures / Lighting
The lighting of SFEC-Onshore activities as well as construction of the SFEC – Interconnection Facility (Cove Hollow Road, adjacent to existing 69 kV LIPA substation) and the SFEC – NYS sea-to-shore transition vault (near the landing sites) would represent a short-term change to onshore natural resources (e.g., altered coastal beachfront as well as sight-seeing conditions) in a localized area. Therefore, there may be ***short-term, negligible*** to ***minor impacts*** on the recreation and tourism during construction and decommissioning, depending on the duration and timing of these activities with the local tourism season and location of the landing site.

The majority of the SFEC – Onshore consists of the onshore export cable which is not expected to have maintenance needs unless in need of repair because of damage from outside influences, such as unexpected digs from other parties. The SFEC – Interconnection Facility will be located adjacent to the existing LIPA substation and screened to minimize the long-term impacts from visible structures and lighting. Therefore, ***long-term impacts*** to recreation and tourism could be ***negligible***.

4.6.4.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to recreation and tourism.

- The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers.
- A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Project website, public notices to mariners and vessel float plans, and a fisheries liaison. SFW will submit information to the USCG to issue Local Notice to Mariners during offshore installation activities.
- The communication plan will also include outreach to stakeholders in the offshore recreational and tourism industry to minimize impacts to recreational events (e.g., sailboat races).
- The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season.
- New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
- SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.

4.6.5 Commercial and Recreational Fishing

Commercial and recreational fisheries are an integral part of the cultural history of the Southern New England region and provide a vital contribution to the economy. Several recent reports provide some key characteristics of this industry:

- In 2015, New England landings revenue totaled approximately $1.2 billion where commercial fisheries landed approximately 599 million pounds of finfish and shellfish (NOAA, 2017a). Recreational fishing, be it from shore, a private vessel, or a for-hire vessel, is also important to coastal economies and key to coastal communities' cultural heritage.
- According to a NOAA report on marine recreational bait and tackle retail stores, independent bait and tackle retail shops in coastal communities generated an estimated $854 million in total sales of marine bait, tackle, and related equipment (Hutt et al., 2015). These sales also support other top industry sectors such as service, retail and wholesale trade, and manufacturing.
- Recreational fisheries were a key economic driver in 2015 and supported 439,000 full-time or part-time jobs nationwide, supported directly or indirectly by purchases made by anglers (NOAA, 2017b). The NOAA report on the Economic Contribution of Marine Angler Expenditures (Lovell et al., 2013) states that saltwater anglers spent an estimated $4.4 billion on trip-based expenditures such as ice and fuel, and another $19 billion on durable goods and fishing equipment such as boats and fishing rods.

Species that are targeted for commercial and recreational fishing in Southern New England are managed through Fishery Management Plans (FMPs) by the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council (50 CFR 600.105), the Atlantic States Marine Fisheries Commission, or some combination of these (NOAA, 2017c). Some FMPs include multiple species because they share habitat and are often fished using the same gear type. Commercial fisheries that target certain species can be grouped into broad categories by the gear used – mobile-gear, which is used while the vessel is in motion, such as trawls or dredges; and fixed-gear, which is set and retrieved later, such as lobster pots. Recreational fishing activity can be categorized by fishing mode (charter boat, party boat, private boat, or shore) and by fishing location (inland, state territorial sea [shore to 3 nm {5.5 km}], and federal Exclusive Economic Zone [more than 3 nm {5.5 km}]) (NOAA, 2017b).

Vessels hailing from New England and Mid-Atlantic states catch a diverse range of pelagic, demersal, and benthic species using various types of gear. Commercially and recreationally valuable saltwater species populations are highly dynamic, both spatially and temporally. Species shift in terms of their range and population level because fish migrate with the seasons and interannually and because of climate change, fishing, and other ecological pressures.

The information presented in this section summarizes data that is provided in detail in a technical report (Appendix Y). This assessment makes use of public data sources available at the time of publication. Multiple state and federal fisheries data resources for commercial and recreational fishing in the region were reviewed and are referenced in this section (Table 4.6-19). This regional approach to characterize fishing activity is based on data sources that were designed to be used at a regional scale, rather than at the small spatial and physical scale of the SFWF. In addition, a regional approach recognizes that fish populations shift in physical location throughout the year and over time and cannot be effectively summarized using a spatially and temporally narrow window.

By analyzing data from multiple sources, the fisheries most likely to be impacted by the SFWF and SFEC are specified based on the gear used, the species that are targeted, and the landing ports. Although no single dataset can illustrate the complete picture of how fisheries operate in the region, this section incorporates the best available data that is reported to state and federal resource management agencies.

SFW is also implementing an ongoing fisheries outreach effort (Appendix B) to maintain dialogue with the regional fishing community and utilize their intimate knowledge of the resource. These efforts include one-on-one outreach with fishermen who may fish in or near the SFWF site; interviews with stakeholders who had direct experience with the BIWF, conducted by an independent, third-party; and other outreach events and activities.

Table 4.6-19. Data Sources Used to Characterize Fisheries in the SFWF and SFEC

Affected Environment	Commercial Fishing Activity	Recreational Fishing Activity	Aquaculture
SFWF	Federal Vessel Trip Report (VTR) Data Federal VMS Data OSAMP Data Stakeholder Engagement	Marine Recreational Information Program (MRIP) Data OSAMP Data Stakeholder Engagement	Marine Cadastre
SFEC - OCS and SFEC - NYS	Federal VTR Data State VTR Data Federal VMS Data OSAMP Data Stakeholder Engagement	MRIP Data OSAMP Data Stakeholder Engagement	Marine Cadastre Suffolk County GIS Portal (Suffolk County, New York)

Notes:
Appendix Y provides additional information about these data sources.
Marine Cadastre = MarineCadastre.gov, a BOEM/NOAA data portal

Two primary sources of information for commercial and for-hire recreational fishing activity were incorporated into this analysis. Federal VTR and Federal VMS data are the best available sources to understand which fisheries may be impacted by the SFWF and SFEC.

- The federal VTR data set has the advantage of providing a "census" of almost all fisheries that are active on the Atlantic coast, from Maine to North Carolina; however, VTRs require a single point location to represent activity that may occur over a large area at sea. On average, VTR data can provide a reasonable estimation of fishing activity, and can be examined through the landing port, the landed species, and the gear type used. The VTR data summarized in Appendix Y were first processed by NOAA, following methods described in Kirkpatrick et al. (2017), which includes the application of the statistical model as described in DePiper (2014). The data were requested for a longer and more recent period (2006 to 2015) to update information provided in Kirkpatrick et al. (2017) for fishing activity in the RI-MA WEA. In addition, data were requested for a 6.2-mile (10-km) wide SFEC fisheries study corridor inclusive of the SFEC route, which SFW provided to NOAA for use in the analysis. This method represents a novel approach to capture additional information on activity in both the SFWF and SFEC using the most up-to-date available data.
- VMS data are also valuable because it provides precise vessel locations; however, it is processed using an imperfect method to filter data by vessel-speed to isolate fishing locations from the vessel's path of transit (DePiper, 2017, pers. comm.). As with VTR data, VMS can provide a reasonable estimation of important fishing locations and can be examined for specific fisheries that are subject to reporting to the VMS program.

It is important to note known concerns about both VTR and VMS data. Certain fisheries are not required to report activity through the VMS and VTR programs, including lobster, shrimp, menhaden, and the harvest of non-federally-permitted species; VMS data points are also associated with only one species or group of species managed under a specific FMP, while the fishing vessel may be harvesting multiple species (Battista et al., 2013).

The fishing vessels that are required to use VMS include (50 CFR 648.10):

- Full-time or part-time limited access scallop, or limited access general category scallop permit
- Occasional limited access scallop permit when fishing under the scallop area access program
- Limited access monkfish, occasional scallop, or combination permit electing to provide VMS notifications
- Limited access multispecies permit when fishing on a category A or B day at sea
- Surfclam or ocean quahog open access permit
- Maine mahogany quahog limited access permit
- Limited access monkfish vessel electing to fish in the Offshore Fishery Program
- Limited access herring permit
- Open access herring Areas 2 and 3 permit
- Limited access mackerel permit
- Longfin squid/butterfish moratorium permit

According to the NOAA guidance on vessel reporting, all vessel operators that are permitted to fish in federal waters must submit a VTR "for every fishing trip, regardless of where the fishing occurs, or what species are targeted, with the exception of those vessels that possess only a lobster permit," (GARFO, 2018a, 2018b). In summary, most fishermen targeting scallops, monkfish, surfclam/ocean quahog, northeast multispecies; herring; mackerel; and longfin squid/butterfish are required to use VMS. Other data sources (e.g., VTR, OSAMP, or stakeholder input) characterize fishing activity for those fisheries that are not required to use VMS.

In addition to VMS and VTR data, this analysis recognizes the value of other research and data products that are available, including the results of stakeholder engagement provided in the OSAMP (RI CRMC, 2010) and the detailed assessment of regional VMS data completed by RI DEM (RI DEM, 2017).

Further detail about each of the data sources and their limitations can be found in the Fisheries Technical Report (Appendix Y).

4.6.5.1 Affected Environment

The affected environment for commercial and recreational fishing includes a region defined by the ports with vessels that fish at or near the SFWF and SFEC because the SFWF and SFEC will physically occupy a relatively small space in state and federal waters. This regional approach uses a representative sample of the fisheries activity in the region that may be impacted.

The affected environment is characterized based on several types of data to determine which fisheries, as defined by landing port, landed species or FMP, and gear, will be potentially impacted by the SFWF and SFWF. There is no aquaculture activity in or near the SFWF or SFEC. The process completed to determine the absence of aquaculture activity is described in further detail in the following Regional Overview section.

Regional Overview

Commercial and recreational fisheries are spatially and temporally dynamic because of seasonal and annual changes in the distribution of fish populations. For this reason, the regional overview (as it relates to commercial and recreational fisheries) refers broadly to the area encompassing the RI-MA WEA and the SFEC (including both the SFEC – OCS and the SFEC – NYS). The commercial and recreational fishing described here includes activity in state and federal waters, as reported to the Federal VTR program. Activity in the SFEC – NYS includes fisheries active in New York State waters spanning the Atlantic Ocean west of Montauk to East Hampton. Activity in federal waters, which may occur in or near the SFEC – OCS and the SFWF, are described for fisheries that span west to east from offshore East Hampton, New York to Martha's Vineyard, Massachusetts; and spanning from the state waters of Rhode Island to approximately 30 miles (48 km, 26 nm) offshore, which is approximately the southern boundary of the OSAMP study area. The regional overview is meant to reflect the interconnectivity of commercial and recreational fisheries in the area.

Commercial Fisheries

Commercial fisheries that are active in the SFWF and SFEC encompass a wide range of gears, species, and landing ports. Table 4.6-20 summarizes those elements that define the fisheries that may be impacted by the SFWF, based on federal fisheries data (VTR and VMS data; Appendix Y) and OSAMP data. Based on these data sources, the biggest commercial fisheries near the SFWF in terms of revenue and pounds landed include both mobile gear types (bottom trawl, mid-water trawl, scallop dredge, and clam dredge) and fixed gear types (sink gillnet, lobster and fish pots, and hand gear). As described in the OSAMP chapter on commercial fishing, the data collected in 2010 show Rhode Island commercial fishermen bottom trawl in areas south and southeast of Block Island; while scallop dredges are most active in the areas furthest offshore in the OSAMP, to the south and southwest of Block Island, and in the Cox Ledge area (Appendix Y, Figure Y-10). The mobile gear dataset collected for the OSAMP is consistent with the VTR data, indicating that bottom trawl and scallop dredge vessels fish in areas surrounding the SFEC.

Table 4.6-20. Commercial Fisheries Most Active in the SFWF and SFEC

Gears	Species	Landing Port
Mobile Gears: Bottom trawl Mid-water trawl Scallop dredge Clam dredge Fixed Gears: Sink gillnet Lobster pot Fish pot Hand gear	Species: Monkfish Lobster Skates Sea scallops Atlantic herring Silver hake Little skate Flounder Longfin squid Scup Atlantic mackerel FMP: Monkfish Sea scallops Surf clam/Ocean quahog Skates Atlantic herring Summer flounder/Scup/Black sea bass Mackerel/Squid/Butterfish Northeast Multispecies FMP	Massachusetts New Bedford Chilmark Westport Rhode Island Point Judith Newport Little Compton Tiverton New York Montauk Moriches Shinnecock Connecticut Stonington New London

Sources for this summary table are Federal VTR and VMS data, and the OSAMP report.

Among fixed gear, the biggest commercial fisheries (in terms of revenue and pounds landed) in the SFWF and SFEC include sink gillnet, lobster pot, and hand gear (Appendix Y, Table Y-1). The fixed gear fishing location data collected for the OSAMP are also in agreement with the VTR data, and indicate areas considered important by Rhode Island commercial fishermen who use lobster pots, fish pots, and gill nets. The OSAMP only included input from Rhode Island commercial fishermen; however, fishermen from New York, Connecticut, and Massachusetts who use the same gear may also consider these same areas to be important. A large portion of Rhode Island Sound, including Cox Ledge and Southwest Shoal, is fished with fixed gear (Appendix Y, Figure Y-11); in addition, there is fixed gear fishing activity indicated in Block Channel, which is crossed by the SFEC – OCS. These fixed gear fishing areas were highlighted by the Rhode Island fishermen who contributed to the OSAMP; fishermen from New York, Connecticut, and Massachusetts using fixed gear may also consider those areas important. VTR data indicate that sink gillnet and lobster pot gears are among the top five gears used (in terms of average annual revenue) for fishing reported within the broad SFEC fisheries study corridor surrounding the SFEC – NYS and SFEC – OCS used for this analysis (Appendix Y, Table Y-6). In addition, of those vessels with only New York State permits, fishermen using gill nets landed the greatest proportion of pounds caught in New York State waters that are crossed by the SFEC – NYS (Appendix Y-Table Y-11).

The fisheries that may be impacted by the SFWF and SFEC are those targeting monkfish; sea scallops; surf clam/ocean quahog; skates; Atlantic herring; summer flounder/scup/black sea bass; northeast multispecies; and mackerel/squid/butterfish FMPs. In addition, fisheries for other species that may be impacted by the SFWF and SFEC include lobster, skates, silver hake, and Atlantic mackerel. A complete list of species and additional detail on estimated revenue and landings of species and FMPs that are caught within the SFWF and SFEC is provided in Appendix Y, Tables Y-2, Y-3, Y-7 and Y-8. The ports where catch from the SFWF and SFEC are frequently landed include the Massachusetts ports of New Bedford, Chilmark, and Westport; the Rhode Island ports of Point Judith, Newport, Little Compton, and Tiverton; the New York ports of Montauk, Moriches, and Shinnecock; and the Connecticut ports of Stonington and New London. Most fishing activity is conducted by vessels hailing from ports in Massachusetts, Rhode Island, Connecticut, and New York; there are also some vessels that fish in the RI-MA WEA from New Jersey, Virginia, and North Carolina (Appendix Y, Tables Y-4, Y-5, Y-9, and Y-10). Commercial fisheries in New York State waters also include hook-and-line gear. Additional detail on species caught in New York State waters is provided in Appendix Y, Table Y-12.

Fishing occurs throughout the SFEC and SFWF area, and variation in intensity of fishing activity by location is challenging to accurately and precisely categorize with available data sources. VMS data for several commercial fisheries indicate respective levels of intensity of vessel traffic and fishing activity in the SFWF and SFEC. The available data suggest that most fisheries do not have high relative fishing intensity within the RI-MA WEA compared with nearby waters (Appendix Y, Figures Y-3 through Y-9). The fisheries with the greatest intensity of activity within the RI-MA WEA is from vessels targeting monkfish and groundfish. Vessels targeting monkfish have very high and high relative fishing intensity just south of the RI-MA WEA and medium-high to high relative fishing intensity within the SFWF MWA. Vessels targeting groundfish had some activity within the RI-MA WEA, including medium-low and low relative fishing intensity within the SFWF MWA. Generally, groundfish vessels were much more active to the south and west of the RI-MA WEA. The VMS data suggest multiple fisheries are active near the SFEC – OCS and SFEC – NYS. The SFEC - OCS crosses an area of relatively high-intensity of groundfish fishing, very high intensity of monkfish fishing, and high intensity of scallop fishing. In the nearshore New York State waters, the VMS data indicate there was relatively high intensity of fishing for squid in the area crossed by the SFEC – NYS.

Recreational Fisheries

Recreational fisheries in the SFWF and SFEC target a wide range of pelagic, highly migratory, and demersal species (Table 4.6-21). A comprehensive list of species that are targeted within the OSAMP area was developed through an iterative process, using catch data, and correspondence with recreational charter boat captains (RI CRMC, 2010). MRIP data on the relative seasonal intensity of recreational angler trips are presented in Appendix Y, Figure Y-13. These data indicate the peak activity for angler trips out of New England and Mid-Atlantic states for all fishing locations, particularly in federal waters, occur from May through October (NOAA, 2017d).

Table 4.6-21. Common Species Targeted in Recreational Fisheries in the SFWF and SFEC

Common Name	Scientific Name
Atlantic bonito	Sarda
Atlantic cod	Gadus morhua
Black sea bass	Centropristis striata
Bluefish	Pomatomus saltatrix
False albacore	Euthynnus alletteratus
Pollock	Pollachus virens
Scup	Stenotomus chrysops
Shortfin mako	Isurus oxyrinchus
Blue shark	Prionace glauca
Thresher shark	Alopias vulpinus
Striped bass	Morone saxatilis
Summer flounder	Paralichthys dentatus
Tautog	Tautoga onitis
Bluefin tuna	Thunnus thynnus
Yellowfin tuna	Thunnus albacares
Winter flounder	Pseudopleuronectes americanus

Note:
This list was developed based on the OSAMP documentation of recreational fisheries, which used information collected from representatives of the Rhode Island-based recreational fishing industry. While these species are commonly targeted for recreational fishing, this is not an exhaustive list of recreational species in the region.

There are few data sources available that describe recreational fishing activity. MRIP data are used to summarize recreational angler-trips from surrounding states; however, this dataset does not include fishing locations, so it may be used only to characterize the relative intensity of fishing activity among states and over time. Information on fishing location data from the OSAMP is also used for additional context; this information was provided by for-hire recreational fishermen for inclusion in the OSAMP (Appendix Y). To characterize recreational fishing activity in the SFWF and SFEC, the number of angler trips leaving from the four surrounding states: New York, Connecticut, Rhode Island, and Massachusetts (Appendix Y, Table Y-14), is summarized using the last 5 years of available recreational angler-trip data (2012 to 2016). Intercept-surveys with fishing-area data missing were recorded as fishing in "unknown" locations but provide information as to whether the trip is on a charter or private vessel. Over this 5-year period, the greatest number of angler-trips to federal waters left from New York, with an average of more than 197,000 estimated trips per year (Appendix Y, Table Y-14). In terms of the percent of total angler trips at the state level, most trips leaving from each of the four states were in private vessels (Appendix Y, Table Y-15). New York has the greatest proportion of charter-boat angler trips among the four states (11 percent of all angler-trips out of New York State), and Rhode

Island has the greatest proportion of shore-based angler trips among the four states (50 percent of all Rhode Island angler-trips). Data collected by the RI CRMC for the OSAMP included spatial data provided by for-hire recreational fishermen from Rhode Island, who noted on a map the locations of particular value to their industry. In Appendix Y, Figure Y-12, the SFWF and SFEC is mapped with the recreational fishing locations data. The map indicates that recreational fishing occurs in the SFWF, and that some recreational fishing occurs near the eastern portion of the SFEC - OCS.

Aquaculture

There are no active aquaculture lease areas or operations in federal waters in the SFWF turbine array area, or in the SFEC - OCS, as of spring 2018. There are also no active aquaculture lease areas or operations in the SFEC - NYS or SFEC – Onshore. This was determined through a careful examination of the available aquaculture data on the Marine Cadastre spatial data portal (BOEM and NOAA, 2017) and the Suffolk County, New York GIS Portal's Shellfish Aquaculture Lease Program (Suffolk County GIS Portal, 2017). Furthermore, staff at the NYSDEC confirmed the absence of aquaculture activities on the south shore of the South Fork of Long Island, New York (Carden, 2017, pers. comm.).

Although there are no current aquaculture activities within the SFWF or SFEC, the company Manna Fish Farms is in a permitting process to install finfish grow-out pods to be located 16.2 nm (30 km) south off the coast of Hampton Bays, New York, on the South Fork of Long Island, per a May 2016 article (Fish Farmer, 2016). The farm planned to "install a pod array off the coast of Eastern Long Island to moor up to two dozen mesh-enclosed galvanized steel geodesic 'Aquapods' in the Atlantic Ocean," which would host striped bass, raised from fingerling-size juveniles (Ryan, 2015). The SFEC – OCS is approximately 15 miles (24 km) to the east-northeast of where this activity is proposed.

South Fork Wind Farm

Commercial Fisheries

The following section utilizes two sources of information on commercial fisheries that are active in the RI-MA WEA: VTR data as provided by NOAA for the years 2006 through 2015; and the results of an analysis of commercial fisheries data for the years 2011 through 2016, as reported by the RI DEM (RI DEM, 2017). The analysis reported in RI DEM (2017) is based on federal landings revenue data linked to VMS fishing locations and directly connects revenue to fishing location as reported by VMS. In contrast, the NOAA VTR data summarized in Appendix Y are modelled revenue-estimates for fishing activity. The revenue and landings estimates provided by these reports cannot be accurately divided proportionally over the footprint of a smaller area due to the way the data were analyzed. For context, it is important to consider the area where SFWF WTG will be located compared to the entire RI-MA WEA (approximately 97,498 acres or 394.6 km^2). The SFWF has a footprint of approximately 9 percent of the total area of the RI-MA WEA, but fishing revenues within the SFWF Project envelope may not represent 9 percent of the total fishing revenue of the RI-MA WEA. This section does not provide the exact dollar amounts estimated by this analysis, because those values are valuable as estimates of relative intensity of fishing activities but cannot be used to assess the exact amount of revenue and pounds that should be expected from fishing in the SFWF. The complete results of the VTR data analysis provided by NOAA (with confidential information redacted) are provided in Appendix Y.

The fisheries likely to be impacted by the SFWF, as characterized by gear type, species/FMP, and fishing ports, are described in the following sections and summarized in Table 4.6-22. The potential impacts of the SFWF on the impacted fisheries, including both negative and potential beneficial impacts, are discussed in detail in Section 4.6.5.2. The greatest landings revenue from fishing in the RI-MA WEA were generated by otter bottom trawl, sink gillnet, and scallop dredge gear (RI DEM, 2017). For the results of the VTR analysis in the RI-MA WEA by gear type, see Appendix Y, Table Y-1. Commercial fishermen have also reported to SFW that while gillnetting does occur in the SFWF area, there is limited use of mobile gear because of the presence of boulders and hazards that can destroy gear.

Table 4.6-22. Commercial Fisheries Most Active in the SFWF Area

Gears	Species	Landing Port
Bottom trawl	Species:	Massachusetts
Gillnet	Monkfish	New Bedford
Lobster pot	Lobster	Chilmark
Scallop dredge	Skates	Harwich Port
	Sea scallop	Westport
	Surfclam/ocean quahog	Rhode Island
	FMP:	Point Judith
	Monkfish	Newport
	Sea scallop	Little Compton
	Surfclam/ocean quahog	New York
	Skates	Montauk
	Northeast Multispecies FMP	

Sources for this summary table are Federal VTR and VMS data, and the OSAMP report.

According to VMS data, the FMPs that earned the most landings revenue from fishing in the RI-MA WEA during 2011 through 2016 include sea scallops, monkfish, and Northeast multispecies (RI DEM, 2017). In addition, NOAA VTR data indicate that the top species by landings revenue were monkfish, lobster, skates, sea scallops, and surf clam/ocean quahog for the years 2006 through 2015. For the results of the VTR analysis in the RI-MA WEA by species and FMP, see Appendix Y, Table Y-2 and Table Y-3, respectively.

As characterized by the NOAA VTR data, the Massachusetts ports that earned the greatest revenue on average each year from fishing in the RI-MA WEA include Westport, Harwich Port, and New Bedford. The ports Westport and Chilmark caught a larger proportion of their total average annual landings revenue from within the RI-MA WEA. The Rhode Island ports that earned the greatest revenue on average each year for that period from fishing in the RI-MA WEA include Little Compton, Newport, and Point Judith. A larger proportion of the total average annual revenue for landings in Little Compton, Rhode Island came from fishing in the RI-MA WEA. Among New York ports, the VTR data indicates that Montauk had the greatest landings revenue on average for fish caught within the RI-MA WEA from 2006 to 2015. It is likely that fishermen from several other New York ports also fished in the RI-MA WEA during that period; however, because of confidentiality concerns, their activity could not be provided by NOAA. Fishermen that were active during this period near the SFEC may also fish in the RI-MA WEA; those ports are listed in Appendix Y, Table Y-9. For the full results of the VTR analysis in the RI-MA WEA by port, see Appendix Y, Table Y-4 and Table Y-5.

According to the VMS data as analyzed in RI DEM (2017), over the years 2011 to 2016, New Bedford, Massachusetts earned a total of $2.9 million in revenue, with the greatest landings in the year 2014 (more than $969,000). For the same set of years, Point Judith, Rhode Island earned more than $2 million total in revenue, with the greatest earnings in 2013 (more than $594,000).

VMS data overlaid with the SFWF provide additional information for specific fisheries that are active in that facility area (Appendix Y, Figures Y-3 through Y-9). A qualitative summary of the fishing effort and intensity near the SFWF is provided in Table 4.6-23. Additional detail on fishing activity as characterized by VTR data provided by NOAA is included in Appendix Y (Gears: Table Y-1; Species/FMP: Table Y-2; Ports: Table Y-3). For further detail on fishing activity as characterized by VMS data and reported by RI DEM, see RI DEM (2017).

Table 4.6-23. Characteristics of Fishing Intensity and Occurrence in the SFWF for Fishery Management Plans based on VMS Data

Fishery	Year(s) of Data	Relative Intensity	Occurrence
Groundfish	2011-2014	Medium-High to Low	Widespread
Monkfish	2011-2014	High to Medium-Low	Widespread
Pelagics (Herring/Mackerel/Squid)	2015-2016	Medium-Low to Low	Scattered
Herring	2011-2014	None	Absent
Scallop	2011-2014	Medium-High to Low	Scattered
Surfclam/Ocean Quahog	2012-2014	None	Absent
Squid	2014	None	Absent

Source: *Qualitative assessment of Federal VMS data* (GARFO, 2018), acquired from the Northeast Ocean Data Portal (2018).

Recreational Fisheries

Recreational fishing trips (private, charter, or shoreside trips) peak during the months of May through October (Appendix Y, Figure Y-13). The recreational trips departing from Massachusetts, Rhode Island, or New York to federal waters on private or charter vessels are within a reasonable travel distance for a fishing trip, to the SFWF[14]; MRIP data indicate that the greatest number of trips to federal waters by either charter or private vessels departed from Massachusetts or New York during 2012 to 2016. Information provided by fishermen contributing to the OSAMP also indicates that the SFWF is located within a large area that is known to be used by some recreational charter boat fishermen.

SFEC – OCS

Commercial Fisheries

Commercial fisheries near the SFEC – OCS area are broadly characterized in the introductory Regional Overview section. This section focuses on fisheries in the specific footprint of the SFEC – OCS (Appendix Y, Figure Y-1; Table 4.6-24).

The fisheries that are identified as active in the SFEC – OCS by VTR data are summarized by gear, species/FMP, and landing port in Table 4.6-24. The potential impacts of these components on the most impacted fisheries noted here, both negative and beneficial, are discussed in detail in Section 4.6.5.2. The VTR data summary for fishing activity in the SFEC fisheries study corridor was used to assess which fisheries are active near the SFEC; and; revenue values are used to highlight the fisheries that are likely to be the most active near the SFEC.

[14] To characterize ports that may be exposed to the development of offshore WEAs, Kirkpatrick et al. (2017) used the distance of 30 nm (48 km) as a cut-off for those ports that could be exposed to WEAs because 30 nm (48 km) is a about as far as a charter boat might travel to do offshore fishing.

Table 4.6-24. Commercial Fisheries Most Active in the SFEC - OCS

Gears	Species/FMP	Landing Port
• Bottom trawl • Scallop dredge • Clam dredge • Sink gillnet • Lobsterpot	Species: • Monkfish • Sea scallop • Flounder • Squid • Skates FMP: • Monkfish • Sea scallop • Surfclam/ocean quahog • Summer flounder/scup/black sea bass • Atlantic Herring • Squid Mackerel Butterfish	Massachusetts • New Bedford Rhode Island • Point Judith New York • Montauk

Sources for this summary table are Federal VTR and VMS data, and the OSAMP report.

VTR data for the SFEC fisheries study corridor indicate that the most active gears include bottom trawl, scallop dredge, sink gillnet, clam dredge, and lobster pot (Appendix Y, Table Y-6). These results are further supported by the OSAMP spatial data (Appendix Y, Y-10, and Y-11). Commercial fishermen have reported to SFW that there is both gillnetting and scalloping activity west of the SFWF near the SFEC - OCS; in addition, scalloping activity along the SFEC - OCS area intensifies further west of the SFWF, as there is a decrease in boulders that can snag the gear.

Within the SFEC fisheries study corridor, the fisheries with the estimated greatest landings revenue on average each year for 2006 through 2015 were from FMPs of sea scallop, monkfish, surf clam/ocean quahog, summer flounder/scup/black sea bass, Atlantic herring, skate, and squid/mackerel/butterfish. For the full results of the VTR analysis in the SFEC fisheries study corridor by port, see Appendix Y, Table Y-8. When considered in terms of individual species, the greatest revenue on average from fish caught in the SFEC fisheries study corridor during that period include the species grouped in FMPs, as well as skates and inshore longfin squid. In terms of pounds-landed, on average for 2006 to 2015, the FMPs with the greatest landings from the SFEC fisheries study corridor included herring, skates, and monkfish. In terms of pounds-landed for individual species, the largest fisheries on average each year included the abovementioned species, as well as scup and Atlantic mackerel. For the full results of the VTR analysis of fishing in the SFEC fisheries study corridor by species, see Appendix Y, Table Y-7.

According to the NOAA VTR data, the ports with the greatest revenue for landings sourced from within the SFEC fisheries study corridor include Point Judith, Rhode Island; Montauk, New York; and New Bedford, Massachusetts. In addition, the ports of Stonington and New London, Connecticut; Shinnecock, New York; and Newport, Tiverton, Little Compton, and Davisville, Rhode Island were also active near the during that period in the SFEC fisheries study corridor. For the full results of the VTR analysis of fishing in the SFEC fisheries study corridor by port, see Appendix Y, Table Y-9.

VMS data, overlaid with the SFEC – OCS, provide additional information for specific fisheries that are active in this area (Appendix Y, Figures Y-3 through Y-9). A qualitative summary of fishing effort and intensity near the SFEC – OCS is summarized in Table 4.6-25.

Table 4.6-25. Characteristics of Fishing Intensity and Occurrence near the SFEC - OCS for Fishery Management Plans based on VMS Data

Fishery	Years of Data	Relative Intensity	Occurrence
Groundfish	2011-2014	High to Medium-Low	Widespread
Monkfish	2011-2014	Very High to Medium-High	Widespread
Pelagics (Herring/Mackerel/Squid)	2015-2016	Very High to Medium-High	Widespread
Herring	2011-2014	Medium-High to Low	Widespread
Scallop	2011-2014	High to Medium-Low	Widespread
Surfclam/ocean quahog	2012-2014	High to Low	Widespread
Squid	2014	High to Medium-Low	Scattered

Source: Qualitative assessment of Federal VMS data (GARFO, 2018b), acquired from the Northeast Ocean Data Portal (2018).

Recreational Fisheries

The recreational fishing activity that may be impacted by the SFEC – OCS will be the same as that described for the SFWF. Additional information provided by fishermen to the OSAMP also suggests that the SFEC – OCS overlaps with some areas used by recreational charter boat fishermen.

SFEC – NYS

Commercial Fisheries

The fisheries that are identified as active in state waters near the SFEC – NYS by NYSDEC VTR data are summarized by gear, species/FMP, and landing port in Table 4.6-26. Fishing locations for commercial vessels that fish *only* in New York State waters are reported to the New York State statistical areas on VTRs; given the fact that confidential information has been redacted for information on fishing by fewer than three individuals, smaller fisheries by revenue and landings value may not be clearly indicated by the values presented in Appendix Y. Fishing activity by vessels that fish in both state and federal waters near the SFEC are described by the Federal VTR data in Appendix Y, Tables Y-6 through Y-10. The SFEC – NYS and potential landing sites transit through two statistical areas. If activity is reported in both statistical areas, the pounds landed from fishing in those areas are separated out (Appendix Y, Figure Y-2). NYSDEC VTR data indicate that the largest fisheries in terms of pounds landed during 2007 through 2016 used gillnets, hook-and-line, dredge, otter trawl, and pots/traps gear. For the full results of the VTR analysis of fishing in New York State waters, see Appendix Y, Table Y-11. Commercial fishermen have reported to SFW that there is a substantial trawling activity in state waters between East Hampton and Montauk, New York. This fishery has a brief (2-month), intense, and very important squid fishing season; fishermen in this area also target mackerel and groundfish.

The top commercial species in terms of pounds landed in these two statistical areas include striped bass, longfin squid, skates, bluefish, American lobster, and monkfish (Appendix Y, Table Y-12). The ports of Moriches, Shinnecock, and Montauk were the largest landing ports for fishing activity in New York State waters in terms of pounds landed on average each year during 2007 through 2016 (Appendix Y, Table Y-13).

Table 4.6-26. Commercial Fisheries Active in the SFEC – NYS as Identified by NYSDEC VTR Data

Gears	Species	Landing Port
Gillnet Hook-and-line Dredge Otter trawls Pots/traps	Species: Striped bass Longfin squid Skates Bluefish American lobster Monkfish	New York Moriches Shinnecock Montauk

Note: This information represents fishing activity as reported by fishermen to NYSDEC from 2007 to 2016, as indicated by data provided by the Atlantic Coastal Cooperative Statistics Program (ACCSP; 2017), which is for fishermen who only hold New York state fishing permits; it does not include fishing activity by fishermen who hold both state and federal fishing permits. Gears include those that landed over 10,000 pounds on average each year from 2007 to 2016.

VMS data, overlaid with the SFEC - NYS, provide additional information for specific fisheries that are active in this area (Appendix Y, Figures Y-3 through Y-9). A qualitative summary of fishing effort and intensity near the SFEC - NYS is summarized in Table 4.6-27.

Table 4.6-27. Characteristics of Fishing Intensity and Occurrence near the SFEC – NYS for Fishery Management Plans based on VMS Data

Fishery	Years of Data	Relative Intensity	Occurrence
Groundfish	2011-2014	High to Low	Widespread
Monkfish	2011-2014	Medium-Low to Absent	Scattered
Pelagics (Herring/Mackerel/Squid)	2015-2016	Very High	Widespread
Herring	2011-2014	Medium-Low to Absent	Scattered
Scallop	2011-2014	Medium-Low to Low	Widespread
Surfclam/ocean quahog	2012-2014	Low	Scattered
Squid	2014	High to Medium-Low	Widespread

Source: Qualitative assessment of Federal VMS data (GARFO, 2018b), acquired from the Northeast Ocean Data Portal (2018).

Recreational Fisheries

Most of New York's recreational fishing effort is estimated to occur from shore (Appendix Y, Figure Y-1) during summer months (May through September). Shore fishing also occurs during the shoulder months of March/April and November/December when there is limited fishing effort by private or for-hire vessels in either state or federal waters. The MRIP data estimate that approximately 3.6 million trips in New York State waters occurred on average each year from 2012 through 2016. These trips include angler-trips on private boats in state waters (49 percent), and shore-based trips (41 percent) (Appendix Y, Tables Y-14 and Y-15). Estimates for angler-effort disaggregated to the county level indicate that approximately 132,000 angler-trips are taken to federal waters each year out of Suffolk County, compared to approximately 2.5 million trips to state waters (Appendix Y, Table Y-16). Approximately 65 percent of all recreational fishing trips that left from New York State are estimated to have departed from Suffolk County each year on average for the years 2012 through 2016.

4.6.5.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the SFWF have the potential to cause both direct and indirect impacts on commercial and recreational fisheries. An overview of IPFs of these activities that may impact fisheries is illustrated on Figure 4.6-5. IPFs associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are described in Section 4.1.

Direct impacts are characterized as those caused specifically by the IPFs associated with the Project phases, as described in Section 4.1. Indirect impacts on fishing activity will be those impacts caused by IPFs on benthic resources, shellfish, and finfish species that are targeted by commercial and recreational fisheries. The SFWF and SFEC are not expected to have major long-term impacts on commercial and recreational fisheries (Sections 4.3.2 and 4.3.3). The following sections are separated into the SFWF and the SFEC, including the SFWF turbine array, the SFEC – OCS, and the SFEC – NYS.

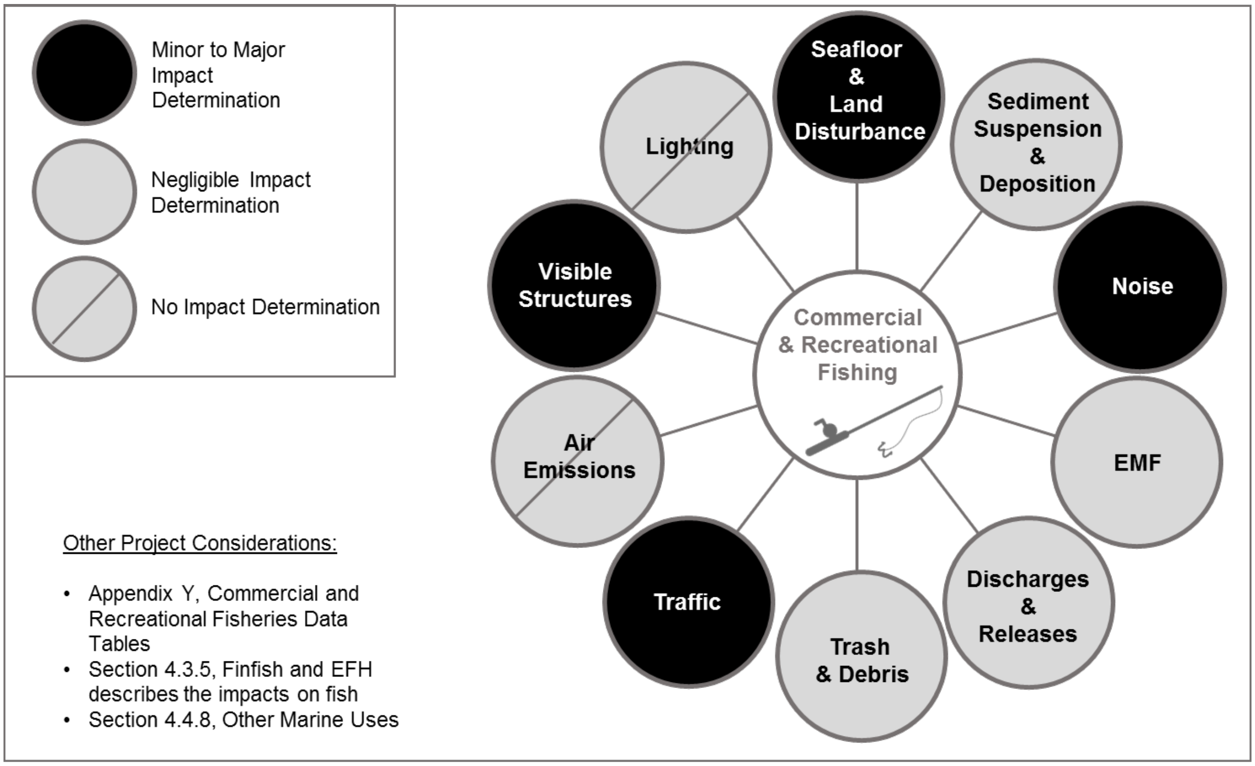

Figure 4.6-5. IPFs on Commercial and Recreational Fisheries
Illustration of potential impacts to commercial and recreational fisheries resulting from SFWF and SFEC activities.

South Fork Wind Farm

Table 4.6-28 summarizes the level of impacts expected to occur to commercial and recreational fisheries during the construction and decommissioning phases of the SFWF. Table 4.6-29 summarizes the level of impacts expected to occur during the O&M phase of the SFWF. Construction and decommissioning activities are generally expected to have ***short-term, minor impacts*** on access to fishing activity because it is anticipated that the USCG will implement a temporary safety zone (potentially 1,642 ft [500 m]) around construction-related vessels and activities (Appendix X), and because of habitat modification that would impact some commercially and recreationally targeted species. O&M activities are expected to have ***long-term, minor*** to ***moderate impacts*** on certain commercial fisheries due to displacement of fishing activity and may have ***minor, beneficial impacts*** on recreational fisheries. As noted in Section 4.1.9, the Visible Structures IPF addresses components that will occupy space underwater, above water, and on land. Additional details on potential impacts to commercial and recreational fisheries from the various IPFs at the SFWF are described in the following sections.

Table 4.6-28. IPFs and Potential Levels of Impact on Commercial and Recreational Fisheries at the SFWF during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impacts
Seafloor & Land Disturbance	Seafloor Preparation	Minor, short-term, direct Moderate, short-term, indirect
	Pile Driving/Foundation Installation	Minor, short-term, direct Minor, short-term, indirect
	OSS Platform Installation	Minor, short-term, direct Minor, short-term, indirect
	SFWF Inter-Array Cable Installation	Minor, short-term, direct Minor, short-term, indirect
	Vessel Anchoring (including spuds)	Minor, short-term, direct Minor, short-term, indirect
Noise	Pile Driving	Minor, short-term, indirect
	Ship, Trenching, Aircraft Noise	Minor, short-term, indirect
Traffic		Minor, short-term, direct
Visible Structures		Minor, short-term, direct
Sediment Suspension & Deposition		Negligible, short-term, indirect
Discharges a		Negligible
Trash &Debris a		Negligible

* Supporting information on the negligible level of impact from the discharges and trash and debris IPFs is provided in Section 4.1.

Table 4.6-29. IPFs and Potential Levels of Impact on Commercial and Recreational Fisheries at the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
Seafloor and Land Disturbance	WTG Foundations	Moderate, long-term, direct Minor, long-term, indirect
	OSS Platform	Moderate, long-term, direct Minor, long-term, indirect
	SFWF Inter-Array Cable	Moderate, long-term, direct (negative) Minor, long-term, indirect (beneficial)
	Vessel Anchoring (including spuds)	Minor, short-term, direct Minor, short-term, indirect
Noise	Ship and Aircraft Noise	Minor, short-term, indirect

Table 4.6-29. IPFs and Potential Levels of Impact on Commercial and Recreational Fisheries at the SFWF during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impact
	WTG Operational Noise	Minor, short-term, indirect
Traffic		Negligible, long-term, direct
Visible Structures		Minor, long-term, direct
Electromagnetic Fields (EMF)		Negligible
Sediment Suspension and Deposition		Negligible
Discharges *		Negligible
Trash and Debris *		Negligible

* Supporting information on the negligible level of impact from the discharges and trash/debris IPFs is provided in Section 4.1.

Construction

Seafloor Disturbance

IPFs associated with seafloor disturbance include seafloor preparation, pile driving and foundation installation, OSS platform installation, SFWF Inter-array Cable installation, and vessel anchoring (including spuds). Section 4.1 describes the expected impact areas associated with the monopile foundation and Inter-array Cable.

In general, seafloor disturbance is expected to produce negligible to minor levels of direct and indirect impacts to species, depending on the mobility of the species present. This will result in ***short-term*** and ***long-term, negligible*** to ***minor levels of indirect impacts*** to commercial and recreational fisheries that target the directly impacted species. Seafloor disturbance during construction is expected to result in ***minor, short-term, direct impacts*** on all commercial and recreational fisheries due to the short-term disruption of access to fishing areas for safety. Additional indirect impacts to commercial and recreational fisheries from seafloor disturbance are described in the following paragraphs.

Seafloor Preparation

Impacts due to seafloor preparation on benthic species with limited mobility are expected because they may not be able to move out of the way during impact-producing activities and will be subject to injury or mortality. Thus ***minor, short-term, indirect impacts*** are expected for fisheries that target more mobile species (such as American lobster, monkfish, skates, and squid), which are likely to temporarily vacate the area but may be subject to limited injury or mortality. These species are likely to return to the area after the construction phase. ***Minor, short-term, indirect impacts*** are expected for commercial fisheries that target less-mobile species (such as sea scallops and surf clams). For more information about shellfish resources in the SFWF, see Section 4.3.2.

Pile Driving and Foundation Installation

Placement of the foundations, piles, and associated scour protection will result in minor, short-term, direct impacts for those species that have preferred habitat in the SFWF (Tables 4.3-4 and 4.3-10) following the disturbance. Fisheries that target species present in the SFWF as listed in Table 4.3-5 and Table 4.3-10, and are commercially or recreationally important, may experience ***minor, short-term, indirect impacts.***

SFWF Inter-Array Cable Installation

SFWF Inter-Array Cable installation may cause short-term, minor, impacts on benthic and demersal species because of habitat modification, as described for Seafloor Preparation. This may have ***minor, short-term, indirect impacts*** on commercial and recreational fisheries that target these species.

Vessel Anchoring and Spuds

Vessel anchoring and spuds will have minor, short-term, direct impacts to benthic habitat due to modification and disturbance of the seabed. However, it is expected to rapidly recover (Guarinello et al., 2017). For this reason, vessel anchoring may result in ***minor, indirect, short-term impacts*** on commercial and recreational fisheries that target benthic and demersal species in the area because of short-term displacement of some species and habitat disturbance.

Sediment Suspension and Deposition

Sediment suspension and deposition impacts in the SFWF during construction are likely to result in minor, short-term, direct impacts for those species that have preferred habitat in the SFWF (Tables 4.3-4 and 4.3-10), which could result in ***short-term, negligible, indirect impacts*** to commercial fisheries that target the directly impacted species.

Noise

Commercial and recreational fisheries are unlikely to experience direct impacts of noise during construction because it is anticipated that the USCG will implement a temporary safety zone (potentially 1,642 ft [500 m]) around construction-related vessels and activities (Appendix X). Therefore, noise impacts are considered in-terms of the potential impacts on benthic and demersal species that are targeted by commercial and recreational fisheries. There may be ***minor, short-term, indirect impacts*** to fisheries targeting the more mobile species in the vicinity of the SFWF because species exposure to underwater noise exhibit short-term behavioral changes – including area avoidance. The commercial and recreational fisheries that may be impacted are those targeting more mobile species, such as Atlantic cod, black sea bass, scup, tautog, monkfish, lobster, and skate. Further information about underwater noise impacts on benthic and demersal species may be found in Sections 4.3.2 and 4.3.3.

Traffic

Commercial and recreational fisheries may experience ***minor, short-term, direct impacts*** due to increased vessel traffic during the construction phases of the SFWF because it is anticipated that the USCG will implement a temporary safety zone (potentially 1,642 ft [500 m]) around construction-related vessels and activities (Appendix X).

Visible Structures

The physical presence of installation vessels will have a ***minor, short-term, direct impact*** on fishing activity, because there will be a minimum safety perimeter around installation vessels that is established during construction activity.

Operations and Maintenance

Seafloor Disturbance

IPFs associated with seafloor disturbance during O&M of the SFWF have been split into foundation, OSS platform, SFWF Inter-array Cable, and vessel anchoring (including spuds). See Section 4.1 for the expected impact areas associated with the monopile foundation and Inter-array Cable. In general, seafloor disturbance is expected to produce ***negligible*** to ***moderate*** levels of ***direct*** and ***indirect impacts*** to species, depending on the mobility of the species. Additional indirect impacts to commercial and recreational fisheries from seafloor disturbance are described in the following paragraphs.

Foundations

The presence of the foundations and associated scour protection will result in ***moderate, long-term, indirect*** impacts to benthic and demersal organisms because of the conversion of existing sand or sand with mobile gravel habitat to hard bottom. This conversion to hard bottom habitat may trigger an impact known as a "reef effect" which could result in adverse and beneficial impacts depending on the species. For further information on common habitat types by species, see Tables 4.3-4 and 4.3-11, and for further information on expected impacts to benthic and demersal finfish species, see Sections 4.3.2.2 and 4.3.3.2. Commercial fisheries that target species with limited mobility may have ***minor, long-term, indirect impacts*** from the presence of the WTG foundations (due to the impact on benthic and demersal species such as ocean quahog clam, Atlantic surfclam, Atlantic sea scallop, and American lobster). ***Minor*** to ***moderate, long-term, direct impacts*** may occur for commercial fishermen using mobile, bottom-tending gear (such as bottom trawl or scallop dredge), that choose not to fish near the WTG foundations. While fishing will not be possible in the exact locations of the WTG foundations, fishermen using either fixed or mobile gear types will be able to fish in surrounding areas.

Recreational fisheries generally do not target benthic invertebrate species in offshore areas. Finfish species are more mobile and are likely to recolonize areas after the conclusion of the installation phase. For these reasons, there are no direct negative impacts expected for recreational fishing in the short- or long-term. Because of the modification of bottom habitat, there may be ***long-term, indirect benefits*** on recreational and commercial fisheries from the reef effect described in Sections 4.3.2.2 and 4.3.3.2 and may eventually attract recreationally and commercially targeted finfish and invertebrates such as the American lobster.

A ***long-term, minor, indirect, benefit*** of the WTGs' physical presence is that hardened structure will likely attract recreationally important species. The physical presence would likely cause the direct, minor impacts on recreational fisheries due to the WTG marking the location with a hardened structure and attracting fishermen. While this is a potentially positive impact of the physical presence of the WTGs, it would also be considered an adverse impact for recreational fishermen who previously utilized the location as a secluded fishing location because, during operation, the SFWF WTGs could potentially become a recreational fishing destination. In addition, increased fishing pressure on fish aggregations at the WTGs may result in increased recreational fishing mortality rates. If these circumstances arise, then ***long-term, minor*** to ***moderate, direct impacts*** are expected.

SFWF Inter-Array Cable Maintenance

Maintenance of the Inter-array Cable is considered a nonroutine event and is not expected to occur with regularity. Impacts associated with exposing the Inter-array Cable will be similar but less frequent to those described for the construction phase.

Commercial and recreational fisheries are expected to experience negligible impacts from the presence of the Inter-array Cable because it would be installed with a target burial depth of 4 to 6 feet (1.2–1.8 m) beneath the seabed. However, some areas of the Inter-array Cable may require armoring, which may cause ***short-term, minor, negative impacts*** on benthic or demersal species because of habitat modification. After recolonization, the armoring locations may provide ***long-term, minor, indirect, benefits*** to recreational fisheries that target certain recreational species that favor habitat in hardened structure. See Section 4.3.2 for more information about Benthic and Shellfish Resources and Section 4.3.3, for more information about Finfish and Essential Fish Habitat. The cable and possibly the presence of cable armoring may have a ***long-term, minor*** to ***moderate, direct, impact*** on commercial fishermen using mobile, bottom-tending gear (such as bottom trawl or scallop dredge) for the same reasons described for likely impacts of the WTG foundations. The accidental snagging of mobile gear may result in ***minor-to-moderate, direct, impacts*** for those commercial fishing vessels. In the event of fishing gear interactions within the Project Area, there are draft guidelines that include the Orsted US Offshore Wind Fisheries Gear Loss Prevention & Claim Procedure, which is part of Appendix B, and is available on the Project website and provided to fishery liaisons.

Vessel Anchoring and Spuds

Vessels are not expected to anchor during O&M activities unless the Inter-array Cable or WTGs require maintenance. Impacts associated with potential vessel anchoring during operation are expected to be similar to but less frequent than those discussed in the Seafloor Preparation and Pile Driving/Foundation Installation section for the construction phase. Surveys for 1 year after the installation of the BIWF found no evidence of short- or long-term impacts to physical or biological habitats at the sites of anchor scarring — aside from the discrete disturbance of habitat. The survey data indicate recolonization of the disturbed seafloor by epifauna in less than 1 year (INSPIRE, 2017).

Sediment Suspension and Deposition

Increases in sediment suspension and deposition during O&M would primarily result from vessel anchoring and maintenance activities that require exposing the Inter-array Cable. Both activities are expected to be nonroutine events and are not expected to occur with regularity. Sediment suspension and deposition impacts to species targeted by commercial and recreational fisheries, because of vessel activity during SFWF O&M, are expected to be similar to vessel-related sediment suspension and deposition impacts described for the construction phase. Therefore, these impacts are expected to have similar ***negligible, short-term, indirect impacts*** on those commercial or recreational fisheries.

Noise

Impacts from vessel and aircraft noise during SFWF O&M are expected to be similar to the ***minor, short-term, indirect*** impacts described in the construction phase. Commercial and recreational fisheries are unlikely to experience direct impacts from WTG operational noise. Noise may have ***negligible*** to ***minor, indirect impacts*** on fisheries targeting the benthic and demersal species that experience direct impacts due to noise. Discussion of the information available for underwater noise impacts on benthic and demersal species may be found in Sections 4.3.2 and 4.3.3, respectively.

Electromagnetic Fields

EMFs from the SFWF Inter-array Cable may adversely impact certain finfish species and may result in ***indirect, negligible impacts*** on commercial and recreational fisheries that target those species. As described in Section 4.3.3 and Appendix K, the modeled EMF levels are below the level at which critical impacts on behavior are reported and are likely to have ***negligible impacts*** on marine organisms themselves.

Traffic

Impacts associated with traffic during O&M are expected to be similar to, but less frequent than, those discussed in the construction phase and may result in ***minor, short-term, direct impacts***.

Decommissioning

Decommissioning of the SFWF will have similar impacts as construction. After the SFWF is decommissioned, the area is expected to recover to pre-Project conditions.

South Fork Export Cable

Table 4.6-30 summarizes the level of impacts expected to occur to commercial and recreational fisheries during the construction and decommissioning phases of the SFEC and Table 4.6-31 summarizes the level of impacts expected to occur during the O&M phases of the SFEC. Cable installation and decommissioning activities are generally expected to have ***minor, short-term impacts*** on access to fishing grounds because of safety restrictions in the vicinity of construction vessels; and because of habitat modification that will impact some commercially and recreationally targeted species. O&M activities are expected to have some ***long-term, minor*** to ***moderate, direct impacts*** on certain commercial fisheries due to displacement of fishing activity and may have ***minor, beneficial impacts*** on recreational fisheries. Additional details on potential impacts to commercial and recreational fisheries from the various IPFs are described in the following sections.

Table 4.6-30. IPFs and Potential Levels of Impact on Commercial and Recreational Fisheries at the SFEC - OCS and SFEC - NYS during Construction and Decommissioning

IPF	Potential Impact	Maximum Level of Impacts
Seafloor Disturbance	Seafloor Preparation (PLGR)	Minor, short-term, direct Minor, short-term, indirect
	Pile Driving/Cofferdam Installation	Minor, short-term, direct Minor, short-term, indirect
	SFEC Installation	Minor, short-term, direct Minor, short-term, indirect
	Vessel anchoring (including spuds)	Minor, short-term, direct Minor, short-term, indirect
Noise	Ship, Trenching, and Aircraft Noise	Negligible, short-term, indirect
	Pile Driving (Cofferdam)	Minor, short-term, indirect
Traffic		Minor, short-term, direct
Visible Structures		Minor, short-term, direct
Sediment Suspension and Deposition		Negligible
Discharges *		Negligible
Trash and Debris *		Negligible

* Supporting information on the negligible level of impact from the Discharges and Trash and Debris IPFs is provided in Section 4.1.

Table 4.6-31. IPFs and Potential Levels of Impact on Commercial and Recreational Fisheries at the SFEC - OCS and SFEC - NYS during Operations and Maintenance

IPF	Potential Impact	Maximum Level of Impacts
Seafloor Disturbance	Cofferdam	No impact
	SFEC	Minor, short-term, direct, and indirect Moderate, long-term, direct
	Vessel Anchoring (including spuds)	Minor, short-term, direct Minor, short-term, indirect
Ship and Aircraft Noise		Negligible, short-term, indirect
Traffic		Negligible, long-term, direct
Visible Structures		Minor, long-term, indirect
EMF		Negligible
Sediment Suspension and Deposition		Negligible
Discharges *		Negligible
Trash and Debris *		Negligible

* Supporting information on the negligible level of impact from the Discharges and Trash and Debris IPFs is provided in Section 4.1.

SFEC – OCS

Construction

Seafloor Disturbance
IPFs associated with seafloor disturbance during construction of the SFEC – OCS components have been split into seafloor preparation, SFEC – OCS installation, and vessel anchoring (including spuds).

In general, seafloor disturbance is expected to produce negligible to minor levels of direct and indirect impacts to species, depending on the mobility of the species present, which would in turn, result in ***short-***and ***long-term, negligible*** to ***moderate levels of indirect impacts*** to commercial and recreational fisheries that target the directly impacted species. For all construction activities, seafloor disturbance is expected to result in ***minor, short-term, direct impacts*** on commercial and recreational fisheries due to the short-term disruption of access to fishing areas for safety. Additional indirect impacts to commercial and recreational fisheries from the various components of seafloor disturbance are described in the following paragraphs.

Seafloor Preparation
Seafloor preparation activities for the construction of the SFEC are expected to have similar impacts on commercial and recreational species as described for the SFWF. The impacts are expected to be ***minor, short-term, and indirect*** for fisheries targeting more mobile species, which are likely to temporarily vacate the area but may be subject to limited injury or mortality. These species are likely to return to the area after the construction phase. ***Minor*** to ***moderate, short-term, indirect impacts*** are expected for fisheries targeting less mobile species. For more information, see Section 4.3.2.

SFEC – OCS Installation

The installation of the SFEC – OCS is expected to have similar impacts as described for the installation of the SFWF Inter-array Cable. It is expected to have ***minor-to-moderate, short-term, direct impacts*** on benthic species due to habitat modification, depending on the mobility of the species. Therefore, the installation is expected to have ***minor, short-term, indirect impacts*** on commercial and recreational fisheries that target these species.

Vessel Anchoring and Spuds

Vessel anchoring and spuds will have ***minor, indirect impacts*** in the short-term to fisheries due to the impact on benthic habitat. The habitat is expected to experience rapid recovery after disturbance to benthic habitat (Guarinello et al., 2017). Vessel anchoring may result in ***direct minor*** and ***short-term impacts*** due to the displacement of habitat.

Sediment Suspension and Deposition
Sediment suspension and deposition impacts from construction of the SFEC – OCS are expected to have similar ***negligible impacts*** on commercial and recreational fisheries as those described for the SFWF Inter-array Cable.

Noise
Commercial and recreational fisheries are unlikely to experience direct impacts due to noise, because fishing activity would be temporarily restricted in the immediate area of the installation activities. The impacts from SFEC vessel and trenching noise during construction are expected to be similar to those described for the SFWF; ***negligible, short-term indirect***. Discussion of the information available for underwater noise impacts on benthic and demersal species is described in Sections 4.3.2 and 4.3.3, respectively.

Traffic
Traffic during the construction of the SFEC is expected to have similar impacts (***negligible, long-term, direct***) on commercial and recreational fisheries as those described for the SFWF.

Operations and Maintenance

Seafloor Disturbance

IPFs associated with seafloor disturbance during O&M of the SFEC – OCS have been split into SFEC maintenance (repairs) and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce ***negligible to moderate, direct and indirect impacts to fisheries***, depending on the mobility of the species present that are targeted by commercial and recreational fishermen. Additional indirect impacts to commercial and recreational fisheries from the various components of seafloor disturbance are described in the following paragraphs.

Maintenance of the SFEC is considered a nonroutine event and is not expected to occur with regularity. Impacts associated with exposing the SFEC would be similar but less frequent than those described for the construction phase.

Commercial and recreational fisheries are expected to experience ***negligible impacts*** from the presence of the SFEC because it will be buried beneath the seabed. However, some areas of the SFEC may require armoring, which may cause ***short-term, minor impacts*** on benthic or demersal species because of habitat modification. After recolonization, the armoring locations may provide ***long-term, minor-to-moderate, indirect, benefits*** to recreational fisheries that target certain recreational species that favor habitat in hardened structure. For additional information, see Sections 4.3.2 and 4.3.3. There is no planned restriction on fishing for any gear type in the vicinity of the SFEC. However, some fishermen may choose not to fish using bottom-tending (mobile) gears. In these instances, this shift in fishing activity would be a ***long-term, minor to moderate impact*** on bottom trawl and scallop dredge gears.

The potential use of armoring on the SFEC - OCS may cause **long-term, minor, negative impacts** on benthic species because of habitat modification, which may lead to **long-term, minor, indirect impacts** on commercial and recreational fisheries targeting these benthic species. Although there is no planned restriction on fishing for any gear type in the SFEC - OCS, some commercial fishermen may choose not to fish using bottom-tending (mobile) gears. This is interpreted as a **long-term, minor** to **moderate impact** on bottom trawl and scallop dredge gears that are used in the SFEC. However, fishing activity is expected to continue in areas near the SFEC - OCS after construction activities are completed. Commercial fishing activity using fixed gear (such as lobster pots) is expected to continue in nearby areas after installation is completed. The accidental snagging of mobile gear may affect commercial fishermen using mobile, bottom-tending gear (such as bottom trawl or scallop dredge). In the event of fishing gear interactions within the Project Area, there are draft guidelines that include the Orsted US Offshore Wind Fisheries Gear Loss Prevention & Claim Procedure, which is part of Appendix B, and is available on the Project website and provided to fishery liaisons.

<u>Vessel Anchoring and Spuds</u>

Vessels are not expected to anchor during O&M activities unless the SFEC requires maintenance. Impacts associated with potential vessel anchoring during O&M of the SFEC are expected to be similar to but less frequent than those described for the construction phase, and may include both ***minor, short-term, direct and indirect impacts***.

<u>Sediment Suspension and Deposition</u>

Impacts from increased sediment suspension and deposition to commercial and recreational fisheries in the SFEC – OCS during O&M are expected to be similar to the ***negligible impacts*** described for O&M of the SFWF Inter-array Cable.

Noise

Commercial and recreational fisheries are expected to experience ***negligible impacts*** from vessel or aircraft noise during the SFEC – OCS O&M phase. Impacts from vessel and aircraft noise during O&M of the SFEC are expected to be similar to, but less frequent than those described for the construction phase. Discussion of the information available for underwater noise impacts on benthic and demersal species may be found in Sections 4.3.2 and 4.3.3, respectively.

Electromagnetic Fields
EMF impacts to commercial and recreational fisheries from the SFEC during O&M are expected to be similar to the ***negligible impacts*** described for O&M of the SFWF Inter-array Cable.

Traffic
Traffic during the O&M of the SFEC is expected to have similar ***negligible, long-term, direct impacts*** on commercial and recreational fisheries as those described for the SFWF.

Decommissioning

Decommissioning of the SFEC – OCS would have similar impacts as construction. After the SFEC - OCS is decommissioned the area is expected to recover to pre-Project conditions.

SFEC - NYS

Construction

Seafloor Disturbance
IPFs associated with seafloor disturbance during construction of the SFEC – NYS have been split into seafloor preparation, pile driving for installation of the short-term cofferdam, SFEC – NYS installation, and vessel anchoring (including spuds).

In general, seafloor disturbance is expected to produce the same impacts as described for construction of the SFEC – OCS. Seafloor disturbance is expected to produce ***negligible to moderate direct and indirect impacts*** to species, depending on the mobility of the benthic species, shellfish, and finfish species present — which will in turn result in ***short-term and long-term, negligible to moderate indirect impacts*** to commercial and recreational fisheries that target the directly impacted species. For all construction activities, seafloor disturbance is expected to result in ***minor, short-term direct impacts*** on commercial and recreational fisheries due to the short-term disruption of access to fishing areas for safety. Additional indirect impacts to commercial and recreational fisheries from the various components of seafloor disturbance are described in the following paragraphs.

Seafloor Preparation
Seafloor preparation is expected to produce the same impacts (***minor, short-term, and indirect*** for fisheries targeting more mobile species and ***minor-to-moderate, short-term, indirect*** impacts for fisheries targeting less mobile species) as described for construction of the SFEC – OCS.

Pile Driving and Cofferdam Installation

Installation of a cofferdam will result in a ***minor, short-term, direct impact*** from short-term disruption of access to fishing areas. Construction of the cofferdam would result in ***moderate, short-term, direct impacts*** to species with limited mobility, and ***minor, short-term, direct*** impacts to mobile species, for those species that have preferred habitat in the SFEC - NYS area (Tables 4.3-4 and 4.3-10). Commercial fisheries that target these species may have ***minor, short-term, negative impacts*** (for species including ocean quahog clam, Atlantic surfclam, Atlantic sea scallop, and American lobster). There are ***no direct impacts*** expected for recreational fishing in the short or long-term.

SFEC - NYS Installation

The installation of the SFEC - NYS is expected to have the same impacts (***minor, short-term, indirect impacts***) as described for construction of the SFEC - OCS.

Vessel Anchoring and Spuds

Vessel anchoring and spuds are expected to produce the same impacts (***minor, indirect impacts***) as described for construction of the SFEC - OCS.

Sediment Suspension and Deposition
Sediment suspension and deposition are expected to produce the same ***negligible*** impacts as described for construction of the SFEC – OCS.

Noise
Commercial fisheries are unlikely to experience direct impacts of noise from pile driving for the cofferdam or from trenching or vessel activity because fishing activity will be temporarily restricted in the immediate area of the installation activities. The impacts from SFEC construction noise are expected to be similar to those described for the SFWF (***negligible, short-term*** and ***indirect***). Discussion of the information available for underwater noise impacts on benthic and demersal species may be found in Sections 4.3.2 and 4.3.3, respectively.

Shoreside recreational fishermen may be deterred from fishing in the vicinity of the cofferdam pile driving activity due to vibratory hammer sounds. This activity is expected to have a ***short-term, minor, direct impact*** on recreational fishing activity in the area.

Traffic
Traffic during the construction of the SFEC – NYS is expected to have similar impacts (***negligible, long-term,*** and ***direct***) on commercial and recreational fisheries as those described for the SFEC – OCS and the SFWF.

Visible Structures
The physical presence of visible structures is expected to produce the same impacts (***minor, short-term,*** and ***direct***) as described for construction of the SFEC – OCS.

Operations and Maintenance

Seafloor Disturbance
IPFs associated with seafloor disturbance during O&M of the SFEC – NYS have been split into cofferdam, SFEC maintenance, and vessel anchoring (including spuds). In general, seafloor disturbance is expected to produce ***negligible*** to ***moderate levels of direct*** and ***indirect impacts*** to fisheries, depending on the mobility of the benthic species, shellfish, and finfish species present that are targeted by commercial and recreational fishermen.

Cofferdam

The cofferdam will be a short-term structure used during the construction phase only. As described in Sections 4.3.2.2 and 4.3.3.2, no conversion of habitat is expected, and no long-term impacts are expected related to the displacement of fishing activity or species that are targeted by commercial and recreational fisheries. Therefore, the cofferdam is expected to have ***negligible, short-term, minor impacts*** to fisheries.

SFEC Cable

Impacts from maintenance and the presence of the SFEC – NYS are expected to be similar to those described for O&M of the SFEC – OCS (***long-term, minor*** to ***moderate impact*** on bottom trawl and scallop dredge gears and ***long-term, minor*** or ***moderate, indirect, beneficial impacts*** to recreational fisheries).

Vessel Anchoring and Spuds

Vessel anchoring and spuds are expected to produce the same impacts as described for O&M of the SFEC – OCS (***minor, short-term, direct*** and ***indirect impacts***).

Sediment Suspension and Deposition
Sediment suspension and deposition is expected to produce the same ***negligible impacts*** as described for O&M of the SFEC – OCS.

Noise
Ships and aircraft noise are expected to produce the same ***negligible impacts*** as described for O&M of the SFEC – OCS.

Electromagnetic Fields
Negligible impacts to finfish in the SFEC - NYS during O&M are expected to be similar to those described for the O&M phase of the SFEC – OCS and the SFWF Inter-array Cable.

Traffic
Traffic during the O&M of the SFEC – NYS is expected to have similar, ***negligible, long-term, direct impacts*** on commercial and recreational fisheries as those described for the SFEC – OCS and the SFWF.

<u>Decommissioning</u>
Decommissioning of the SFEC – NYS would have similar impacts as construction. After the SFEC – NYS is decommissioned, the area is expected to recover to pre-Project conditions.

4.6.5.3 Proposed Environmental Protection Measures
Several environmental protection measures will reduce potential impacts to commercial and recreational fishing.

- SFW is committed to a spacing of approximately 1.15 mile (1.8 km), or one nautical mile (nm), between turbines . The Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including sensitive shoreline habitats and shoreline fishing areas.
- As appropriate and feasible, BMPs will be implemented to minimize impacts on fisheries, as described in the *Guidelines for Providing Information on Fisheries Social and Economic Conditions for Renewable Energy Development* (BOEM, 2015).
- Siting of the SFWF, and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys.
- SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction.
- Each WTG will be marked and lit with both USCG and approved aviation lighting.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- Communications and outreach with the commercial and recreational fishing industries will be guided by the project-specific Fisheries Communication and Outreach Plan (Appendix B). This outreach will be led by the SFW Fisheries Liaisons. Fisheries Representatives from the ports of Montauk, Point Judith, and New Bedford represent the fishing community.
- SFW is committed to a Gear Loss Prevention and Claim Procedure for the commercial fishing industry.
- A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, a Project website, and public notices to mariners and vessel float plans (in coordination with USCG).

For information related to minimizing impacts to finfish and essential fish habitat resources, see Section 4.3.3, and for impacts to benthic resources, see Section 4.3.2.

4.6.6 Commercial Shipping

This section discusses the commercial shipping activities that may be impacted by the construction, O&M, or decommissioning of the proposed SFWF and SFEC. The section is supported by a detailed navigational safety risk assessment (NSRA) prepared for the SFWF and included in Appendix X. The NSRA includes a detailed analysis of marine traffic, possible interference with navigation, and assessment of risk of collision with other vessels, or allision with fixed structures, such as WTGs. Although the NSRA addresses all types of vessel traffic, this section focuses on the findings specific to commercial shipping. The NSA was prepared in accordance with USCG guidance for Offshore Renewable Energy Installations (OREIs), as noted in the Navigation and Vessel Inspection Circular (NVIC) 01-19, as presented in Appendix X. Consultations were also held with the USCG and marine transportation stakeholders.

An overview of commercial shipping in the SFWF and SFEC is presented in Section 4.6.6.1. A summary of potential impacts from SFWF and SFEC activities on commercial shipping, including results of the NSRA, is provided in Section 4.6.6.2 for each of the relevant IPFs described in Section 4.1.

4.6.6.1 Affected Environment

Regional Overview

Commercial shipping within the region includes cargo vessels transiting to or from ports in the Narragansett Bay, Buzzards Bay, and Long Island Sound area. It also includes vessels transiting between a variety of other ports including the Port of New York and New Jersey, the Port of Boston, and other ports located on the east coast or abroad (RI CRMC, 2010).

South Fork Wind Farm and South Fork Export Cable

Because similar data and maps will be used to describe the impacted environment for the SFWF and SFEC, they are described together in this section.

Marine transportation in the Block Island and Rhode Island Sounds region is characterized by a range of vessel types and activities. Commercial shipping involves the transport of goods such as petroleum products, coal, and cars through this area, while passenger ferries and cruise ships transport people between nearby coastal communities. Pilot boats, government enforcement vessels, and search and rescue vessels provide critical support to commercial vessel operations and facilitate safe navigation (RI CRMC, 2010).

For the purposes of this section, commercial shipping refers to the activity of tankers, cargo vessels, tugs, and barges. Vessels in the SFWF and SFEC that fall under other categories are discussed in the NSRA report (Appendix X) and in the following sections of the COP:

- Recreation and Tourism – Section 4.6.4
- Commercial and Recreational Fishing – Section 4.6.5
- Other Marine Uses – Section 4.6.8

Designated Commercial Shipping Lanes

The SFWF is located south-southeast of the entrance to Narragansett Bay and almost due south of the entrance to Buzzards Bay. There are two main shipping lanes and a marine traffic roundabout located west of the SFWF, as shown on Figure 1-3 in Appendix X. The North Lease area, including the SFWF, was defined by BOEM to avoid these shipping lanes and other marine space-use conflicts (see Section 2 for a discussion about the evolution of siting the SFWF).

The Narragansett Bay Traffic Separation Scheme roundabout (Figure 2-2, Appendix X) is a routing measure aimed at the separation of opposing streams of traffic by the establishment of shipping lanes, shipping zones, recommended routes, and precautionary areas (U.S. Department of Homeland Security, 2010). Vessel traffic and navigation in the area may at times be impacted by restrictions. The SFWF and SFEC are within the Narragansett Bay Special Operating Area (OPAREA) Complex boundary, within which national defense training exercises are routinely conducted (NOAA, 2018). The OPAREA includes Block Island Sound and Rhode Island Sound, and extends seaward to the south. The SFWF also lies within a seasonal North Atlantic right whale speed-restriction area, which requires seasonal vessel speed reductions (NOAA, 2017e).

No designated commercial shipping lanes are located along the SFEC route, as shown on Figures 1-3 and 2-33 in Appendix X.

Vessel Traffic

Marine traffic patterns in the area were assessed using Automatic Identification System (AIS) data. AIS data on vessel traffic are collected by the USCG through a navigation safety device that transfers large vessel information in real time. All self-propelled vessels of more than 1,600 gross tons are required to carry AIS, with certain exceptions made for foreign vessels. These data provide a quantifiable and reliable method to determine the primary traffic patterns and analyze the size, speed, and movements of vessels in the region. As described in Appendix X, AIS data were obtained for the most recent available full-year period, July 2018 to June 2019 (2018-07-01 to 2019-06-30). AIS data allow the traffic to be converted into vessel tracks that are conducive to a quantitative analysis. For instances when the AIS data did not appear to provide sufficient information to fully depict the traffic patterns, the AIS maps were supplemented with data obtained from the Northeast Ocean Data portal.

The AIS data show that traffic is most dense through Rhode Island Sound and along the traffic separation zones. The Narragansett Bay traffic separation zone, with commercial traffic transiting north-south, is more than 7 nm (13 km) to the northwest of the SFWF. Traffic continues transiting from the Narragansett Bay traffic separation zone in a north-south direction past the SFWF through the precautionary zone. To the north of the SFWF, the Buzzards Bay traffic separation zone is more than 4 nm (7.4 km) from the SFWF and more than 1.5 nm (2.8 km) from the northwesternmost portion of the lease area (Figure 2-3 of Appendix X). Vessel traffic is also indicated along the general route of the SFEC, but additional analysis in Appendix X indicates that closer to the Long Island and Block Island shorelines, to the northwest of the SFWF, this traffic is primarily tugs and tow boats, with the larger cargo vessels transiting further offshore than in the location of the SFEC route.

Appendix X indicates that the traffic density shows relatively low AIS point density in the SFWF. In line with the calculated vessel tracks, there are areas of higher density north of the lease area. East Passage has areas of high density that continue through the pilot boarding area and the north-south Narragansett Bay Traffic Separation Zone (Figure 2-4 and Appendix B of Appendix X).

Deep draft commercial vessels (cargo/carriers and tankers) transit the main shipping routes following the designated traffic separation zones as is expected. Deep draft vessels predominantly transit three main courses, primarily outside of the SFWF as depicted on Figure 2-6 of Appendix X. In the vicinity of the SFWF, cargo vessels show greatest traffic density following the Traffic Separation Scheme into Narragansett Bay, with some traffic traversing the SFWF WTG area (indicated as “low” frequency on the density map).

Passenger vessels (including ferries and cruise ships) tend to strictly follow Narragansett Bay inbound and outbound lanes to and from East Passage (Figure 2-13 of Appendix X), in the same routes taken by deep draft vessels. This route transits to the west of the SFWF and diverges south after the defined precautionary area, which consists of vessels operating between Narragansett Bay or Buzzards Bay and an established traffic lane. Routes for smaller passenger and pleasure/recreational vessels are relatively dense near the coast and without established routes elsewhere.

The AIS tracks for tugs are concentrated primarily to the northwest of the lease area, as shown on Figure 2-15 of Appendix X. Tugs transit to and from various port locations, with the southernmost location being New Harbor in Great Salt Pond on Block Island, and other locations north of Point Judith, Rhode Island. Tug and tow vessel traffic is reported to track closer to the coasts of the nearby coastal states and rarely transits the SFWF WTG area.

AIS tracks for “other” vessel types, which include AIS vessel subcategories that do not successfully fit into other defined categories, such as research vessels, “special vessels,” and drill ships. From the data set, these vessels appear to rely less on defined shipping channels but still occasionally transit Narragansett Bay inbound and outbound lanes to the west of the SFWF project area. Areas of tracks are present that indicate systematic vessel movements, which typically indicate movements of a research vessel (Figure 2-16 of Appendix X).

Additionally, the SFEC – OCS will cross the southern seaward edge of the Narragansett Bay Traffic Separation Scheme and the vessel traffic paths leading to Narragansett Bay. As the SFEC – OCS and SFEC – NYS approach the southern coast of eastern Long Island, only tugs, towing vessels, fishing vessels, and recreational boats are expected to occur. Much of the vessel traffic that transits the SFEC – OCS through the north-south Narragansett Bay Traffic Separation Zone will largely be deep draft vessels (cargo/carrier and tankers); the normal traffic patterns of these transits are not expected to be significantly disrupted by the SFEC.

Vessel Statistics

The analysis in Appendix X shows the distribution of vessel types that transit in the lease area. Vessel traffic is generally equivalent between different types of vessels, including pleasure, fishing, tug/service, and passenger vessels (Figure 2-5 of Appendix X).

Vessel Size

This section describes the average vessel sizes by vessel type and the number of vessels within the SFWF. For deep draft vessels, the AIS-recorded size is likely close to reality. For smaller vessels, AIS may overestimate their average sizes because, typically, only the largest vessels are equipped with AIS transponders. Table 3-2 in Appendix X presents the average dead-weight tonnage (DWT), length overall (LOA), and beam for the vessel types near and within 5 miles (8 km) of the SFWF. As expected, tankers (both with hydrocarbon cargo and non-hydrocarbon cargo) are the largest in terms of DWT, as well as being one of the largest vessel types in terms of LOA. Cargo/carriers, tankers, and passenger vessels are the largest in terms of LOA and beam.

Traffic Speed

The NSRA also evaluated vessel speeds in the study area by vessel type. Table 3-3 of Appendix X presents the total AIS data set speed profile; most vessel transits are between 8 and 12 knots.

4.6.6.2 Potential Impacts

Construction, O&M, and decommissioning activities associated with the Project have the potential to cause direct and indirect impacts on commercial shipping activity as discussed in the following sections. IPFs associated with the Project phases are described in Section 4.1.

An overview of the potential impacts on commercial vessel activity due to Project activities is presented on Figure 4.6-6.

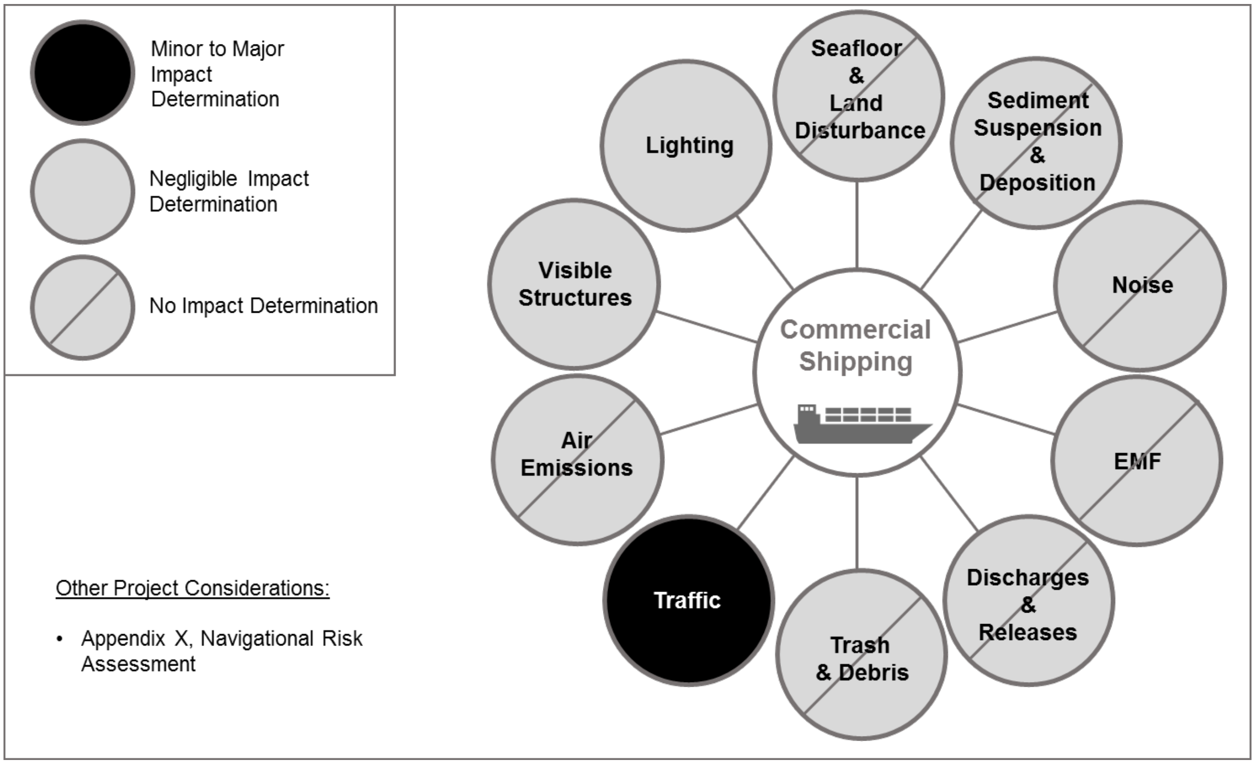

Figure 4.6-6. IPFs on Commercial Shipping

Illustration of potential impacts to commercial vessel activity resulting from SFWF and SFEC activities.

South Fork Wind Farm

The NSRA did not identify major areas of concern regarding the SFWF impact on marine navigation. The SFWF is located in open water over 4 nm (7.4 km) from high-vessel density deep draft commercial shipping lanes, approximately 19 miles (30.6 km, 16.6 nm) southeast from the closest land mass (Block Island), and approximately 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York. The layout of the SFWF conforms to the recommendations in the USCG MARI PARS final report concerning WTG layout, including a standard and uniform grid with approximately 1.15 mile (1.8 km, 1 nm) by 1.15 mile (1.8 km, 1 nm) spacing that aligns with other proposed adjacent offshore wind projects in the Rhode Island/Massachusetts Wind Energy Area (USCG 2020).

Construction

Traffic

Given the Project location relative to major commercial shipping lanes (not including commercial fishing), there is not expected to be a significant disruption of the normal traffic patterns during the construction or installation of the SFWF. The number of vessels that will operate during the SFWF construction phase is expected to result in a ***negligible to minor impact*** and risk addition to normal traffic patterns.

SFWF construction is anticipated to take place in work windows for specific construction activities that will limit the number of vessels introduced to local traffic at one time. Potential tasks to be completed individually in a work window include monopile foundation installation, offshore cable line installation, and final WTG installation. The vessels that are anticipated to be present during construction of the SFWF include construction barges, support tugs, jack-up rigs, supply/crew vessels, and cable laying vessels. These vessels will also be present in the region during decommissioning of the SFWF. The highest navigation risk during construction would be smaller vessels operating close to construction and work vessels during construction operations.

This risk is mitigated by a safety zone that is anticipated to be implemented by USCG during construction operations (Section 4.6.6.3).

Informal consultation with the Northeast Marine Pilots Association indicates that the SFWF may have a ***negligible*** to ***minor impact*** on commercial traffic in the region during construction. The minor impact identified could occur occasionally when vessels, primarily passenger vessels, would request to deviate from the north-south traffic separation zone and request to transit to the southeast to reach Boston. During construction of the SFWF, the pilotage association would assess the requests on a case-by-case basis to determine whether the vessel can safely transit southeast around or through the SFWF.

Lighting
USCG-approved navigation lighting is required for Project-related vessels during construction, O&M, and decommissioning. Project-related vessels operating between dusk and dawn are required to turn on navigation lights. Vessel and equipment lighting used during construction will be temporary as vessels travel between the shore and SFWF and conduct construction activities at the SFWF. Therefore, potential impacts from lighting during construction of the SFWF is expected to be ***negligible*** and ***short-term***.

Operations and Maintenance

Traffic
Based on discussions with USCG Sector Southeastern New England, it is confirmed that there is not expected to be safety or exclusion zones during operation of the SFWF. Therefore, vessels are free to navigate within, or close to, the SFWF. It is expected that mariners, including SFWF service vessels, would strictly adhere to all the International Regulations for Preventing Collisions at Sea 1972 (COLREGs) and be aware of the prevailing environment and situation to avoid unsafe situations. The WTG layout at the SFWF provides sufficient sea room for most vessels to transit between WTGs if the risks have been considered and a vessel is transiting at a safe speed per COLREGs. In addition, it is expected that deep draft and commercial vessels (excluding commercial fishing vessels) will not choose to transit through or near the wind farm because the SFWF is more than 4 nm (7.4 km) from major commercial shipping lanes (excluding commercial fishing frequented areas) and directly east of the precautionary area after the traffic separation zones end.

Assessment of collision, allision, and grounding annual frequency was conducted for current traffic conditions ("Base Case") and for traffic conditions after operation of the SFWF ("Future Case"). There is an overall small increase of predicted incident frequencies from the Base Case to the Future Case. The frequency of marine accidents is estimated to increase by 0.04 accidents per year in the study area and the effect from the Project represents less than 1 percent increase (Appendix X).

The slight predicted increase in incidents is attributable to risk of allision with a WTG foundation and to grounding risk for pleasure vessels (not near the Project, but due to modeling assumption that additional pleasure vessels would transit to Project area.

This small increase in traffic incident frequency represents a ***negligible*** to ***minor impact*** on commercial shipping.

The NRSA (Appendix X) also analyzed the impact of the SFWF on visual navigation and potential impacts on collision avoidance. The USCG reported that the largest concern would be the ability of mariners to see through the SFWF to the traffic on the other side. Analyses presented in Appendix X concluded that the SFWF would pose a minimal visual obstruction to mariners transiting through or past the SFWF. In addition, the SFWF would not have an adverse impact on a mariner's ability to use marked Aids to Navigation (ATON) as described in Appendix X.

SFW's informal consultation with the Northeast Marine Pilots Association indicates that the Association feels that the SFWF is not expected to have a significant impact on commercial traffic in the region during O&M. The SFWF is located far enough from commercial traffic lanes that with proper navigational marking, it is not expected to pose adverse impacts on commercial traffic. A ***minor impact*** identified is that occasionally vessels, primarily passenger vessels, would request to deviate from the north-south traffic separation zone and request to transit to the southeast to reach Boston. During O&M of the SFWF, the pilotage association would assess requests for determining vessel transit around or through the SFWF.

Visible Structures

Because of the spacing between WTGs and the linear WTG placement, the structures are not anticipated to significantly increase risk to vessels operating within the boundaries of the SFWF. Any risk increase is considered a ***negligible impact***.

As described in the Traffic IPF section (Section 4.1), a small increase of 0.04 accidents per year is estimated in annual marine incidents (from collision, allision, and grounding) in the NRSA study area from the presence of the SFWF (Appendix X). Potential consequences of a powered allision are detailed further in Section E of Appendix X, which describes the impact analysis of vessels with a WTG. Although potential consequences have the possibility of being severe, it is important to consider the frequency of powered allisions when considering the consequence. Not all vessel types could cause severe consequences. The vessel types that have the potential to cause severe consequences are cargo/carrier and tankers (regardless of product). When combining the frequency of these vessel types in the SFWF, the resulting frequency of any powered allision is extremely low (<.0005).

The NSRA also evaluated the impact the SFWF could have on normal operations, including anchorage areas. As described in Appendix X, the SFWF is expected to have ***no impact*** on vessel anchorage operations.

Lighting

Project lighting will meet BOEM and USCG requirements. USCG-approved navigation lighting is required for all vessels, for the OSS platform, and for WTGs during operation so that the vessels and structures are visible to other vessels and aircraft.

Impacts of navigational lighting on commercial shipping during O&M are considered ***long-term*** and ***negligible***. In fact, the lighting serves as a required safety feature for navigating vessels.

Decommissioning

Decommissioning of the SFWF is expected to have similar impacts on commercial shipping as those described for the construction phase. Ultimately, commercial shipping activity in the SFWF area is expected to return to pre-Project conditions when the facility is decommissioned.

SFEC – OCS and SFEC – NYS

Construction

Traffic

Given the Project location relative to major commercial shipping lanes (not including commercial fishing), there is not expected to be a significant disruption of the normal traffic patterns during the construction of the SFEC. The number of vessels that will operate during the SFEC construction phase is expected to have a ***negligible impact*** to normal traffic patterns. Other traffic-related impacts on commercial shipping during construction of the SFEC are expected to be similar to those described for the SFWF construction phase.

In addition, based on informal consultation with the Northeast Marine Pilots Association, ***no impacts*** or issues on navigation are anticipated as a result of the SFEC or SFEC route (Section 3.3 of Appendix X).

Operations and Maintenance

Traffic

Impacts associated with traffic during O&M are expected to be similar to, but less frequent than, those discussed in the construction phase.

Visible Structures

Although not visible, the impact of the presence of the SFEC on anchorage areas was evaluated in the NSRA (Appendix X). There are no designated anchorage areas within the vicinity of the SFEC route. Therefore, the SFEC would not interfere with normal vessel anchorage activities. However, deviations from "normal" anchorage activities have the potential to introduce additional risk of damage to the SFEC. Ships rarely drop anchors, especially outside of normal operations, but a vessel could damage the SFEC if it dropped an anchor directly on top of the SFEC or dragged it across the SFEC. However, as described in Section 4.6.6.3, proper marking of the SFEC on navigation charts would reduce this risk.

Decommissioning

Decommissioning of the SFEC is expected to have similar impacts on commercial shipping as described for the construction phase. Ultimately, the SFEC is expected to return to pre-Project conditions.

4.6.6.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to commercial shipping.

- SFW is committed to a spacing of approximately 1.15 mile (1.8 km, 1 nm), or 1 nm, between turbines. Each WTG will be marked and lit with both USCG and approved aviation lighting. AIS will be installed at the SFWF marking the corners of the wind farm to assist in safe navigation.
- All appropriate lighting and marking schemes, based on current regulations, will be implemented.
- SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges.
- Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
- Project construction, O&M, and decommissioning activities will be coordinated with appropriate contacts at USCG and DOD command headquarters.
- A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, Project website, and public notices to mariners and vessel float plans (in coordination with USCG).

4.6.7 Coastal Land Use and Infrastructure

This section describes the affected environment and provides an assessment and discussion of potential impacts for existing coastal land use and infrastructure during construction, O&M, and decommissioning of the SFWF and SFEC. To characterize existing coastal land uses and infrastructure within the vicinity of the various Project components, current public data sources related to land use and zoning in East Hampton, Suffolk County, and on eastern Long Island, including local and state-agency published reports and the Visual Impact Assessment for the SFWF (Appendix V) were reviewed.

4.6.7.1 Affected Environment

The affected environment for the SFWF includes the area surrounding the SFWF O&M facility. The affected environment for the SFEC includes the lands along the potential onshore routes for the SFEC – Onshore from the sea-to-shore transition vault at the potential landing sites on the south coast of Long Island to the SFEC – Interconnection Facility. The previous sub-sections within Section 4.6, Socioeconomics, provided a detailed presentation of the demographic and economic setting for the SFWF and SFEC. The following sections focus on the limited coastal areas that may be impacted by anticipated Project activities.

Regional Overview

The SFWF and much of the SFEC will be located on the southern New England OCS, on the northern end of the Mid-Atlantic Bight. Existing coastal land uses in the region consist of the developed and undeveloped coastlines of New York, Connecticut, Rhode Island, and Massachusetts. The coastal areas closest to the SFWF and SFEC are Block Island, Rhode Island; eastern Long Island, New York; and Martha’s Vineyard, Massachusetts.

South Fork Wind Farm

There are no existing coastal uses or infrastructure within the lease area where the SFWF will be located. Existing marine uses of this area are addressed in Section 4.6.4, Recreation and Tourism; Section 4.6.5, Commercial and Recreational Fishing; Section 4.6.6, Commercial Shipping; and, Section 4.6.8, Other Marine Uses.

However, the SFWF includes a land-based O&M facility that will be built to support SFWF O&M activities (Section 3.1.2.5). The O&M facility will be in an existing port either in Montauk, East Hampton, New York or in Quonset Point, North Kingstown, Rhode Island.

Coastal land use and infrastructure within Montauk and Quonset Point are characterized as established maritime commercial and industrial areas with nearby population centers. Montauk is the easternmost area of the South Fork of Long Island, supports the largest commercial fishing port in New York State, and consists of high density commercial and residential development with large seasonal population influxes from recreation and tourism (Liquori and Nagle, 2005). Quonset Point is a multimodal business park consisting of marine terminal facilities, airport, and mixed commercial and industrial uses located on Narragansett Bay. The *Quonset Business Park Master Land Use* categorizes the districts within the park that support waterfront and water-dependent uses and the planning and regulatory processes for future uses (Maguire Group Inc., 2008).

SFEC – OCS and SFEC – NYS

The coastal land use and infrastructure associated with the SFEC – OCS and SFEC - NYS are similar to the broader regional and SFWF settings. Both segments occupy areas of open water with no existing coastal infrastructure.

SFEC – Onshore

The SFEC – Onshore is the onshore component of the export cable that extends from the landing site to the SFEC – Interconnection Facility. Generally, as shown on Figures 4.6-7 and 4.6-8, the existing land uses along the SFEC – Onshore are predominantly low-medium residential (all single-family residences), commercial land, and vacant land (undeveloped land not reserved as a community preservation area or a nature preservation area). The surrounding land uses and adjacent to the SFEC – Onshore also include commercial, transportation (i.e., land associated with the LIRR and East Hampton Airport), industrial, agricultural, institutional/community facilities (including schools, libraries, fire departments, police stations, religious centers, and recreational facilities utilized by children and the community), recreational uses (parks and recreational clubs), and open space.

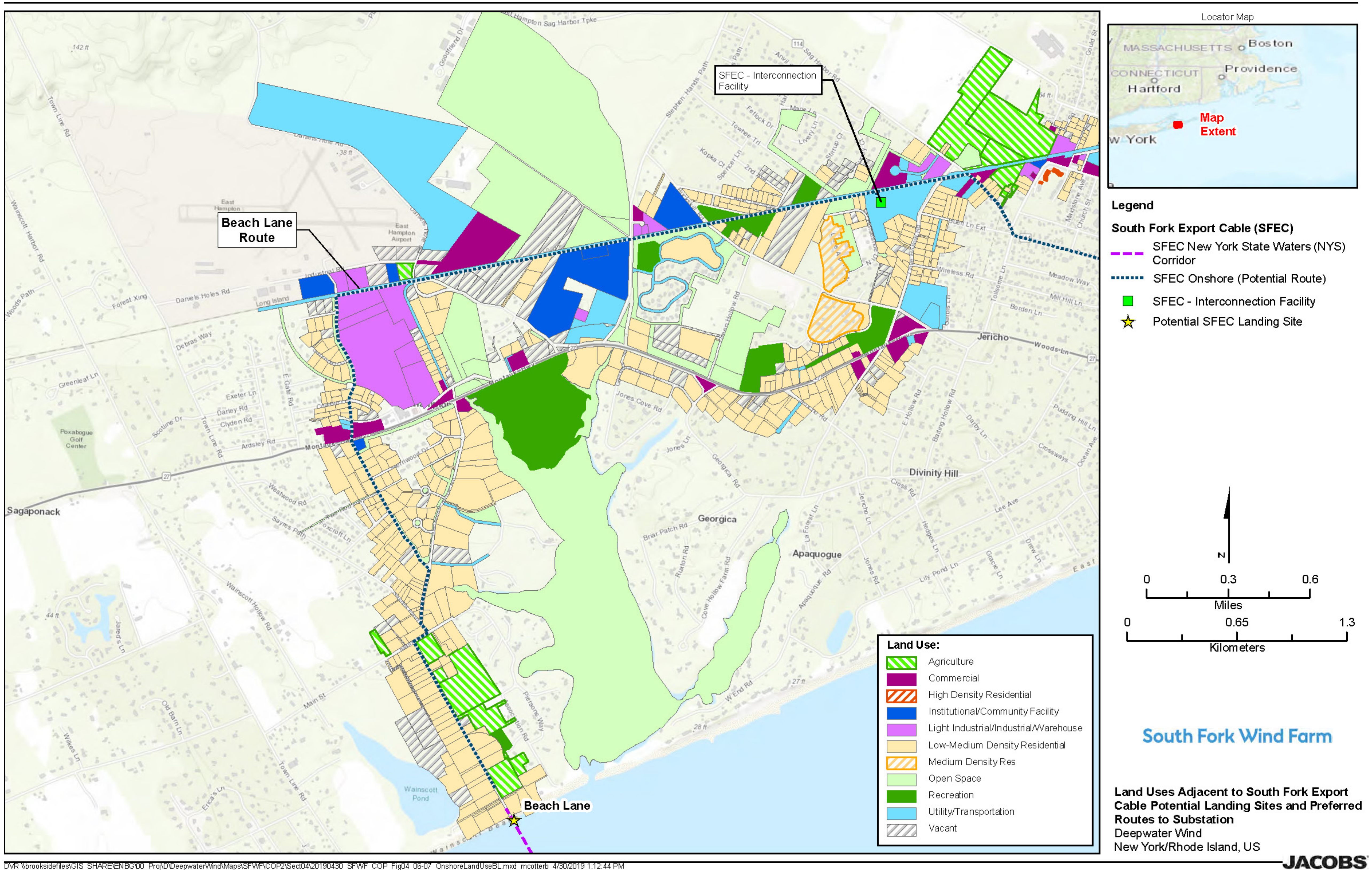

Figure 4.6-7. Existing Land Uses at Beach Lane Landing Site and along the SFEC – Onshore Route

Depiction of the existing land uses along the SFEC – Onshore route from Beach Lane landing to the SFEC – Interconnection Facility.

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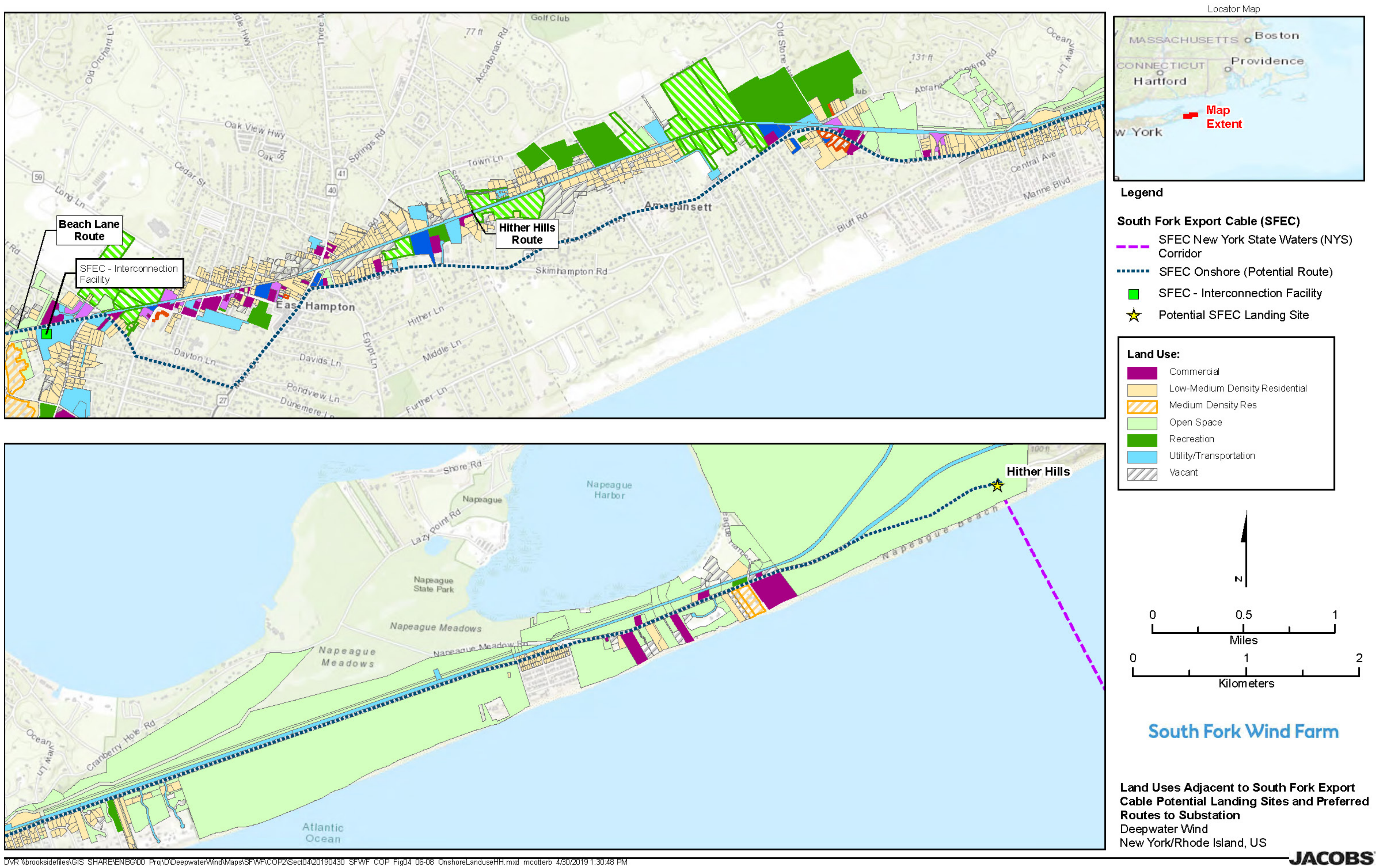

Figure 4.6-8. Existing Land Uses at Hither Hills Landing Site and along the SFEC – Onshore Route

Depiction of the existing land uses along the SFEC – Onshore route from the Hither Hill landing to the SFEC – Interconnection Facility.

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4.6.7.2 Potential Impacts

The IPFs associated with the construction, O&M, and decommissioning phases for the SFWF and SFEC are defined in Section 4.1 and illustrated on Figure 4.6-9.

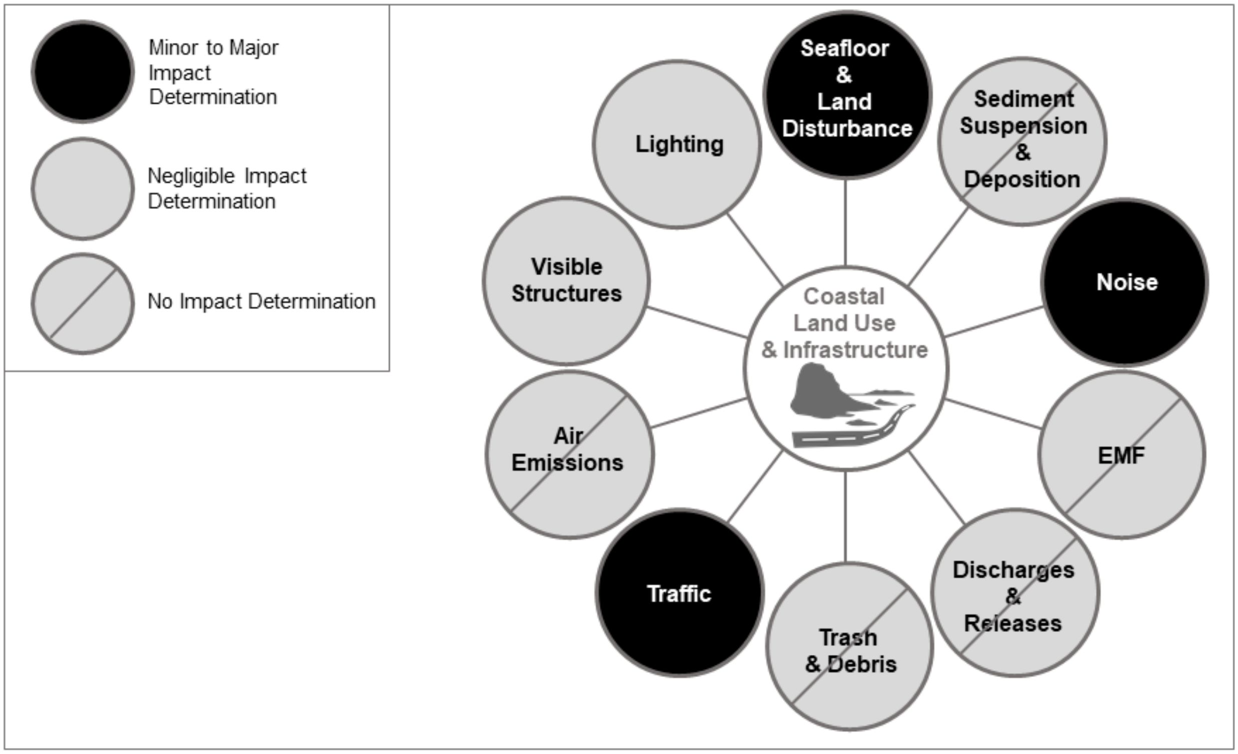

Figure 4.6-9. IPFs on Coastal Land Use and Infrastructure
Illustration of potential impacts to coastal land use and infrastructure resulting from SFWF and SFEC activities.

South Fork Wind Farm

The SFWF is not expected to have major long-term impacts on coastal land use and infrastructure. Impacts are expected to be ***negligible to minor, localized,*** and ***short-term,*** with the exception of permanent infrastructure placement.

<u>Construction</u>

Land Disturbance
The SFWF O&M facility will be in an existing developed area and existing port either in Montauk, East Hampton, New York or in Quonset Point, North Kingstown, Rhode Island.

Because SFWF activities at these sites are consistent with the existing uses in those areas, ***negligible, direct impacts*** to coastal land use and infrastructure from construction of onshore facilities are anticipated.

Traffic
Section 4.1.7 discusses marine vessel and land traffic that could be generated by the SFWF construction. Increased marine vessel and vehicular traffic at port facilities during SFWF construction will result in ***negligible*** to ***minor impacts*** relative to existing traffic conditions at those ports but would be relatively ***short-term*** in duration. Therefore, traffic impacts on existing infrastructure during construction are expected to be ***short-term*** and ***negligible***.

Visible Structures / Lighting
There could be ***short-term, negligible impacts*** to other coastal land uses from Project-related visible structures during construction during establishment of the SFWF O&M facility in Montauk or

Quonset Point. Despite incremental changes to visible coastal infrastructure during the SFWF, construction will be consistent with existing land uses and lighting in these ports.

Operations and Maintenance

No impacts to coastal land use and infrastructure are anticipated during O&M of the SFWF. The SFWF O&M facility will be in an existing developed area and will be consistent with existing land uses.

Decommissioning

Potential impacts to coastal land use and infrastructure during decommissioning of the SFWF would be similar to those described for construction activities, if removal of Project components occurs with the use of similar equipment and methods.

SFEC – OCS and SFEC – NYS

Construction

No impacts to coastal land use and infrastructure are anticipated during construction of the SFEC – OCS and SFEC – NYS. However, the same potential impacts related to port activities described for the SFWF apply to SFEC construction.

Operations and Maintenance

No impacts to coastal land use and infrastructure are anticipated during O&M of the SFEC – OCS and SFEC – NYS.

Decommissioning

No impacts to coastal land use and infrastructure are expected during decommissioning of the SFEC – OCS and SFEC – NYS.

SFEC - Onshore

Construction

Land Disturbance

The SFEC – Onshore will be constructed entirely underground within existing county, town, and LIRR road and railroad ROW, respectively. Therefore, construction-related land disturbance of the SFEC – Onshore is expected to have ***negligible*** and ***short-term impacts*** to current land uses within, adjacent, or proximate to the SFEC – Onshore cable routes.

The SFEC – Interconnection Facility will be constructed on leased private land, on the same parcel as the existing LIPA substation in the town of East Hampton's Commercial Industrial zoning district. The construction of the SFEC – Interconnection Facility will enlarge the commercial footprint on an approximately 18-acre (7.28-ha) parcel comprised of woodland and the existing 69 kV LIPA substation currently zoned for a utility land use. ***Minor*** and ***short-term impacts*** would result from the construction of the SFEC – Interconnection Facility.

Noise

Impacts from noise will be short-term, generally resulting from traffic or construction equipment. Construction noise levels are expected to meet all applicable construction noise federal, state, and local noise policy, guideline, and ordinance criteria (Appendix J3). ***Short-term, negligible*** to ***minor impacts*** to coastal land use and infrastructure from noise during construction could occur; however, these impacts will be limited to the construction areas along the SFEC - Onshore cable installation route, the sea-to-shore transition area (HDD), and near the SFEC – Interconnection Facility construction site.

Traffic

Impacts to local roadways and railroads are anticipated to be ***short-term*** and ***localized*** during construction of the sea-to-shore transition vault at either landing site and along the SFEC – Onshore routes to the SFEC – Interconnection Facility. It is expected that there would be short-term and localized increases in truck and construction equipment traffic on area roadways and along the LIRR ROW during construction and decommissioning phases. Periodic traffic restrictions will be in place for public and Project worker safety reasons but impacts on traffic are not expected to be permanent and result in changes to roadways and the railroad. Therefore, s***hort-term, negligible*** to ***minor impacts*** to existing traffic are expected as the result of the SFEC – Onshore construction and decommissioning.

Visible Structures / Lighting

As indicated by the viewshed analysis for the SFEC – Interconnection Facility (Appendix U), the physical presence of the SFEC – Interconnection Facility would result in ***long-term, negligible impacts*** from the new infrastructure introduced to the area. The new SFEC - Interconnection Facility replaces a wooded area. However, the addition of the SFEC – Interconnection Facility is consistent with surrounding land uses and would not constitute an incongruous alteration in local land use patterns. As a result, construction of the SFEC – Interconnection Facility is not anticipated to result in significant changes to the existing visual character or scenic quality of the area.

There may be ***short-term, negligible impacts*** from lighting on coastal land use and infrastructure during construction and decommissioning, depending on the duration and timing of these activities at the SFEC - Interconnection Facility, the sea–to-shore transition vault, and along the SFEC - Onshore corridor.

<u>Operations and Maintenance</u>

Land Disturbance

Operation and maintenance of the SFEC – Onshore would not alter established land uses. Because the SFEC – Onshore cable will be located entirely underground, no ongoing land disturbance is expected. The SFEC – Onshore would not impact present or future planned uses.

Operation of the SFEC – Interconnection Facility will be consistent with the existing land use at the East Hampton Substation and is not anticipated to adversely impact land uses in the area because operation will be within the existing property already zoned for utility land use. In addition, land uses surrounding the SFEC – Onshore route, north of the East Hampton Substation, consist of light industrial uses and the SFEC – Interconnection Facility will be consistent with these uses. Therefore, O&M-related land disturbance for the SFEC – Onshore is expected to have ***no impacts*** to current land uses within, adjacent, or proximate to the SFEC – Onshore.

Noise

Because there is no permanent noise-generating equipment associated with the SFEC - Onshore or the sea-to-shore transition, operational noise of the underground cable is expected have ***no impacts*** to current land uses within, adjacent, or proximate to the SFEC – Onshore. The SFEC-Interconnection Facility, as designed, will generate sound below existing ambient sound levels; therefore, operational noise levels are expected to be ***negligible***.

Traffic

During SFEC O&M, ***negligible, short-term impacts*** to the local transportation system would result if maintenance is required and the underground cable must be exposed. But, once inspection or maintenance is completed, no impacts to infrastructure would be expected.

Visible Structures / Lighting

The only visible structure associated with the SFEC – Onshore is the SFEC – Interconnection Facility. The presence of the SFEC – Interconnection Facility will not alter surrounding land uses but will add to the existing 69 kV LIPA substation and utility uses of the immediate area (Appendix U). Therefore, the visible presence of the SFEC – Interconnection Facility is expected to have ***negligible impacts*** to current land uses within, adjacent, or proximate to the existing LIPA onshore substation.

Decommissioning

Potential impacts to coastal land use and infrastructure during decommissioning of the SFEC would be similar to those described for construction activities.

4.6.7.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to coastal land use and infrastructure.

- SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROWs.
- The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
- SFW will coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.
- A SWPPP, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to adjacent lands uses during construction of the SFEC - Onshore.

4.6.8 Other Marine Uses

The potential for the SFWF and SFEC to impact other marine uses was evaluated based on identification of potential sources of Project-related routine and nonroutine activities and uses in the marine environment, and activities that could impact those uses (see Section 4.1, Summary of Impact-producing Factors). Other marine uses within the potentially affected environment are described in the following subsections, followed by an evaluation of potential Project-related impacts.

4.6.8.1 Affected Environment

This section describes the military (U.S. Navy), public, commercial, and recreational marine uses within the general vicinity of the lease area, the SFWF, and SFEC not previously described in Section 4.6.4, Recreation and Tourism; Section 4.6.5, Commercial and Recreational Fishing; and Section 4.6.6, Commercial Shipping. It characterizes these resources to provide a baseline to compare against proposed construction, O&M and decommissioning activities associated with the SFWF and SFEC.

Regional Overview

The location of the RI-MA WEA was selected based on extensive pre-screening conducted by BOEM (see Section 2 for a discussion regarding the evolution of the current lease area). One of the primary objectives of the pre-screening was to minimize conflicts with other marine uses. The screening utilized the wide array of data sources and marine spatial planning completed by both state governments and BOEM, including the OSAMP and the Massachusetts Ocean Management Plan. In addition, BOEM conducted extensive stakeholder outreach and public meetings to further define potential conflicts with other marine uses.

BOEM's NEPA review for the lease issuance included analysis of several geographic alternatives for the location of each WEA and evaluated these alternatives through an Environmental Assessment (BOEM, 2013). This NEPA review included further opportunity for public comment on the RI-MA WEA locations.

In general, the WEA area (Rhode Island Sound and surrounding waters, including Block Island Sound, and portions of Buzzards Bay, Long Island Sound, Nantucket Sound, and Narragansett Bay), are used for a wide range of commercial, military, and recreational activities. Commercial and recreational marine uses in the region include sailing, power boating, parasailing, sportfishing, marine wreck diving, and wildlife viewing (bird, dolphins, sharks, and whales) (INSPIRE and SeaPlan, 2016; RI CRMC, 2010; BOEM, 2013; INSPIRE, 2017). Recreational use generally peaks in the summer.

Military uses (U.S. Navy and other services, including Homeland Security [USCG]) in the region are largely because of the proximity to Naval Station Newport, Newport Naval Undersea Warfare Center (Rhode Island), Naval Submarine Base New London, and USCG Academy (New London) (BOEM, 2013; RI CRMC, 2010). The U.S. Atlantic Fleet conducts training and testing exercises in the Narraganset Bay OPAREA, as the Newport Naval Undersea Warfare Center routinely performs testing in the area (BOEM, 2013).

Several databases were researched to identify marine uses located within the SFWF and SFEC. The databases included NOAA nautical charts for the region and GIS websites published by the Northeast Ocean Data Portal Collaborative, the Mid-Atlantic Regional Council on the Ocean, and an interagency partnership between NOAA and BOEM. Marine uses investigated included ATONs, alternative energy facilities, anchorage areas, artificial reefs, passenger ferry routes, high-frequency (HF) radar locations, ocean disposal sites, pilot boarding areas, existing submarine cables and other cable areas, and unexploded ordnance (UXO). The proximity of these marine uses to the SFWF and SFEC are shown on Figure 4.6-10 and listed in Tables 4.6-32 and 4.6-33.

Aids to Navigation

The ATONs are structures intended to assist a navigator in determining position or safe course, or to warn of dangers or obstructions to navigation. This data set includes lights, signals, buoys, day beacons, and other ATONs. The ATONs in the region and near the SFWF and SFEC are shown on Figure 4.6-10 and listed in Table 4.6-32.

Alternative Energy Facilities

The BIWF, a 30-MW offshore wind farm located approximately 3 miles (5 km) southeast of Block Island, is the only active alternative energy facility in the region. There are several other lease areas in the region that are expected to support production and transmission of alternative energy within the next decade. The locations of the alternative energy facility and the lease areas are shown on Figure 4.6-10 and listed in Tables 4.6-32 and 4.6-33.

Anchorage Areas

An anchorage area is a location at sea where vessels can lower their anchors and moor the vessel. The locations usually have conditions for safe anchorage, providing protection from poor weather conditions and other hazards. They can also be used as a mooring area for vessels waiting to enter a port or for the short-term staging area for barges containing construction materials. The two anchorage areas near the SFWF and SFEC are illustrated on Figure 4.6-10 and listed in Table 4.6-32. The Brenton Point Anchorage is the closest anchorage site to the SFWF and SFEC. Gardiners Island Anchorage is the only anchorage area within New York State waters. This anchorage area is located approximately 5 miles (8 km) northwest of Montauk Point, east of Gardiners Island.

Artificial Reefs

The artificial reefs near the SFWF and SFEC are generally created from obsolete materials, such as small steel boats and other marine vessels, surplus armored vehicles, tires, and concrete pipes, and are used to provide critical habitat for numerous species of fish in areas devoid of hard-bottom (BOEM, 2013). The artificial reefs located in the region and near the SFWF and SFEC are shown on Figure 4.6-10 and listed in Table 4.6-32.

Passenger Ferry Routes

There are several passenger ferry services in the SFWF and SFEC areas that provide regular and seasonal transportation to Long Island, Block Island, Martha's Vineyard, and Nantucket. As shown on Figure 4.6-10 and listed in Tables 4.6-32 and 4.6-33, the passenger ferry service routes are initiated in either New York, Connecticut, Rhode Island, or Massachusetts. None of the ferry routes intersect with the SFWF or the SFEC. However, they do cross potential routes of materials and support vessels traveling from ports to the SFWF or SFEC. Passenger ferry in the SFWF and SFEC are also discussed in Section 4.6.4, Recreation and Tourism.

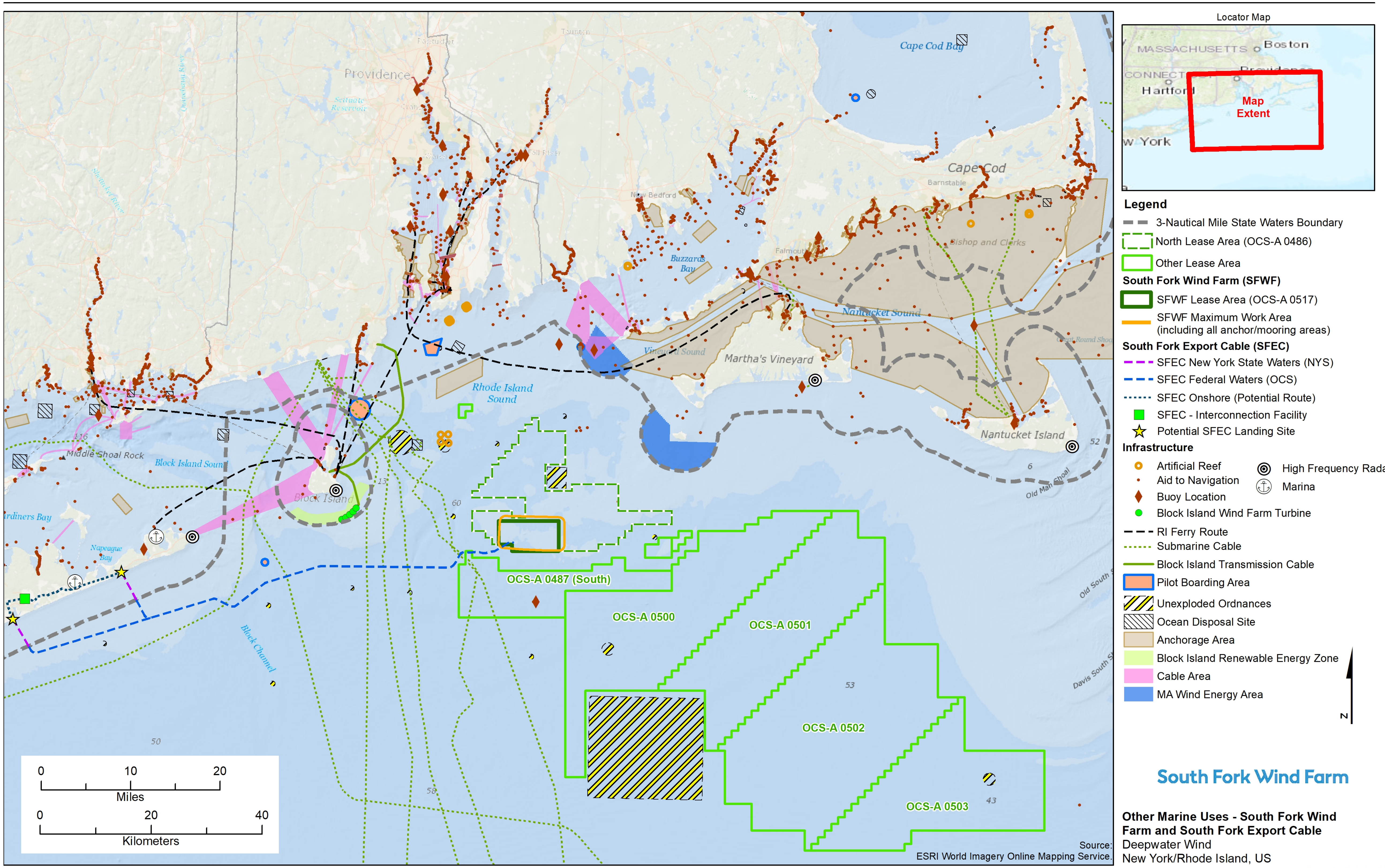

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Figure 4.6-10. Other Marine Uses - South Fork Wind Farm and South Fork Export Cable
Depiction of the proximity of other marine uses to the SFWF and SFEC Project Areas.

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High-Frequency Radar Locations

Preliminary modeling results and studies from Europe incorporating typical offshore wind farm configurations have indicated that wind turbines may have a negative impact on HF radar systems. Presently, however, there are no proposed metrics to develop specific mitigation measures to address HF radar interference. Further research and coordination between HF radar operators and offshore wind energy developers are needed before and after wind turbine installation to accurately investigate and mitigate potential radar interference by wind turbines and to establish standard mitigation measures that may be employed for wind turbine siting within the range of HF radar network (Ling et al., 2013).

Although not in the direct vicinity of the SFWF and SFEC, there are three civilian-operated HF radar stations in the region. The HF radar stations are shown on Figure 4.6-10 and listed in Table 4.6-32.

In addition to civilian-operated HF radar stations, SFW evaluated potential conflicts with NEXRAD and long-range radar systems in the vicinity of the SFWF. Based on review of the Department of Defense Preliminary Screening Tool, SFWF is located within the "yellow zone" for long-range radar, indicating that impacts are likely to air defense and homeland security radars. The closest six radar sites are Falmouth Airport Surveillance Radar model-8 (ASR-8), Nantucket ASR-9, North Truro Air Route Surveillance Radar model-4 (ARSR-4), Providence ASR-9, and the Riverhead ARSR-4. Two additional radar sites in the vicinity of SFW include the Boston Terminal Doppler Weather Radar (TDWR) and the Cape Cod Air Force Station (AFS) Early Warning Radar (EWR).

The SFWF will not be visible to four of these radar sites, including ASR-8, Nantucket ASR-9, North Truro ARSR-4, and Riverhead ARSR-4. The SFWF will not be visible to the Boston Airport Surveillance Radar model-9 (ASR-9) or Boston TDWR because both are beyond the instrumented range of the SFWF. The SFWF is located within the "green zone" for proximity to NEXRAD weather stations, such that impacts are not likely.

Ocean Disposal Sites

As shown on Figure 4.6-10, there are several ocean disposal sites in the region. The Rhode Island Sound Disposal Site listed in Tables 4.6-32 and 4.6-33 is the nearest ocean disposal site to the SFWF and SFEC.

Pilot Boarding Areas

Pilot boarding areas are locations at sea where pilots who are familiar with local waters board incoming vessels to navigate their passage to a destination port. Pilotage is required by law for foreign vessels and U.S. vessels under register in foreign trade with specific draft characteristics. Pilot boarding areas are represented by a 0.5-nautical-mile (0.9-km) radius around a coordinate point unless the coast pilot specifically designates a different radius or boarding area boundary. Pilot boarding areas in the region and near the SFWF and SFEC are illustrated on Figure 4.6-10 and listed in Table 4.6-33.

Submarine Cables and Cable Areas

There are seven existing submarine cables that run through OCS waters between the SFWF and Long Island, as illustrated on Figure 4.6-10 and listed in Table 4.6-33. Three of these submarine cables are active, while the other four are considered to be inactive. It is anticipated that the SFEC will intersect with the seven submarine cables in OCS waters and not within New York State waters. In addition, there are NOAA nautical chart cable areas shown on Figure 4.6-10; however, these areas do not necessarily mean that actual cables are present there (BOEM, 2013).

Unexploded Ordnance Sites

As noted, the U.S. Atlantic Fleet conducts training and testing exercises in the Narraganset Bay OPAREA, which includes Rhode Island and Block Island Sounds. In the past, the Navy established testing ranges for torpedo, depth charge, and mine testing in these waters. Today, UXO is a historically significant component of the seafloor landscape of these sounds. UXO is explosive weapons (e.g., bombs, bullets, shells, grenades, mines, torpedoes) that did not explode when they were deployed and still pose a risk of detonation. As shown on Figure 4.6-10 and listed in Tables 4.6-32 and 4.6-33, there are approximately 15 locations within the OCS waters and Rhode Island Sound waters where UXO disposal locations have been identified, with approximately seven of the UXO sites within 6 nm (11 km) of the RI-MA WEA (BOEM, 2013; Appendix H5). These UXOs may include depth charges, bombs, general ordnances, and a submerged torpedo. Construction and decommissioning of the WTGs, Inter-array Cables, and submarine export cable will likely avoid UXO sites shown on Figure 4.6-10 because they are not directly located within the SFWF or SFEC alignment. However, real time magnetometer surveys during construction, O&M, and decommissioning phases could further reduce risk from UXOs.

South Fork Wind Farm

As shown on Figure 4.6-10 and discussed, no other marine uses are identified within the SFWF. However, there is a wide array of other commercial, military, and recreational marine uses identified near the SFWF. The other marine uses that are near the SFWF are presented in Table 4.6-32.

Table 4.6-32. Other Marine Uses Near the SFWF

Marine Use Type	Specific Details	Approximate Distance and Direction from the SFWF
ATON	USACE Block Island Lighted Research Buoy 154	6 miles (10 km) southeast
Alternative Energy Facilities	BIWF	12 miles (19 km) northwest
	Commercial Lease OCS-A 0487	2 miles (3 km) south
	Commercial Lease OCS-A 0500	7 miles (11 km) southeast
	Commercial Lease OCS-A 0501	21 miles (33 km) southeast
	Commercial Lease OCS-A 0502	30 miles (48 km) southeast
	Commercial Lease OCS-A 0503	45 miles (72 km) southeast
Anchorage Areas	Brenton Point Anchorage Area is located within Rhode Island Sound	18 miles (29 km) north
Artificial Reefs	Located within Rhode Island Sound	9 miles (15 km) northwest
Passenger Ferry Routes	Connects Montauk, New York, to New Harbor, Block Island in approximately 1 hour by high-speed ferry and offers six trips a day during the peak season.	10 miles (16 km) northwest
	Connects Montauk, New York, to Martha's Vineyard, Massachusetts by a high-speed ferry. The ferry only offers a few trips a week.	7 miles (11 km) north
	Connects Montauk, New York, to Martha's Vineyard, Massachusetts by a high-speed ferry. The ferry only offers a few trips a week.	37 miles (59 km) northwest

Table 4.6-32. Other Marine Uses Near the SFWF

Marine Use Type	Specific Details	Approximate Distance and Direction from the SFWF
HF Radar	HF radar on Block Island, Rhode Island (two radars operated by University of Rhode Island and Rutgers University)	25 miles (40 km) east/northeast
	HF radar on Martha's Vineyard, Massachusetts (operated by Rutgers University)	40 miles (64 km) east
	HF radar on Nantucket Island, Massachusetts (operated by Rutgers University)	12 miles (19 km) northwest
Ocean Disposal Sites	Rhode Island Sound Disposal Site	6 miles (9 km) northwest
Unexploded Ordnance Sites	Six sites in OCS waters within Rhode Island Sound east of Block Island and nine sites in OCS waters south	Nearest two sites are 3 miles (5 km) west and 6 miles (10 km) northeast

South Fork Export Cable

The SFEC – OCS extends from the SFWF to the 3-mile (4.8 km) territorial waters limit and from there the SFEC – NYS extends to the landing site in East Hampton along the south coast of Long Island, New York on the Atlantic Ocean. As shown on Figure 4.6-10 and as discussed, there is a wide array of other commercial, military, and recreational marine uses identified near the SFEC – OCS. There are no other marine uses near the SFEC – NYS. The other marine uses that are near the SFEC – OCS are presented in Table 4.6-33.

Table 4.6-33. Other Marine Uses Near the SFEC – OCS

Marine Use Type	Specific Details	Approximate Distance and Direction from the SFEC – OCS
Alternative Energy Facilities	BIWF	12 miles (19 km) northwest
	Commercial Lease OCS-A 0487	2 miles (3 km) south
	Commercial Lease OCS-A 0500	7 miles (11 km) southeast
	Commercial Lease OCS-A 0501	21 miles (33 km) southeast
	Commercial Lease OCS-A 0502	30 miles (48 km) southeast
	Commercial Lease OCS-A 0503	45 miles (72 km) southeast
Passenger Ferry Routes	Connects Montauk, New York, to New Harbor, Block Island in approximately 1 hour by high-speed ferry and offers six trips a day during the peak season.	5 miles (8 km) north
	Connects Montauk, New York, to Martha's Vineyard, Massachusetts by a high-speed ferry. The ferry only offers a few trips a week.	9 miles (15 km) north
	Connects Montauk, New York, to Martha's Vineyard, Massachusetts by a high-speed ferry. The ferry only offers a few trips a week.	9 miles (15 km) north
Ocean Disposal Sites	Rhode Island Sound Disposal Site	20 miles (32 km) north

Table 4.6-33. Other Marine Uses Near the SFEC – OCS

Marine Use Type	Specific Details	Approximate Distance and Direction from the SFEC – OCS
Pilot Boarding Areas	Point Judith Pilot Station	27 miles (43 km) north
	Montauk Point Pilot Station	3 miles (4.8 km) north
Submarine Cables and Cable Areas	Intersection with seven cables (three active and four inactive) along export cable route in OCS waters.	Intersections occur at seven different locations along the SFEC - OCS.
Unexploded Ordnance Sites	Six sites in OCS waters within Rhode Island Sound, east of Block Island and nine sites in OCS waters south.	Four nearest sites are within 5 miles (5 km) south and 6 miles (10 km) north of the SFEC.

4.6.8.2 Potential Impacts

Project-related IPFs that could potentially result in impacts to other marine uses during the construction, O&M, and decommissioning phases of the SFWF and SFEC are described in this section. Impacts to other marine industries and activities are addressed in Section 4.6.4, Recreation and Tourism; Section 4.6.5, Commercial and Recreational Fishing; and Section 4.6.6, Commercial Shipping. The IPFs that are discussed in this section that may impact other marine uses are traffic, visible structures, and lighting. IPFs such as seafloor disturbance, discharges and releases, and trash and debris could have indirect impacts on some of the other marine uses included in this chapter but given the lack of direct impact with Project activities, these IPFs are dismissed as no impact for the remainder of this discussion. A summary of IPFs and the potential impacts to other marine uses associated with the SFWF and SFEC is presented on Figure 4.6-11.

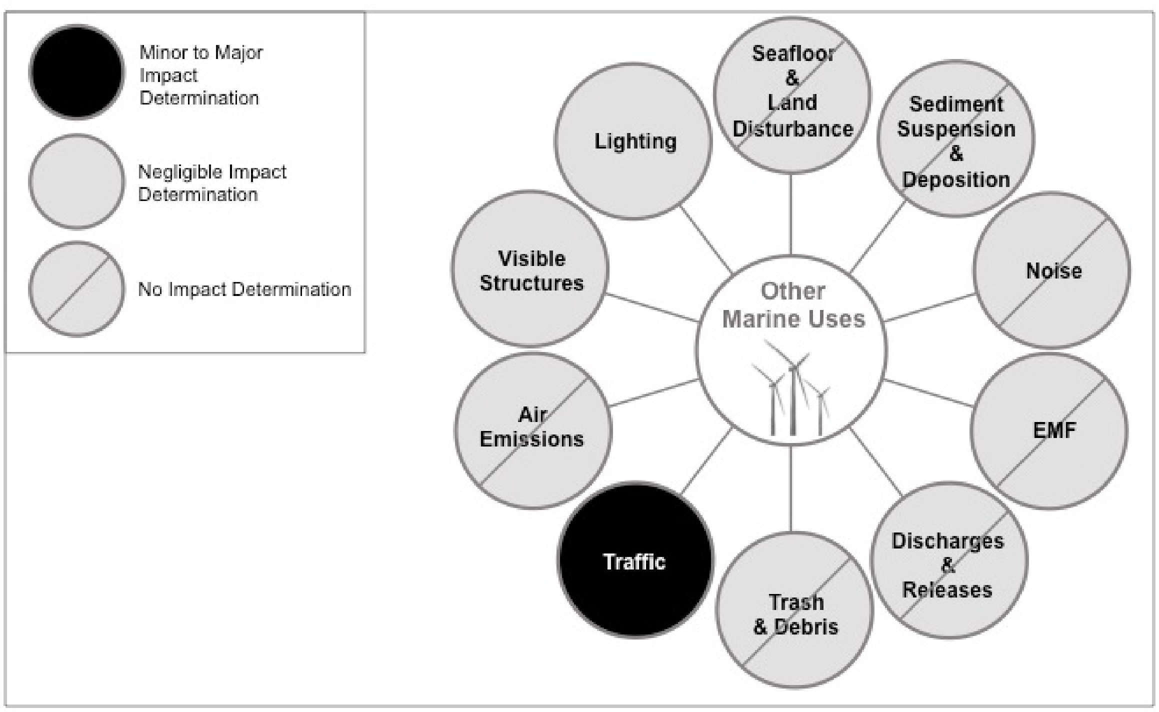

Figure 4.6-11. IPFs on Other Marine Uses
Illustration of potential impacts to other marine uses resulting from SFWF and SFEC activities.

South Fork Wind Farm

Construction

Traffic

Project-related vessel traffic impacts on commercial shipping was discussed in the previous section. Anticipated impacts to other marine uses, such as passenger ferry service or military operations, from SFWF construction vessel traffic are anticipated to be ***minor, short-term,*** and ***localized***. For instance, depending on the ports of origin and destination, time of year, and time of day, SFWF vessel traffic may cross and impact passenger ferry service routes between Rhode Island and Massachusetts, and possibly routes between New York and Connecticut. Although SFWF marine vessels and passenger ferry routes may overlap during all Project phases, vessel traffic will be the greatest during the construction phase. Therefore, potential impacts to passenger ferry during the construction phase are anticipated to be the highest. There may be localized areas where re-routing the ferry routes is necessary, but there are no long-term or major impacts on ferry routes expected from construction, especially if conducted offseason when there are less ferry crossings. Timely communication and notices will be issued to mariners informing them of construction activities and areas designated as off-limits.

Lighting

USCG-approved navigation lighting is required for Project-related vessels during construction, O&M, and decommissioning. Project-related vessels operating between dusk and dawn are required to turn on navigation lights. Vessel and equipment lighting used during construction will be temporary as vessels travel between the shore and SFWF and conduct construction activities at the SFWF. Therefore, potential impacts from lighting during construction of the SFWF is expected to be ***negligible*** and ***short-term***.

Operations and Maintenance

Traffic

During the SFWF O&M phase, minimal vessel traffic is anticipated; therefore, impacts to other marine uses from vessel traffic are expected to be ***negligible***.

Visible Structures

The WTGs and OSS visible structures are expected to have an impact because there would be some displacement to other marine uses in the specific location of the SFWF. However, given that no other marine uses are identified within the SFWF, impacts are expected to be ***negligible*** but ***long-term*** because they exist so long as the SFWF WTGs are present.

Also, the presence of the WTGs for the duration of the O&M phase may interfere with the operation of three HF radar stations, one long-range radar site (Providence ASR-9), and one weather radar (Cape Cod AFS EWR) in the region. Given there are now operational offshore wind turbines at the BIWF, BOEM has completed a study through the Office of Renewable Energy Programs Environmental Studies Program that assessed the impact of offshore wind farms to the U.S. HF Radar Network (BOEM, 2018). The key findings of the BOEM study are that offshore wind turbines interfere with the operation of HF radars; interference can be simulated; and mitigation techniques range from insufficient to effective. The study determined that effective wind turbine interference mitigation techniques utilize wind turbine rotation rate estimates to remove Doppler spectrum signals. However, the study also indicated that further research and study are needed to advance the proposed mitigation approaches to operational status.. Lessons learned from this program will be applied to the SFWF and SFW is coordinating with DoD to address these potential radar impacts.

Lighting
Project lighting will meet BOEM and USCG requirements. USCG-approved navigation lighting is required for all vessels, for the OSS platform, and for WTGs during operation so that the vessels and structures are visible to other vessels and aircraft.

Impacts of navigational lighting on commercial shipping during O&M are considered ***long-term*** and ***negligible***. In fact, the lighting serves as a required safety feature for navigating vessels.

Decommissioning

Potential impacts to other marine uses during decommissioning of the SFWF would be similar to those described above for construction activities assuming that SFWF Project components are removed using similar vessels, equipment, and methods. After decommissioning of the SFWF, the lighting would be removed.

SFEC – OCS

Construction

Traffic
Construction vessel traffic for the SFEC-OCS could result in similar impacts to passenger ferry service and military operations as described under the SFWF. Installation of the SFEC by either a mechanical cutter, mechanical plow (which may include a jetting system), and/or jet plow will cross seven existing submarine cables.

Visible Structures
Crossing of existing and operational telecommunication cables poses the risk of damage to these existing facilities during SFEC installation. However, the SFW has coordinated with the cable owners to identify methods to cross these cables in agreement with the cable owners that will mitigate risk of damage (Appendix F). Once installed, the SFEC will not be visible or interfere with the operation of the existing, functioning cables because of the shielded construction of the SFEC cable itself. Therefore, ***short-term, localized,*** and ***negligible impacts*** to existing submarine cables are anticipated.

Operations and Maintenance

No impacts are expected during O&M unless there is a failure or malfunction of the SFEC – OCS requiring exposure and repair of the cable. In this nonroutine, infrequent situation, the impacts to other marine uses would be expected to be ***negligible, short-term,*** and ***localized***.

Traffic
Impacts associated with traffic during O&M are expected to be similar to, but less frequent than, those discussed in the construction phase.

Visible Structures
Negligible impacts are expected during the O&M of the SFEC - OCS to the existing submarine cables at the points of crossing. Any SFEC repairs near the crossings will need to be conducted in agreement with existing submarine cable owners.

Decommissioning

Potential impacts to other marine uses during decommissioning of the SFWF would be similar to those described above for construction activities in the event the SFEC – OCS is removed by similar vessels, equipment, and methods.

SFEC – NYS

Potential impacts to other marine uses during construction, O&M, and decommissioning of the SFEC - NYS would be similar to those described above for activities during the SFEC – OCS. There are no other marine use conflicts because there were no other marine uses identified in the SFEC – NYS that have not already been addressed in other sections (i.e., Section 4.6.4, Recreation and Tourism; Section 4.6.5, Commercial and Recreational Fishing; and Section 4.6.6, Commercial Shipping).

SFEC – Onshore

There are no other marine use conflicts because there were no other marine uses identified in the SFEC – Onshore that have not already been addressed in other sections (i.e., Section 4.6.4, Recreation and Tourism and Section 4.6.7, Coastal Land Use and Infrastructure).

4.6.8.3 Proposed Environmental Protection Measures

Similar to the environmental protection measures discussed in Section 4.6.4, Recreation and Tourism; Section 4.6.5, Commercial and Recreational Fishing; and Section 4.6.6, Commercial Shipping, SFW will minimize conflicts with the other marine uses described in this section.

4.6.9 Environmental Justice

4.6.9.1 Affected Environment

EO 12898 requires that federal agencies take steps to identify and address disproportionately high and adverse health or environmental impacts of federal actions on minority and low-income populations as well as populations who principally rely on fish or wildlife for subsistence. According to Council on Environmental Quality (CEQ) environmental justice guidance under NEPA (EPA, 2016), minorities are those groups that include American Indian or Alaskan Native; Asian or Pacific Island; Black, not of Hispanic origin; or Hispanic. Minority or low-income populations are defined where either (a) the population of the impacted area exceeds 50 percent or (b) the population of the impacted area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Regional Overview

This section presents the demographic analysis used to determine the presence or absence in minority and low-income populations in the communities noted in the socioeconomic ROI (Table 4.6-1). To do so, the communities, either CDPs or incorporated areas such as cities, are compared to their corresponding county for the purposes of the geographic analysis.

South Fork Wind Farm and South Fork Export Cable

Poverty status was determined for all people except institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old. These groups were excluded from the numerator and denominator when calculating poverty rates. Table 4.6-34 summarizes the percentage of state, county, and town populations that will be considered minority or low-income for analysis. Only a limited number of the communities in the socioeconomic ROI have the potential for low income or minority status because of either exceeding 50 percent or being significantly higher than their corresponding county of comparison for this analysis. The following communities, also described in Table 4.6-34, have the potential for environmental justice populations:

- Between 13 and 23 percent of the populations of Montauk and Wainscott CDPs have income below the poverty level as compared to 7 percent in Suffolk County. However, these percentages are comparable to the state of New York.
- Twenty-nine percent of the population of the city of Providence has income below the poverty level as compared to 18 percent for Providence County and 14 percent for Rhode Island. The city of Providence's population is 69 percent minority, comparable to that of the county, 67 percent, but significantly higher than Rhode Island's minority percentage of 33 percent.
- The percentage of the city of New Bedford's population with income below the poverty level, 23 percent, is modestly higher than Bristol County and Commonwealth of Massachusetts percentages of 12 and 13 percent, respectively. New Bedford's population is 47 percent minority, compared to 20 percent of Bristol County and 31 percent for the Commonwealth of Massachusetts (USCB, 2015f, 2015g, and 2015h).

Table 4.6-34. 2015 Income and Minority Population Levels

Entity	Population for whom Poverty is Determined	% of Population			
		With Income Below Poverty Level	Hispanic or Latino	Minority not Hispanic or Latino	Total Minority
NEW YORK	19,164,034	16%	18%	35%	54%
Suffolk County	1,471,614	7%	18%	19%	37%
Town of East Hampton	21,801	9%	16%	10%	25%
East Hampton North CDP	3,979	9%	26%	7%	34%
Montauk CDP	3,474	13%	10%	7%	17%
Wainscott CDP	731	23%	17%	5%	22%
RHODE ISLAND	1,013,455	14%	14%	19%	33%
Washington County	120,415	10%	3%	7%	9%
Town of North Kingstown	26,098	9%	3%	8%	11%
Providence County	604,585	18%	40%	27%	67%
City of Providence	165,268	29%	20%	49%	69%
MASSACHUSETTS	6,471,313	12%	11%	20%	31%
Bristol County	536,309	13%	7%	13%	20%
City of New Bedford	93,118	23%	18%	28%	47%

Source: USCB, 2015f, 2015g, and 2015h

4.6.9.2 Potential Impacts

As noted in the revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities for the RI-MA WEA, the WEA is 10.4 nm (19.3 km) or more from the nearest coastline; thus, offshore Project activities would not have disproportionally high or adverse environmental or health impacts on minority or low-income populations (BOEM, 2013). Only onshore activities associated with the port options, the SFWF O&M facility, and the SFEC – Interconnection Facility would have the potential to impact minority or low-income populations (ESS Group, 2016). However, the potential for impacts is generally low and limited to the ports because of the location of the other onshore Project components and the short duration of the construction activities.

IPFs that could result in short-term or long-term impacts to environmental justice communities are indicated on Figure 4.6-12. The noise, traffic, and visible structures IPFs have potential to result in negligible impacts; thus, are briefly evaluated in this section.

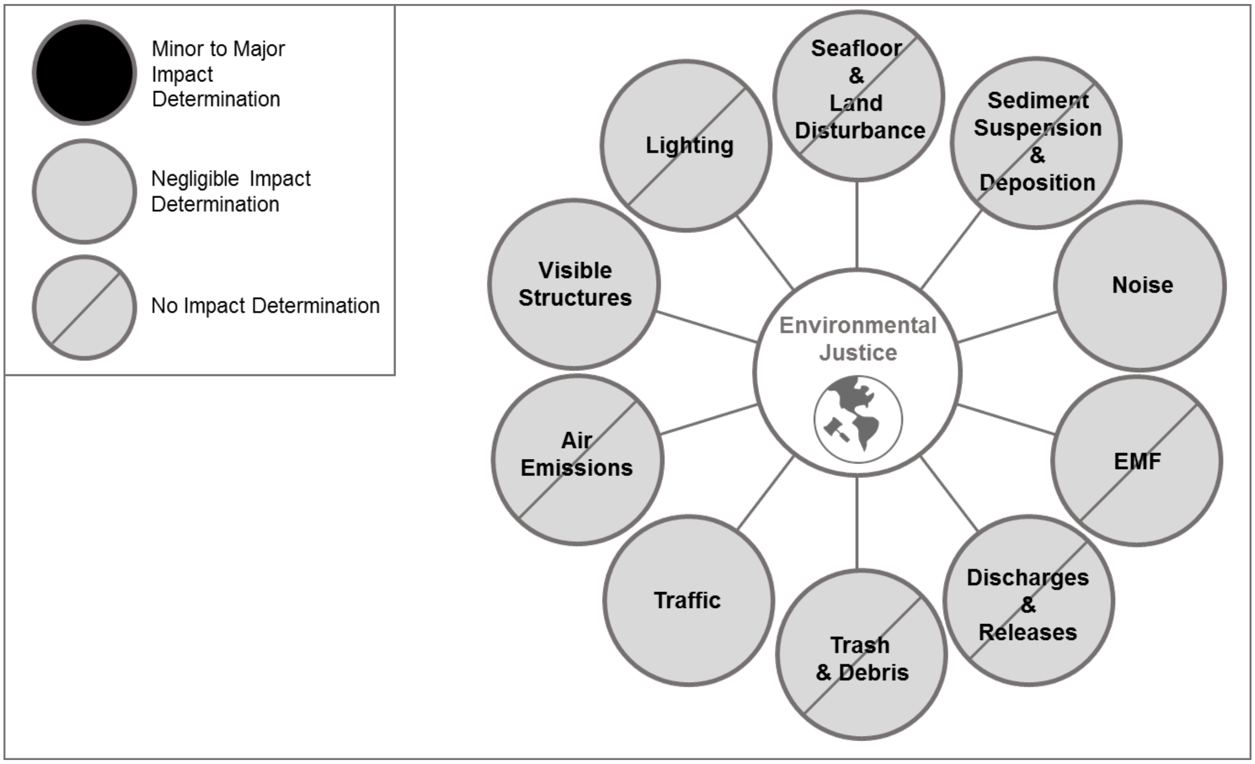

Figure 4.6-12. IPFs on Environmental Justice
Illustration of potential impacts to environmental justice resulting from SFWF and SFEC activities.

South Fork Wind Farm

Noise, Traffic, and Visible Structures

Most of the construction and decommissioning activities for the SFWF will occur at one of the ports listed in Table 4.6-1. Because of the existing industrial nature and uses of these ports, the relatively short duration of these activities, and Project-specific environmental protection measures, the potential is low for disproportionally high or adverse environmental or health impacts for minority or low-income populations. Therefore, impacts from SFWF are considered ***negligible***.

Operation and maintenance of the SFWF will be remotely conducted by onshore project technicians at an O&M facility in Suffolk County, New York or North Kingstown, Rhode Island over the anticipated 25+ year operation life of the SFWF. Table 4.6-34 illustrates that there are no environmental justice communities associated with North Kingstown, Rhode Island and only a limited number of low-income residents in Suffolk County, New York. Thus, ***negligible, long-term impacts*** on environmental justice populations are expected because of the SFWF O&M.

SFEC – OCS and SFEC NYS

Because construction activities for the SFEC will occur in unpopulated areas over open water, there will be ***no impacts*** to environmental justice from construction, O&M, or decommissioning of the SFEC – OCS and SFEC – NYS.

SFEC – Onshore

Onshore activities associated with construction, O&M, or decommissioning of the SFEC – Onshore would have no impact to environmental justice communities because of the lack of proximate minority or low-income populations and the short duration of these activities.

4.6.9.3 Proposed Environmental Protection Measures

Several environmental protection measures will reduce potential impacts to environmental justice populations that may be identified.

- The use of wind to generate electricity will have a beneficial impact on air emissions in East Hampton, as it reduces the need for electricity generation from traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.
- Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning.
- New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
- SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.

4.7 Summary of Potential Impacts and Environmental Protection Measures

This section provides a summary of the potential impacts anticipated from the implementation of activities described in this COP and also provides a summary of the proposed environmental protection measures that will be implemented to avoid and minimize these potential impacts. The information presented in Section 4 was developed and presented to support review under NEPA and, as appropriate, the ESA, MMPA, Migratory Bird Treaty Act, CZMA, NHPA, and the MSFCMA.

The scopes of the resource characterizations and impact assessments presented in Section 4 were based upon the requirements set forth in 30 CFR 585.627 but also guided by input from federal and state agencies and other public and private stakeholders in the region. Physical, biological, cultural, visual, and socioeconomic resources were characterized based upon extensive desktop studies, targeted field studies, predictive modeling, and data analysis. These assessments provided a detailed background on the condition of these resources in the affected environment. Desktop studies included literature reviews; examination of publicly available datasets; direct communication with academic and government science researchers; and consultation with state and federal government entities. The OSAMP, the New York Ocean Plan, and the Massachusetts Ocean Plan provided important insight on environmental conditions and existing human activities in and near the SFWF and SFEC. The resource characterizations also relied on the material published in recent BOEM NEPA documents, such as the Final *Programmatic Environmental Impact Statement (PEIS) for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* (BOEM, 2007).

As demonstrated by the impact evaluations presented throughout Section 4, The type and degree of potential impacts from proposed Project activities varies based on the characteristics of the resource (e.g., presence/absence, conservation status, abundance) and the IPF that may affect each resource. Potential impacts are discussed separately for the SFWF and SFEC. Where relevant and distinct, potential impacts for different segments of the SFEC are discussed separately. Where applicable, potential impacts were identified as direct or indirect; short-term or long-term; and negligible, minor, moderate, or major. If measures are proposed to avoid and minimize potential impacts, the impact evaluation included consideration of these environmental protection measures.

Table 4.7-1 summarizes the resources identified within the affected environment and the range of potential impacts expected from the implementation of the activities described in this COP. Table 4.7-2 describes the corresponding environmental protection measures that SFW would adopt to minimize these potential impacts. These tables provide a summary of the information discussed in each resource section throughout Section 4.

The Project was sited, planned, and designed to avoid and minimize impacts. Several potential impacts to affected physical, biological, cultural, visual, and socioeconomic resources will be mitigated. Resources that may be impacted by the SFWF and SFEC are expected to recover given that impacts will be limited temporally and/or spatially. Post construction environmental monitoring of various resources will take place and will include, at a minimum, coordination and data sharing with regional monitoring efforts. Monitoring plans will be developed in coordination with the relevant agencies prior to construction.

Table 4.7-1. Summary of the Evaluation of Impact-producing Factors associated with the South Fork Wind Farm and South Fork Export Cable and Affected Physical, Biological, Cultural and Socioeconomic Resources

	Physical Resources				Biological Resources							Cultural Resources				Socioeconomic Resources								
Impact-producing Factor	**Air Quality**	**Water Quality & Water Resources**	**Geological Resources**	**Physical Oceanography & Meteorology**	**Coastal & Terrestrial Habitat**	**Benthic & Shellfish Resources**	**Finfish & Essential Fish Habitat**	**Marine Mammals**	**Sea Turtles**	**Avian Species**	**Bat Species**	**Above-ground Historic Properties**	**Marine Archaeological Resources**	**Terrestrial Archaeological Resources**	**Visual Resources**	**Population, Economy, & Employment**	**Housing & Property Values**	**Public Services**	**Recreation & Tourism**	**Commercial & Recreational Fishing**	**Commercial Shipping**	**Coastal Land Use & Infrastructure**	**Other Marine Uses**	**Environmental Justice**
Impact Evaluation Section Number	***4.2.1.2***	***4.2.2.2***	***4.2.3.2***	***4.2.4.2***	***4.3.1.2***	***4.3.2.2***	***4.3.3.2***	***4.3.4.2***	***4.3.5.2***	***4.3.6.2***	***4.3.7.2***	***4.4.1.2***	***4.4.2.2***	***4.4.3.2***	***4.5.2***	***4.6.1.2***	***4.6.2.2***	***4.6.3.2***	***4.6.4.2***	***4.6.5.2***	***4.6.6.2***	***4.6.7.2***	***4.6.8.2***	***4.6.9.2***
Seafloor and Land Disturbance		Neg-Min	Neg-Min	Neg	Neg	Neg-Min	Neg-Min	Neg	Neg–Min	Neg	Neg-Min		Min-Mod	Min-Mod						Min-Mod		Neg-Min		
Sediment Suspension and Deposition		Neg-Min	Neg-Min	Neg	Neg	Neg-Min	Neg-Min	Neg	Neg	Neg			Neg							Neg				
Noise						Neg-Min	Neg-Mod	Neg-Maj	Neg-Mod	Neg-Min	Neg	Neg				Neg	Neg			Neg-Min		Neg-Min		Neg
Electromagnetic Field						Neg	Neg	Neg	Neg											Neg				
Discharges and Releases		Neg			Neg	Neg	Neg	Neg	Neg	Neg										Neg				
Trash and Debris		Neg			Neg	Neg	Neg	Neg	Neg	Neg										Neg				
Traffic						Neg	Neg-Mod	Neg-Mod	Neg-Mod	Neg-Min	Neg	Neg			Min	Neg	Neg	Neg	Neg	Neg-Min	Neg-Min	Neg-Min	Neg-Min	Neg
Air Emissions	Neg-Min																							
Visible Structures				Neg				Neg	Neg	Neg-Min	Neg-Min	Neg - Maj			Min	Neg-Min	Neg		Neg-Min	Min	Neg	Neg	Neg	Neg
Lighting						Neg	Neg	Neg	Neg	Neg-Min	Neg-Min	Neg-Min			Min		Neg		Neg-Min		Neg	Neg	Neg	

Notes:
Neg = Negligible
Min = Minor
Mod = Moderate
Maj = Major

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Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Air Quality	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: Negligible – Minor • Visible Structures: No Impact • Lighting: No Impact	• Vessels providing construction or maintenance services for the SFWF will use low sulfur fuel where possible. • Vessel engines will meet the appropriate EPA air emissions standards for NOx emissions when operating within Emission Controls Areas. • Equipment and fuel suppliers will provide equipment and fuels that comply with the applicable EPA or equivalent emission standards. • Marine engines with a model year of 2007 or later and non-road engines complying with the Tier 3 standards (in 40 CFR 89 or 1039) will be used to satisfy BACT. • The use of wind to generate electricity reduces the need for electricity generation from new traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions.
Water Quality	• Seafloor and Land Disturbance: Negligible - Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize turbidity and TSS. • Vessels will comply with regulatory requirements related to the prevention and control of discharges and accidental spills. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • At the onshore HDD work area for the SFEC, drilling fluids will be managed within a contained system to be collected for reuse as necessary • An HDD Inadvertent Release Plan will minimize the potential risks associated with release of drilling fluids or a frac-out. • An SWPPP, including erosion and sedimentation control measures, and a Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.
Geological Resources	• Seafloor and Land Disturbance: Negligible – Minor	• The SFWF and SFEC - Offshore will avoid, to the extent practicable, identified shallow hazards.

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Sediment Suspension and Deposition: Negligible – Minor • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• Installation of the SFWF Inter-Array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, these methods will minimize impacts to surficial geology. • Use of monopiles with associated scour protection will minimize impacts to surficial geology, compared to other foundation types. • Use of DP vessel for cable installation for the SFWF Inter-Array Cable and SFEC - Offshore will minimize impacts to surficial geology, as compared to use of a vessel relying on multiple-anchors. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. The SFEC - Onshore is sited within previously disturbed existing ROWs.
Oceanographic and Meteorological Conditions	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: No Impact	• SFW has designed the Project to account for site-specific oceanographic and meteorological conditions within the Project Area; therefore, no additional measures are necessary.
Coastal and Terrestrial Habitat	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible	• SFEC - Onshore is sited within previously disturbed existing ROWs. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • A SWPPP, including erosion and sedimentation control measures, and a

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Traffic: No Impact • Air Emissions: No Impact • Visible Structure: No Impact • Lighting: No Impact	Spill Prevention, Control, and Countermeasures Plan, will minimize potential impacts to water quality during construction of the SFEC - Onshore.
Benthic and Shellfish Resources	• Seafloor and Land Disturbance: Negligible - Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: Negligible – Minor • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: Negligible	• The SFWF and SFEC - Offshore will minimize impacts to harder and rockier bottom habitats to the extent practicable. • Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize long-term impacts to the benthic habitat. • Use of monopiles with associated scour protection will minimize impacts to benthic habitat, compared to other foundation types. • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to benthic and shellfish resources, as compared to use of a vessel relying on multiple-anchors. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including benthic and shellfish resources. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided.
Finfish and Essential Fish Habitat	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: Negligible – Minor • Noise: Negligible – Moderate • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Moderate • Air Emissions: No Impact	• The SFWF and SFEC - Offshore will minimize impacts to important habitats for finfish species. • Installation of the SFWF Inter-array Cable and SFEC - Offshore will occur using equipment such as mechanical cutter, mechanical plow, and/or jet plow. Compared to open cut dredging, this method will minimize sediment disturbance and alteration of demersal finfish habitat.

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Visible Structures: No Impact • Lighting: Negligible	• The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • Use of DPV for cable installation for the SFWF Inter-array Cable and SFEC - Offshore will minimize impacts to finfish and EFH resources, as compared to use of a vessel relying on multiple-anchors. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone, including finfish and EFH resources. • Siting of the SFWF and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys. • SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).
Marine Mammals	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Major • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Moderate • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: Negligible	• Exclusion and monitoring zones for marine mammals will be established for pile driving activities and HRG survey activities. • Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate. • Pile driving activities will not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right whale, which will have a protective effect for other marine mammal species.

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		• Vessels will follow NOAA guidelines for marine mammal strike avoidance measures, including vessel speed restrictions. • All personnel working offshore will receive training on marine mammal awareness and marine debris awareness. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
Sea Turtles	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Moderate • Electromagnetic Field: Negligible • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible - Moderate • Air Emission: No Impact • Visible Structure: Negligible • Lighting: Negligible	• Exclusion and monitoring zones will be established for sea turtles during pile driving and HRG survey activities. • Mitigation measures will be implemented for pile driving and HRG survey activities. These measures will include soft-start measures, shut-down procedures, protected species monitoring protocols, use of qualified and NOAA-approved protected species observers, and noise attenuation systems such as bubble curtains, as appropriate. • Pile driving activities will not occur at the SFWF from January 1 to April 30 to minimize potential impacts to the North Atlantic right whale, which will have a protective effect for sea turtles. • Vessels will follow NOAA guidelines for sea turtle strike avoidance measures, including vessel speed restrictions. • All personnel working offshore will receive training on sea turtle awareness and marine debris awareness. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D).

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		• The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m).
Avian Species	• Seafloor and Land Disturbance: Negligible • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Minor • Electromagnetic Field: No Impact • Discharges and Releases: Negligible • Trash and Debris: Negligible • Traffic: Negligible – Minor • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• The SFWF WTGs will be widely spaced apart allowing avian species to avoid individual WTGs and minimize risk of potential collision. • The location of the SFWF, more than 18 miles (30 km, 16 nm) offshore, avoids the coastal areas, which are known to attract birds, particularly shorebirds and seaducks. • Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction or disorientation. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. • An avian management plan for listed species will be prepared for the SFEC - Onshore. • The SFEC - Onshore cable will be buried; therefore, avoiding the risk to birds associated with overhead lines.
Bat Species	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• Lighting during operations will be limited to the minimum required by regulation and for safety, therefore minimizing the potential for attraction (or attraction of insect prey) and possibly collision of bats at night. • SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROW, therefore, minimizing potential impacts from clearing.

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Above-Ground Historic Properties	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible - Major • Lighting: Negligible – Minor	• The location of the SFWF WTGs, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive above-ground historic properties. • SFWF WTGs will have uniform design, speed, height, and rotor diameter. • The color of the SFWF WTGs (less than 5 grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips. • The SFEC - Onshore cable will be buried; therefore, minimizing potential visual impacts to above ground historic properties. • The SFEC - Interconnection Facility will be located adjacent to an existing substation on parcel zoned for commercial and industrial/utility use. • The SFEC - Interconnection Facility land parcel is currently screened by mature trees. After construction, additional screening will be considered to further reduce potential visibility and visual impact.
Marine Archaeological Resources	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: Negligible • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• The SFWF and SFEC - Offshore will avoid or minimize impacts to potential submerged cultural sites, to the extent practicable. • Native American tribes were involved, and will continue to be involved, in marine survey protocol design, execution of the surveys, and interpretation of the results. • A plan for vessels will be developed prior to construction to identify no-anchor areas inside the MWA to protect sensitive areas or other areas to be avoided. An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation. • As appropriate, SFW will conduct additional archaeological analysis and/or investigation to further assess potential sensitive areas. • G&G survey coverage is sufficient to support design changes, if minor

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		refinement of SFWF facility locations is necessary to avoid paleolandforms.
Terrestrial Archaeological Resources	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: No Impact • Air Emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	• The route for the SFEC - Onshore will minimize impacts to, or avoid, potential terrestrial archeological resources, to the extent practicable. • Native American tribes were involved, and will continue to be involved, in terrestrial survey protocol design, execution of the surveys, and interpretation of the results. • Analysis shows that the majority of the SFEC - Onshore route has been previously disturbed; therefore, the risk of potentially encountering undisturbed archaeological deposits is minimized. • An Unanticipated Discovery Plan will be implemented that will include stop-work and notification procedures to be followed if a cultural resource is encountered during installation. • SFW will conduct additional archaeological investigation to further assess potential sensitive areas.
Visual Resources	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Minor • Air Emissions: No Impact • Visible Structures: Minor • Lighting: Minor	• The location of the SFWF WTGs, approximately 19 miles (30.6 km, 16.6 nm) from Block Island, 21 miles (33.7 km, 18.2 nm) from Martha's Vineyard, and 35 miles (56.3 km, 30.4 nm) from Montauk, restricts available views from visually sensitive public resources and population centers. • SFWF WTGs will have uniform design, speed, height, and rotor diameter. • The color of the SFWF WTGs (less than 5 grey tone) generally blends well with the sky at the horizon and eliminates the need for daytime lights or red paint marking of the blade tips. • Use of ADLS will mitigate nighttime visual impacts. • The SFEC - Interconnection Facility will be located adjacent to an existing substation on a parcel zoned for commercial and industrial use. • At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise.

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
Population, Economy, & Employment	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible - Minor • Lighting: No Impact	• Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning. • The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers. • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
Property Values	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible • Lighting: Negligible	• The SFEC - Onshore cable will be buried; therefore, minimizing potential impacts to adjacent properties. • The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers. • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • At the SFEC - Interconnection Facility, additional screening will be considered to further reduce potential visibility and noise. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures.
Public Services	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact	• The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC – Onshore

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Traffic: Negligible • Air emissions: No Impact • Visible Structures: No Impact • Lighting: No Impact	construction to minimize local traffic impacts. • A comprehensive communication plan will be implemented during offshore construction. SFW will submit information to the USCG to issue Local Notice to Mariners during offshore installation activities.
Recreation & Tourism	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structures: Negligible – Minor • Lighting: Negligible – Minor	• The location of the SFWF WTGs restricts available views from visually sensitive public resources and population centers. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Project website, public notices to mariners and vessel float plans, and a fisheries liaison. SFW will submit information to the USCG to issue Local Notice to Mariners during offshore installation activities. • The communication plan will also include outreach to stakeholders in the offshore recreational and tourism industry to minimize impacts to recreational events (e.g., sailboat races). • The SFEC - Onshore construction schedule has been designed to minimize impacts to the local community during the summer tourist season. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.
Commercial and Recreational Fishing	• Seafloor and Land Disturbance: Minor – Moderate • Sediment Suspension and Deposition: Negligible • Noise: Negligible – Minor • Electromagnetic Field: Negligible • Discharges and Releases: Negligible	• SFW is committed to a spacing of approximately 1.15 mile (1.8 km, 1 nm) between turbines. • The SFWF Inter-array Cable and SFEC - Offshore will be buried to a target depth of 4 to 6 feet (1.2 to 1.8 m). • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone,

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Trash and Debris: Negligible • Traffic: Negligible - Minor • Air Emissions: No Impact • Visible Structures: Minor • Lighting: No Impact	including. sensitive shoreline habitats and shoreline fishing areas. • As appropriate and feasible, BMPs will be implemented to minimize impacts on fisheries, as described in the *Guidelines for Providing Information on Fisheries Social and Economic Conditions for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM, 2015). • Siting of the SFWF and SFEC - Offshore were informed by site-specific benthic habitat assessments and Atlantic cod spawning surveys. • SFW is committed to collaborative science with the commercial and recreational fishing industries pre-, during, and post-construction. • Each WTG will be marked and lit with both USCG and approved aviation lighting. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • Communications and outreach with the commercial and recreational fishing industries will be guided by the Project-specific Fisheries Communication and Outreach Plan (Appendix B). This outreach will be led by the SFW Fisheries Liaisons. Fisheries Representatives from the ports of Montauk, Point Judith, and New Bedford represent the fishing community. • SFW is committed to a Gear Loss Prevention and Claim Procedure for the commercial fishing industry. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, a Project website, and public notices to

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
		mariners and vessel float plans (in coordination with USCG).
Commercial Shipping and Other Marine Uses	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: No Impact • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible – Minor • Air Emissions: No Impact • Visible Structures: Negligible • Lighting: Negligible	• SFW is committed to a spacing of approximately 1.15 mile (1.8 km, 1 nm) between turbines. • Each WTG will be marked and lit with both USCG and approved aviation lighting. AIS will be installed at the SFWF marking the corners of the wind farm to assist in safe navigation. • All appropriate lighting and marking schemes, based on current regulations, will be implemented. • SFW will require all construction and operations vessels to comply with regulatory requirements related to the prevention and control of spills and discharges. • Accidental spill or release of oils or other hazardous materials will be managed through the OSRP (Appendix D). • Project construction, O&M, and decommissioning activities will be coordinated with appropriate contacts at USCG and DOD command headquarters. • A comprehensive communication plan will be implemented during offshore construction to inform all mariners, including commercial and recreational fishermen, and recreational boaters of construction activities and vessel movements. Communication will be facilitated through a Fisheries Liaison, Project website, and public notices to mariners and vessel float plans (in coordination with USCG).
Coastal Land Use & Infrastructure	• Seafloor and Land Disturbance: Negligible – Minor • Sediment Suspension and Deposition: No Impact • Noise: Negligible - Minor • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible - Minor • Air Emissions: No Impact	• SFEC - Onshore will be located underground in previously disturbed areas, such as roadways and railroad ROW. • The SFEC sea-to-shore transition will be installed via HDD to avoid impacts to the dunes, beach, and near-shore zone. New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - Onshore

Table 4.7-2. Summary of Potential Impacts and Environmental Protection Measures, by Resource

Resource	Potential Impacts by IPF	Environmental Protection Measures
	• Visible Structure: Negligible • Lighting: Negligible	construction to minimize local traffic and noise impacts. • A SWPPP, including erosion and sedimentation control measures, and a SPCC Plan, will minimize potential impacts to adjacent lands uses during construction of the SFEC - Onshore.
Environmental Justice	• Seafloor and Land Disturbance: No Impact • Sediment Suspension and Deposition: No Impact • Noise: Negligible • Electromagnetic Field: No Impact • Discharges and Releases: No Impact • Trash and Debris: No Impact • Traffic: Negligible • Air Emissions: No Impact • Visible Structure: Negligible • Lighting: No Impact	• The use of wind to generate electricity will have a beneficial impact on air emissions in East Hampton, as it reduces the need for electricity generation from traditional fossil fuel powered plants on the South Fork of Long Island that produce greenhouse gas emissions. • Where possible, local workers will be hired to meet labor needs for Project construction, O&M, and decommissioning. • New York State Law requires that the SFEC - Onshore be constructed in compliance with a detailed plan that includes traffic and other control measures. • SFW will also coordinate with local authorities during SFEC - Onshore construction to minimize local traffic and noise impacts.

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Section 5 - References

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5.6 Section 4.4 – Cultural Resources

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