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# VINEYARD WIND

# Draft Construction and Operations Plan

## Volume III Text

## Vineyard Wind Project

June 3, 2020


**Submitted by**
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**Submitted to**
**Bureau of Ocean Energy Management**
**45600 Woodland Road**
**Sterling, Virginia 20166**

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Epsilon ASSOCIATES INC.

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June 3, 2020

# Section 4.0

Summary of Potential Benefits, Impacts, and Mitigation Measures

# 4.0 SUMMARY OF POTENTIAL BENEFITS, IMPACTS, AND MITIGATION MEASURES

## 4.1 Project Benefits

The purpose of the Project is to provide the Commonwealth of Massachusetts with 800 MW of clean, renewable wind energy, and is in direct response to 2016 energy legislation passed by the Commonwealth and signed by Governor Baker. Massachusetts's *Act to Promote Energy Diversity* requires the Commonwealth to procure cost-effective long-term contracts for 1,600 megawatts ("MW") of offshore wind energy within the next decade (Mass.Gov, 2016). Construction of the Project will serve the public interest by increasing the reliability and diversity of the regional and statewide energy supply.

The Project is also expected to create a range of environmental and economic benefits for southeastern Massachusetts (including New Bedford, the Cape, and the Islands), Massachusetts as a whole, and the entire New England region. Project benefits will extend across the design, environmental review, and permitting phase, the procurement, fabrication, and construction/commissioning phase, the multi-decade operating phase, as well as the future decommissioning effort.

A description of the Project's community and environmental benefits associated with Vineyard Wind's winning bid for offshore wind power to the Commonwealth of Massachusetts is included in Appendix III-Q and Section 3.1 of the COP Addendum.

### *4.1.1 Energy Reliability Benefits*

The Vineyard Wind Project would enhance the reliability and diversity of the energy mix on Cape Cod and in the Commonwealth of Massachusetts. This is particularly important given that several base load/cycling plants have already retired, including:

- Brayton Point Power Plant (Somerset, MA): 1,600 MW, shut down May 31, 2017;
- Pilgrim Nuclear Power Plant (Plymouth, MA): 690 MW, shut down May 31, 2019;
- Vermont Yankee Nuclear Power Plant (Vernon, VT): 620 MW, shut down December 29, 2014;
- Montaup Power Plant (Somerset, MA): 174 MW, shut down in 2010; and
- Mt. Tom Station (Holyoke, MA): 136 MW, shut down in 2014.

In addition, other plants such as Canal Generating Station (1,200 MW, oil/natural gas-fired, two units commissioned in 1968 and 1976), are approaching their normal end of life, making it important for other energy generation alternatives to fill the gap. In addition to the plants mentioned above, ISO-NE has identified over 5,000 MW of oil and coal capacity "at risk" for retirement in the coming years.[6]

The Project would be a major source of clean, renewable electric power. Just 400 MW of the 800 MW Project could supply two-thirds of the peak Cape Cod load. With higher hub heights and longer, more efficient blades, Vineyard Wind's wind turbine generators ("WTGs") will take full advantage of the superior offshore wind regime. Accordingly, the Vineyard Wind Project is expected to operate at an annual capacity factor in excess of 45%.

The Project will enhance energy supply diversity. The Project will not be affected by possible cold weather gas limitations or supply shortages. Additionally, summer offshore wind patterns will allow the Project to produce substantial power during summer afternoons/early evenings, typical peak power demand periods on the Cape and the Islands.

Lastly, Cape Cod is at the outer reaches of the regional transmission system. The Cape is essentially supplied by one 345 kV and two 115 kV radial feeds. While recent significant investments in transmission reliability have strengthened the electricity supply to Cape Cod, Vineyard Wind would further improve the situation by feeding power into the center of the on-Cape transmission system. By connecting to the bulk power system on Cape Cod, the Project will increase the supply of power to the Cape and southeastern Massachusetts, which is an area that has experienced the largest impact from recent generation retirements.

### *4.1.2 Economic Benefits*

The Project is expected to generate numerous economic benefits across Massachusetts and the entire New England region. Economic benefits from the Project will occur throughout the preconstruction, construction, operations and maintenance ("O&M"), and decommissioning phases and include:

- The Project has already opened and staffed a New Bedford office and has engaged a number of Massachusetts-based professionals to support elements of the design effort, licensing, and permitting.

- Project construction will create opportunities for area maritime industries (tug charters, other vessel charters, dockage, fueling, inspection/repairs, provisioning).

[6] ISO-NE. https://www.iso-ne.com/about/regional-electricity-outlook/grid-in-transition-opportunities-and-challenges/power-plant-retirements

- The construction and installation process will make use of existing port facilities, and the Project has already signed a letter of intent to utilize the New Bedford Marine Commerce Terminal. To the extent feasible, construction materials and other supplies, including vessel provisioning and servicing, will be sourced from within the Project Area. The Project may also perform fabrication work in Massachusetts.

- As described in Sections 7.1.2.1.1 and 7.1.2.2.1, the Project will create a number of job opportunities within the marine trades and affiliated industries, and will have a positive impact on those sectors, particularly those heavily influenced by seasonal hiring. Once operational, the Project will also create a significant number of O&M jobs.

- The Project may provide additional recreational opportunities. The WTG and ESP foundations may become popular fishing locations, and recreational fishing activities may increase. Angler's interest in visiting the WDA may also lead to an increased number of fishing trips out of nearby ports which could support an increase in angler expenditures at local bait shops, gas stations, and other shore side dependents (Kirkpatrick et al., 2017). The Project may become a popular tourist destination that could provide opportunities for sightseeing vessel operations.

- The Project will make local and regional purchases of goods and services throughout the multi-decade O&M period.

- The Project will continue its efforts to work cooperatively with southeastern Massachusetts educational institutions such as Massachusetts Maritime Academy, UMass Dartmouth, and others to help create opportunities for their students and faculty.

- The Project will continue to work with their local partner, Vineyard Power Cooperative, throughout the phases of the Project.

- In accordance with the lease terms, the Project will make substantial annual rent and operating fee payments to the Federal Treasury. Prior to commercial operations, the Project will make annual lease payments of $500,658. As WTGs are commissioned and become operational, the Project's annual lease payments will decrease and be replaced by annual operating fee payments that are currently not known.

- It is estimated that the Vineyard Wind Project will generate $14.7 - $17 million in state and local taxes as a result of the development, construction, and first year of operations of the 800 MW Project. This includes an estimated $4.7 - $5.3 million increase in Massachusetts personal income and other personal tax payments, a $3.0

- $3.5 million increase in sales taxes, a $5.2 - $6.1 million increase in property taxes, a $1.3 – $1.5 million increase in corporate taxes and payroll taxes, and a $0.5 – $0.6 million increase in fees, fines, and other taxes. Although these tax benefits include only one year of expenditures during the O&M phase, tax benefits will continue annually over the Project's lifetime. In addition, Vineyard Wind signed a Host Community Agreement ("HCA") with the Town of Barnstable. As a result of the HCA with Barnstable, Vineyard Wind will pay an additional $16 million to the Town above property taxes, plus an additional $60,000 for each year the Project is in operation beyond 25 years, and will provide other material benefits to the Town. Vineyard Wind also committed in the HCA to repave the existing parking area at Covell's Beach Landfall Site and to fund the Town's construction of a new bathhouse at Covell's Beach.

- Lastly, the Project should be an important foundational step in creating a thriving, utility scale, domestic offshore wind industry. The Project is committed to working with the Bureau of Ocean Energy Management ("BOEM"), Massachusetts, local and regional officials, and other stakeholders to maximize this unique and timely opportunity to establish Massachusetts as center for the offshore wind industry in the United States.

### *4.1.3 Environmental Benefits*

The Project has significant environmental benefits. The Vineyard Wind Project would enable 800 MW of zero-carbon electric power to be delivered to the ISO New England ("ISO NE") grid, which would displace electricity generated by higher-polluting fossil fuel-powered plants and significantly reduce air emissions in the New England region over the lifespan of the Project. Based on air emissions data for New England power generation facilities from EPA's Emissions & Generation Resource Integrated Database, an 800 MW Project will reduce ISO NE carbon dioxide emissions by approximately 1,630,000 tons per year (tpy). Nitrogen oxides ($NO_x$) and sulfur dioxide emissions across the New England grid are expected to be reduced by approximately 1,050 tpy and 860 tpy, respectively (see Section 5.1.2.2.1 and Appendix III-B for more details).

A reduction in carbon emissions and other greenhouse gas emissions will have wide-reaching benefits for terrestrial, avian, and marine life. For example, the anticipated reduction in air emissions resulting from the Project will ameliorate the impacts of climate change on many species, which has been predicted to impact habitat ranges and access to prey as prey species shift or decline. Thus, the potential impacts of the Project discussed in Section 4.2 below should be considered in the conjunction with the Project's energy reliability, economic, and environmental benefits.

## 4.2 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures

Vineyard Wind has thoroughly analyzed the potential impacts of the Project to physical, atmospheric, biological, economic, cultural, and historic resources and identified measures to avoid, minimize, and mitigate these impacts. In accordance with 30 CFR §585.621(d), the Project will not cause undue harm or damage to natural resources, human life or the human environment, wildlife, property, the marine environment, the coastal environment, or sites, structures, or objects with historical or archeological significance.

Table 4.2-1, below, summarizes the Project's potential impacts on these resources and environmental protection measures that are proposed to minimize adverse effects. Table 4.2-1 is not meant as an exhaustive description of the Project's findings. A more detailed discussion of the Project's potential impacts and associated avoidance, minimization, and mitigation measures can be found in Sections 5, 6 and 7. Low probability events are discussed in Section 8.

### Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Air Quality | Short-term air emissions will come primarily from vessels used during construction, operations and maintenance ("O&M"), and decommissioning.<br><br>Since the Wind Development Area ("WDA") is approximately 23 km (14 miles) offshore, to the southeast of the mainland, and prevailing winds are from the west, the emissions within the WDA are unlikely to have any effect on onshore areas. For all phases of the Project, vessel activities within the port(s) are within the realm of normal harbor activities and will likely contribute only a small fraction of air pollution that is already caused by marine vessel traffic within the port(s). Air emissions from Project activities are not anticipated to cause any violation of Massachusetts or National Ambient Air Quality Standards. | Electricity generated by the wind turbines generators ("WTGs") will displace electricity generated by higher-polluting fossil fuel-powered plants, which will aid in the continued improvement of ambient air quality within the New England Region. The Project is expected to reduce emissions from the ISO New England power grid by approximately 1,630,000 tons per year ("tpy") for carbon dioxide, by 1,050 tpy for nitrogen oxides (NOx), and by 860 tpy for sulfur dioxide.<br><br>Air emissions from the Project will be minimized through the use of low-sulfur fuels, limited engine idling time, and through the use of internal combustion engines designed and operated to minimize the formation of air pollutants. All engines and generators used in this Project will be certified by the manufacturer to comply with applicable on-road, non-road, and marine engine emission standards.<br>The Project's air quality impacts will be further mitigated and minimized through EPA's OCS Air Permit process under 40 C.F.R. Part 55. Some construction phase NOx and VOC emissions from the Project will be mitigated through acquiring and retiring emissions offsets, such as Emission Reduction Credits. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Water Quality and Water Resources | Pile driving, offshore cable installation, horizontal directional drilling ("HDD"), installation of scour protection, dredging, and removal of the Project's offshore facilities may impact water quality via sediment resuspension and dispersion. Impacts to water quality from the Project will be short-term and localized.<br><br>In most cases, during installation of the offshore cable system, mobilized sediment will not be transported far by the currents and will settle rapidly.<br><br>Routine releases from vessels, such as domestic water, bilge water, engine cooling water, deck drainage and/or ballast water are expected, but these releases would quickly disperse, dilute, and biodegrade so that impacts to water quality would be minimal. | Although impacts to water quality are expected to be minimal, the Project will use best management practices ("BMPs") where practicable to minimize sediment suspension during pile driving, cable burial, placement of scour protection, replacement of sediments into temporary cofferdams for HDD operations (if used), and removal of offshore facilities during decommissioning. See BMPs # 1, 12, 37, and 39 in Table 4.2-2.<br><br>The Project will require all vessels to comply with regulatory requirements related to the prevention and control of discharges and the prevention and control of accidental spills. See Section 5.2 for a discussion of relevant regulatory requirements and control technologies vessels will use to prevent discharges of contaminated bilge and ballast water. The Project has also developed a draft Oil Spill Response Plan (see Appendix I-A). |
| Geologic Resources | Project impacts to geological resources are largely expected to be short-term and localized.<br><br>Installation of Project components will not change the sediment composition or overall context of the geological resource. Construction activities will simply displace and rework some of the materials locally and in many instances, disturbances will occur to sediments from the same layer with common physical characteristics. Pile driving, dredging, HDD, cable installation, and scour protection installation will primarily result in short-term, localized impacts that are limited to the area of the activity.<br><br>Cable installation and any cable repairs during O&M may result in a slight modification to the seafloor morphology (seabed scar), but these impacts will be limited to the narrow cable installation trench. Cable protection may replace existing hard bottom with rock or man-made hard bottom. | WTG and electrical service platform ("ESP") foundations have been sited in suitable geologic locations to minimize maintenance due to geotechnical issues over the structure's life span. Micro-siting after the 2018 survey will further refine WTG and ESP positions to minimize risk and impacts.<br><br>The Offshore Export Cable Corridor ("OECC") has been sited to avoid areas with adverse seabed conditions to the extent feasible. The Project will micro-site cable positions within the final OECC to minimize impact to the largest seabed features and adverse conditions.<br><br>To the extent feasible, the Project will avoid using cable protection in sand wave fields by dredging and using the appropriate installation tool to achieve burial into the underlying stable sediment layer. The Project will use appropriate installation methods and tools to minimize disturbance.<br><br>Post-construction monitoring for cable exposure will be conducted. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Terrestrial Fauna | Short-term, localized impacts to terrestrial fauna during construction may be associated with physical habitat disturbance, displacement due to construction noise and vibration, and direct mortality from contact with construction equipment. Long-term impacts potentially affecting wildlife are limited to habitat loss or alteration. The clearing of vegetation at the onshore substation site will result in the permanent loss of approximately 6.1 acres of Pitch Pine-Oak forest habitat.<br><br>Normal O&M activities will not cause further habitat alteration or involve activities expected to have a negative impact on wildlife.<br><br>Project activities will not affect rare or protected habitat types or species. | The Project's Onshore Export Cable Route is sited almost entirely within paved roadways or other previously developed corridors, thereby avoiding undisturbed forest interiors and other significant wildlife habitat. Construction staging areas will be located within previously developed areas whenever practicable. The Onshore Export Cable Route has been sited to avoid crossing any wetlands.<br><br>Siltation fencing will be installed at the proposed onshore substation site before beginning any land-disturbing activities.<br><br>Any required maintenance or repairs to the onshore export cable will primarily take place within splice vaults, without any disturbance to adjacent wildlife habitat.<br><br>Any previously undisturbed areas of wildlife habitat affected by expanded work zones or elsewhere along the Onshore Export Cable Route will be restored in consultation with local officials. |
| Coastal and Marine Birds | The primary potential impact of the Project to birds is mortality or injury due to collision with offshore WTGs. Project activities occurring in the Offshore Project Area are unlikely to cause population level impacts to any coastal or marine bird species.<br><br>Coastal birds (primarily peregrine falcons and songbirds) are expected to be briefly exposed to construction and operation activities during migration. Although coastal birds may encounter construction equipment and may land on vessels, mortality from collision is unlikely. Impacts to coastal birds from displacement are expected to be insignificant.<br><br>Marine birds (primarily gulls) are expected to be briefly exposed to construction, operations, and decommissioning activities during all seasons. Marine birds may be disturbed by vessels, helicopters, and other equipment used during the Project, which may lead to temporary displacement. While there may be short-term | The Project is located in the Massachusetts Wind Energy Area ("MA WEA"), which was selected by the Bureau of Ocean Energy Management ("BOEM") to minimize and mitigate impacts to avian species. The offshore location of the WTGs avoids impacts to many bird species.<br><br>To minimize impacts to birds, the Project will reduce lighting as much as is practicable during construction. During construction, the Project will follow Federal Aviation Administration ("FAA") recommendations to use red-flashing lights. In addition, when practicable, the Project will down-shield lighting and/or use down-lighting to limit bird attraction and disorientation.<br><br>During O&M, the Project will reduce lighting as much as is practicable by (1) reducing the number of lights, (2) using low intensity lights, (3) avoiding white lights, and (4) as appropriate, using flashing lights rather than steady burning lights, when practicable. In addition, when practicable, the Project will use hooded lighting, |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Coastal and Marine Birds (Continued) | disturbance of resident birds during construction, most birds that are initially disturbed will return to the area once construction has been completed.<br><br>Noise from pile driving may cause birds to avoid the construction area and may disperse the local abundance of prey fish. Any short-term reduction in the prey base is expected to recover completely once construction was completed.<br><br>Federally listed species (Roseate Terns, Red Knots, and Piping Plovers) may have limited exposure to the Project, which would largely be restricted to few individuals during the migration periods. Impacts to these birds are expected to be unlikely or insignificant. | colored lighting, or down-lighting to limit bird attraction and disorientation, limit outside light to necessary/required lighting, and close blinds on all windows in boat living quarters. Lighting will also be only used when necessary for work crews.<br><br>Anti-perching is incorporated in the design of the turbines through the use of tubular WTG support towers. In accordance with safety and engineering requirements, the Project will consider anti-perching devices, where and if appropriate, to reduce potential bird perching locations Using a standardized protocol, the Project will document any dead or injured birds found on vessels and structures during construction and O&M. Vineyard Wind is developing a framework for a post-construction monitoring program for birds.<br><br>During decommissioning, the Project will use the best practices available at the time to reduce any potential adverse effects to birds. |
| Bats | During construction and decommissioning, bats may be attracted to vessels associated with the Project, but behavioral vulnerability to collision is expected to be insignificant and population level impacts are unlikely.<br><br>During the operational phase, the primary potential impact of the Project to bats is mortality or injury from collision with WTGs. Bats are not expected to forage in the BOEM Wind Energy Area, but may be present during migration. Bats may experience behavioral vulnerability to collision with WTGs, but overall bat exposure to the WDA is likely to be limited to a few individuals and population level impacts are unlikely. | Bats have the potential to be attracted to vessels to forage on insects, if insects are drawn to vessel lights. Where practicable, the Project will minimize lighting during construction activities in order to mitigate the risk of attracting bats.<br><br>The WDA is far offshore and there are no nearby landing areas (e.g. islands), which might otherwise increase the presence of bats in the WDA.<br><br>The Project will not clear trees greater than 7.6 cm (3 inches) in diameter from June 1 to July 31 (unless a presence/probable absence surveys is conducted pursuant to current US Fish and Wildlife Service ("USFWS") protocols and no northern long-eared bats are documented). |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Coastal Habitats | Depending on the final Landfall Site selected, some disturbances or alteration to coastal habitat may be required. At the Covell's Beach Landfall Site, no disturbance to the adjacent dune or beach habitats will occur. At the New Hampshire Avenue Landfall site, impacts to coastal habitats will be avoided unless the conventional open cut trench method is used, in which case impacts to coastal habitats would be short-term and highly localized.<br><br>Normal O&M activities will not cause further habitat alteration or involve activities expected to have a negative impact. | Landfall Sites are located in previously disturbed areas and have sufficient work space that can be effectively segregated from any nearby coastal habitats.<br><br>To the greatest extent practicable, the OECC has been routed to avoid impacts to sensitive coastal habitat, including mapped eelgrass. If sensitive resources are known to exist along vessel routes, vessels will be advised to avoid the area to the greatest extent practicable. HDD can be employed to minimize any impacts to eelgrass habitat or coastal wetlands.<br><br>At the Covell's Beach Landfall Site and potentially the New Hampshire Avenue Landfall Site, disturbance to the adjacent dune or beach habitats will be avoided through use of HDD and by performing all construction operations and staging within a paved road surface and adjacent parking area. If the conventional open cut trench method is used at the New Hampshire Avenue Landfall Site, the site will be restored in consultation with local officials.<br><br>Refueling and lubrication of onshore equipment will be conducted in a manner that protects coastal habitats from accidental spills. A Construction Spill Prevention Control and Countermeasures Plan will be prepared in accordance with all applicable federal, state, and local requirements. This Plan will identify all measures that will be implemented to prevent spills and the best management practices that that will be in place to contain spills that may occur. Additionally, the Oil Spill Response Plan ("OSRP Plan"), included in Appendix I-A, will provide for rapid spill response, clean-up, and other measures that should also help to minimize any potential impact to affected resources as it relates to spills and accidental releases that might occur.<br><br>Maintenance or repairs to the onshore export cable will take place primarily within splice vaults, without any disturbance to adjacent coastal habitat. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Benthic Resources | During construction, impacts from the alteration of habitat in the WDA and along the OECC are expected to be insignificant and recovery of natural assemblages is likely.<br><br>Installation of WTG and ESP foundations is expected to result in short-term and localized loss of habitat, such that population level impacts are unlikely.<br><br>Mortality of benthic organisms is expected within the WDA where temporary disturbance of the seafloor occurs due to cable and foundation installation, but the impacts are expected to be localized and unlikely at the population level. This is because the surrounding vicinity has an abundant area of similar habitat type, the portion of the WDA that will be disturbed is relatively small (0.5% of the entire WDA), and the sandy bottom community typical to the area has adapted to frequent natural sediment movement that already creates temporary impacts.<br><br>Impacts to benthic resources due to the introduction of WTGs and ESPs as structured habitat will be direct, long-term (over the operation lifetime of the Project) and localized. WTG and ESP foundations may support more taxa than the surrounding primarily homogenous sand habitats. | The Project is located in the MA WEA, which has been sited to avoid the most sensitive areas for benthic and other resources.<br><br>WTGs are widely-spaced so that the foundations (and associated scour protection) for the WTGs, along with the ESPs, inter-link cables, and inter-array cables, only occupy a minimal portion of the WDA, leaving a huge portion of the WDA undisturbed.<br><br>The Project will conduct post-construction monitoring to document habitat disturbance and recovery (see Benthic Habitat Monitoring Plan in Appendix III-D).<br><br>Anchored vessels will not be used as primary construction and installation vessels, but may be used along the offshore export cable corridor and potentially within the WDA. Any anchoring that does take place within the OECC or WDA will occur within the APE as described in Volume II-C. If used, anchored vessels will avoid sensitive seafloor habitats to the greatest extent practicable. Where feasible and considered safe, the Project will use mid-line buoys on anchor lines to minimize impacts from anchor line sweep.<br><br>HDD will be used to minimize impacts to benthic habitat at the Covell's Beach Landfall Site, unless future site investigations determine that HDD is technically infeasible. At the New Hampshire Landfall Site, HDD or a conventional trench will be used. |
| Finfish, Invertebrates, and Essential Fish Habitat | Impacts to finfish species, invertebrate species, and essential fish habitat ("EFH") are expected to be short-term and localized during the construction, operation, and decommissioning of the Project.<br><br>Pelagic species will be able to avoid construction areas and are not expected to be substantially impacted by construction and installation. Impacts to mobile pelagic fish and invertebrate species include localized and short-term avoidance behavior. Avoidance behaviors due to increased vessel presence in | The Project Area is located in the MA WEA, which was selected by BOEM to exclude most sensitive fish and invertebrate habitat. The low total fish biomass and high species richness in the Project Area makes this location ideal for wind energy as it reduces impacts to individual organisms and targets an area which will likely be able to recover following any potential Project-related disturbances. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Finfish, Invertebrates, and Essential Fish Habitat (Continued) | the WDA are expected to be similar to those already displayed by fish when near fishing or recreational vessels.<br><br>Immobile life stages of fish species in or on benthic sediment (i.e., demersal eggs) and sessile benthic organisms in the direct path of construction may experience direct mortality. However, loss of many adult fish and population level impacts are not expected as most of these species produce millions of eggs each year and already have low adult survival rates and because the Project Area is only a very small portion of habitat in the region.<br><br>Overall, current literature indicates noise generated from the operation of wind farms is minimal and only localized avoidance behaviors are expected; acclimation to the noise over time may occur.<br><br>All habitat within the Project Area is expected to remain the same, except for approximately 0.22 $km^2$ (53 acres) that would be converted into hard substrate from foundations and scour protection, 0.40 $km^2$ (99 acres) where cable protection would be installed in the WDA and along the OECC, and the portion of hard bottom habitat that would be covered along the OECC. Alteration of sand wave habitat will likely be temporary and will have little impact on fish in the area, as they may be conditioned to a changing environment. Recovery of disturbed habitats is expected.<br><br>The addition of structured habitat in the WDA would increase EFH for species that prefer rocky substrate and minimally decrease EFH for species that prefer sandy bottoms. The addition of hard structure habitat will add a complexity to the area that did not exist before and will likely attract species that prefer structured habitat.<br><br>Electromagnetic field ("EMF") from submarine cables is not expected to impact elasmobranchs or other electro-sensitive fish species. | Loss of immobile benthic organisms or fish species in the direct path of construction may occur. These impacts will be minimized through the use of mid-line buoys, if feasible and safe, and installation equipment that minimizes installation impacts, such as jet plow. The Project will apply a soft-start procedure to the pile driving process to mitigate the potential impacts of injury to fish from pile driving.<br><br>WTGs will also be widely spaced, leaving a huge portion of the WDA undisturbed by WTG and ESP installation. The OECC has been routed to minimize impacts to sensitive habitats.<br><br>Vineyard Wind is conducting pre- and post-construction fisheries monitoring. Vineyard Wind is working with the Massachusetts School for Marine Science and Technology and local stakeholders to develop a monitoring plan to measure the Project's effect on fisheries resources.<br><br>The Project will avoid important habitats such as eelgrass and hard bottom sediments to the extent feasible.<br><br>Cables will be buried in the substrate or covered with rock or concrete mattresses to mitigate the impacts of EMF. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Marine Mammals | For all phases of the Project, disturbance to marine mammals may result from increases in vessel traffic and short-term, localized noise caused by survey activities, vessels, and other operations. More significant and widespread disturbance to marine mammals may result from pile driving noise. There is also potential for vessel collision. Species vulnerability to these stressors varies, but it is unlikely that population level impacts will occur for ESA and non-ESA listed species.<br><br>For Sei Whales, Fin Whales, and North Atlantic Right Whales (endangered species under ESA) there are no anticipated losses of individuals, but disturbance of individuals may occur.<br><br>Feeding disruption of Harbor Porpoise could be an important impact of response to noise, but feeding can occur in nearby areas if Harbor Porpoises are temporarily displaced.<br><br>Entanglement of marine mammals in tow lines and anchor lines is highly unlikely because these cables are expected to be under constant tension while deployed. | The Project is located in the MA WEA, which was sited to minimize and mitigate impacts to marine mammals. Vineyard Wind will use acoustic modeling as a tool to inform approaches to mitigation and address sensitive variables relative to potential risk of Project-related noise on marine mammals.<br><br>Modeling will be used to evaluate potential impacts and identify specific mitigation and BMP options. The National Oceanic and Atmospheric<br><br>Administration ("NOAA") and BOEM will be engaged in this iterative and adaptive process. Measures such as the establishment of exclusion and monitoring zones, establishment of clearance zones, pile driving soft-start procedures, vessel speed restrictions and avoidance measures, noise reduction technology, and the use of PSOs are expected to be part of the final mitigation plan.<br><br>To minimize impacts to marine mammals, Project vessels will comply with the National Marine Fisheries Service ("NMFS") Regional Viewing Guidelines while in transit. In addition, environmental training of construction personnel will stress individual responsibility for marine mammal awareness and reporting.<br><br>To address stakeholder concerns to this highly sensitive resource, upon financial close, Vineyard Wind will establish a $3 million fund to develop and demonstrate innovative methods and technologies to enhance protections for marine mammals during offshore wind development. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Sea Turtles | Impacts to sea turtles may include localized noise and vessel traffic, short-term disturbance of local habitat, and long-term modification (not loss) of habitat. These impacts are expected to be short-term and localized.<br><br>Four turtle species could be exposed to stressors from construction, operation, and decommissioning of the Project, but two of these species (Kemp's Ridley and Green Sea Turtles) are not common in the region and have insignificant vulnerability to impacts. Loggerheads and Leatherbacks may be exposed to stressors that may result in the short-term, localized disturbance of individuals. It is unlikely that population level impacts to any sea turtle species will occur. | The Project is located in an area that lacks critical sea turtle habitat. Landfall Sites and onshore facilities are not located near known sea turtle nesting beaches.<br><br>Working collaboratively with BOEM and NOAA, Vineyard Wind will develop mitigation that will effectively minimize and avoid risks to sea turtles from construction, operation, and decommissioning. Vineyard Wind plans to use acoustic modeling as a tool to inform approaches to mitigation and address sensitive variables relative to potential risks of noise.<br><br>Avoidance, minimization, and mitigation measures employed for marine mammals are also applicable to sea turtles. In many cases, measures put in place to minimize impacts for marine mammals are more stringent than those required for sea turtles (e.g., pile driving soft-start procedures and use of noise reduction technology). |
| Demographic and Employment, and Economics | Impacts associated with the activities are anticipated to have a stimulating effect on the Project Area's economy.<br><br>Vineyard Wind has staffed a New Bedford office and has engaged a number of Massachusetts-based environmental consultants, engineers and attorneys to support elements of the design effort, licensing, and permitting.<br><br>Construction, operations and maintenance, and decommissioning activities will provide numerous job opportunities within the marine trades and affiliated industries, and will have a positive impact on those sectors, particularly those heavily influenced by seasonal hiring. Opportunities for marine trades industries include: tug and other vessel charters, dockage, fueling, inspection/repairs, provisioning, and crew work. | To the extent feasible, construction materials and other supplies, including vessel provisioning and servicing, will be sourced from within the Project Region.<br><br>Vineyard Wind will implement a comprehensive communications plan with the various port authorities; federal, state and local authorities; and other key stakeholders, including commercial and recreational fishermen.<br><br>The Project will continue to work cooperatively with southeastern Massachusetts educational institutions to help create training and educational opportunities for their students and faculty throughout each phase of the Project. Vineyard Wind is committed to working with BOEM, the Commonwealth of Massachusetts, local and regional officials and other stakeholders to maximize this unique and timely opportunity to establish Massachusetts as center for the offshore wind industry in the United States. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Demographic and Employment, and Economics (Continued) | The construction of the O&M Facilities may require additional engineering, construction, and trades personnel. The O&M Facilities will be staffed by a team of technicians and engineers. Additional service providers will be necessary during planned inspection, maintenance, and repair of the onshore and offshore facilities.<br><br>The Project anticipates sourcing many goods and services throughout the multi-decade O&M phase from local and regional providers. | |
| Environmental Justice/Minority and Lower Income Groups/Subsistence Resources | There are no Environmental Justice ("EJ") communities, as defined by the USEPA, near the Project Region. Some areas in the Project Region meet the Commonwealth of Massachusetts' criteria for EJ populations.<br><br>The construction, operation and maintenance, and decommissioning of the Project are not anticipated to create disproportionately high and adverse health or environmental effects of federal actions on minority and low-income populations.<br><br>Construction and installation activities along the Onshore Export Cable Route may cause traffic and related impacts within the immediate vicinity these activities, though any disruption to normal and routine functions of the project area will be eliminated upon conclusion of the construction and installation activity. | The Project is not anticipated to cause disproportionately high or adverse effects on minority or low-income populations. In accordance with the provisions of E.O. No. 12898 (1994), no mitigation measures are necessary.<br><br>However, in accordance with Massachusetts' EJ Policy, Project stakeholder engagement plans will include outreach to the communities of the census block groups identified in Section 7.2.1.<br><br>The Project's activities are expected to increase employment opportunities, job training, and economic activity within the Project Region. |
| Cultural, Historical, & Archaeological Resources | Public Archaeology Lab ("PAL") completed an archeological due diligence review of potential Onshore Export Cable Routes. The desktop due diligence review determined that the Onshore Export Cable Routes pass through and are adjacent to previously recorded archeological sites. PAL then conducted a reconnaissance level archaeology survey for the two proposed Onshore Export Cable Routes with their variants and the proposed onshore substation site followed by an intensive survey at the onshore substation site. Additional discussion of terrestrial archaeology can be found in Section 3.5.1 of the COP Addendum. | Avoidance, minimization, and mitigation measures for terrestrial and submarine historical and archaeological resources within the Project Area will be determined in consultation with MHC and Massachusetts Board of Underwater Archaeological Resources through the Section 106 process. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Cultural, Historical, & Archaeological Resources (Continued) | The data from the geophysical and geotechnical offshore surveys indicate that throughout much of the Project Area there is little potential for submerged cultural resources. Marine survey activities located two shipwreck sites in the WDA and five potential shipwreck sites along the OECC, but no direct evidence of pre-contact materials in the Project Area. | |
| Visual Resources | The Project may be visible to viewers along the Martha's Vineyard, Nantucket, and theoretically the Cape Cod and Western Buzzards Bay coastlines, but viewers will only have limited visibility of the WTGs when weather conditions allow. At distances greater than 23 km (14 mi), the Project would likely be considered visually subordinate to the wider landscape.<br><br>All offshore and onshore cables will be subsurface/buried and will not be visible. The power grid connection will be constructed adjacent to an existing onshore substation. The proposed improvements for the onshore substation will be consistent in scale and visual character with the existing electric substation.<br><br>The Historic Properties Visual Impact Assessment (Appendix III-H.b) identified a variety of historic properties, including historic buildings and structures, within the Area of Potential Effect ("APE") for the Project. The potential visual impact on historic properties varies by location. With the exception of Gay Head Lighthouse on Martha's Vineyard, the Nantucket Historic Landmark District, and the Chappaquiddick Island traditional cultural property (as determined by BOEM), no adverse effects on historic properties within the visual APE are anticipated. | Due to the distance of the WDA from shore (over 23 km [14 mi]), the Earth's curvature obstructs visibility of the WDA in its entirety from some locations and partially obstructs visibility elsewhere. At no point can any of the ESPs or WTGs be viewed at their full height from shore. The orientation and layout of the WDA (WTGs closer to shore will obstruct the view of WTGs further from shore) further mitigates visual impacts. Meteorological and atmospheric conditions will often obscure views of the WDA.<br><br>In accordance with FAA Advisory Circular ("AC") 70/7460-1L, Vineyard Wind will paint the WTGs no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey; however, Vineyard Wind anticipates that the WTGs will be painted off-white/light grey to blend into the horizon. The yellow color of the turbine foundation (required by the US Coast Guard ["USCG"]) largely falls below the visible horizon and is nearly undetectable from onshore viewpoints.<br><br>The impact of FAA and USGC lighting is substantially limited by the distance of the Project from coastal vantage points. The Project will use an Aircraft Detection Lighting System, which is automatically activated by approaching aircraft, or a system that adjusts lighting intensity depending on visibility if commercially available and approved by BOEM and FAA. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Recreation and Tourism | Impacts of the Project on recreation and tourism, if any, are expected to be highly localized and largely temporary in nature. The WDA may provide additional recreational opportunities.<br><br>Construction at the Landfall Site may result in minor, temporary disturbances at that location. HDD operations may cause temporary conflicts with pedestrian access to limited portions of the Landfall Site.<br><br>Any impacts to recreational resources associated with the O&M Facilities are anticipated to be limited to a localized area around the O&M Facilities during the facility's construction period.<br><br>The proximity of the WDA to numerous productive recreational fishing areas suggests that the highly localized impacts of construction and installation activities will have only minimal impacts to recreational species. Shore-based fishing activities at the Landfall Site may be temporarily displaced during the construction and installation phase.<br><br>Construction vessels servicing the Offshore Project Area may cause navigation impacts around confined navigation channels and turning basins. Increased vessel traffic may occur through inshore traffic zones and any traffic separation scheme along the selected route to the WDA. Construction activities may result in temporary, minimal impacts to recreational boating activities in the Offshore Project Area.<br><br>When vessels used for construction and decommissioning are in the Offshore Project Area, temporary restrictions on recreational boating and fishing activities in the immediate vicinity of those vessels may be necessary. Vineyard Wind is not proposing any vessel exclusions around the WTGs or other areas of the Project during the operation and maintenance phase. | Vineyard Wind's onshore construction schedule will minimize impacts to recreational uses and tourism-related activities during peak summer months and other times when demands on these resources are elevated (see Section 1.5.3 of Volume I).<br><br>Vineyard Wind will not conduct activities along the onshore transmission route within public roadway layouts from Memorial Day through Labor Day unless authorized by the host town; such work could extend through June 15 subject to consent from the local Department of Public Works (DPW). The Company will consult with the towns regarding the construction schedule and a Traffic Management Plan will be developed so as to minimize disruptions to residences and commercial establishments in the vicinity of construction and installation activities.<br>Typical construction hours will extend from 7:00 AM to 6:00 PM. Nighttime work will be performed only on an as-needed basis, such as when crossing a busy road. When needed, nighttime work/extended construction hours, including possible work on weekends, will be coordinated through each Town.<br><br>To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. Vineyard Wind will distribute Offshore Wind Mariner Updates and coordinate with USCG to issue Notices to Mariners ("NTMs") to notify recreational and commercial vessels of their intended operations to/from and within the WDA. Vineyard Wind will implement a Fisheries Communication Plan to keep the relevant parties informed throughout this phase of the Project (see Appendix III-E).<br><br>To aid mariners navigating the Wind Development Area, WTGs and ESP will be lit, marked, and maintained as Private Aids to Navigation (PATONs) in accordance with International Association of Lighthouse Authorities (IALA) Guidance for the marking of man-made offshore structures (IALA Recommendation O-139, edition 2, 2013), and USCG approval. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Recreation and Tourism (Continued) | The WTGs will provide additional aids to navigation. During the O&M phase, WTG and ESP foundations may become popular fishing locations, and recreational fishing activities may increase. | |
| Commercial Fisheries and For Hire Recreational Fishing | The fisheries that may be affected by the Project are static gear fisheries, ground fish/bottom trawl mobile gear, and Atlantic surfclam/ocean quahog dredge fishery.<br>Impacts of construction and installation activities on commercially harvested species will be highly localized. HDD activities may cause short-term impacts to near-shore commercial shell fishing activities and shellfish habitat. It is anticipated that noise from wind turbine construction, including pile driving, and low-intensity noise from drilling, dredging, or increased vessel traffic may induce commercially targeted species to be temporarily displaced from the immediate vicinity of the construction and installation activities<br><br>If vessel restrictions are necessary to accommodate the safe operation of cable installation and other vessels, such restrictions would be temporary. Project-related vessel traffic during the O&M phase of the Project is not anticipated to cause impacts to either commercial or for-hire recreational fisheries.<br><br>WTGs may become fishing locations, and for-hire recreational fishing activities may increase in the WDA. Anglers' interest in visiting the WDA may lead to an increased number of fishing trips out of nearby ports, which could support an increase in angler expenditures at local bait shops, gas stations, and other shoreside dependents (Kirkpatrick et al., 2017, p. 74).<br><br>Impacts from decommissioning activities will be similar to those associated with construction. | The BOEM WEA, which contains the WDA, was sited to exclude an area of high fisheries value to reduce potential conflict with commercial and recreational fishing activities.<br><br>Vineyard Wind has developed a Fisheries Communication Plan (see Appendix III-E) and will continue to refine that plan during construction. As described in the Fisheries Communication Plan (Appendix III-E), both Fisheries Liaisons (FL) and Fisheries Representatives (FR) will be employed on the Project to ensure effective communication between the Project and the fishermen. More information on the FL and FR roles can be found in Appendix III-E.<br><br>Vineyard Wind has developed a framework for a pre- and post-construction fisheries monitoring program to measure the Project's effect on fisheries resources. Vineyard Wind is working with the Massachusetts School for Marine Science and Technology (SMAST) and local stakeholders to inform that effort and design the study. The duration of monitoring will be determined as part of the initial effort to determine the scope of the study, but it is anticipated to include the pre-construction period and at least one year of post-construction monitoring.<br><br>Post-construction monitoring will also be conducted to document habitat disturbance and recovery (see Benthic Habitat Monitoring Plan in Appendix III-D).<br><br>To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. Offshore Wind Mariner Updates and NTMs will be distributed by Vineyard Wind and the USCG to notify recreational and commercial vessels of their intended operations to/from and within the WDA. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Commercial Fisheries and For Hire Recreational Fishing (Continued) | | Vineyard Wind is currently providing and will continue to provide portable digital media with electronic charts depicting locations of Project-related work to provide fishermen with accurate and precise information on work within offshore Project Area.<br><br>To aid mariners navigating the WDA, WTGs and ESPs will be lit, painted and marked with high-visibility paint and unique identification lettering and numbering, and maintained as Private Aids to Navigation (PATONs). The target burial depth of the cables is of sufficient depth to avoid interactions with fishing gear and/or anchors.<br><br>The Project's offshore facilities only occupy a minimal portion of the WDA so a large portion of the WDA will remain undisturbed, thereby minimizing impacts to fisheries and improving navigational ability throughout the WDA.<br><br>Impacts associated with scheduled, periodic maintenance activities during the O&M phase will be adequately mitigated through ongoing communication with fisherman and implementation of BMPs when feasible. See BMPs # 31-35 in Table 4.2-2. |
| Land Use and Coastal Infrastructure | Vineyard Wind anticipates that each phase of the Project will generate few impacts on extant land use patterns and coastal infrastructure. Any construction impacts will be short term. Impacts from O&M are not anticipated to have adverse effects on the surrounding communities and will not disrupt the communities' routine functions.<br><br>The construction and installation process will make use of existing port facilities and modifications to those facilities are not anticipated. Vessels will operate from existing port facilities, but the frequency of these vessels operating from the New Bedford Marine Commerce Terminal and the future O&M Facilities will increase. | Construction, O&M, and decommissioning activities will be adequately mitigated through the implementation of BMPs when practicable. See BMPs #1, 3, and 41 in Table 4.2-2. Vineyard Wind's onshore construction schedule minimizes impacts to land uses and coastal infrastructure during peak summer months and other times when demands on these resources are elevated. Likewise, Vineyard Wind will not conduct activities along the onshore transmission route within public roadway layouts from Memorial Day through Labor Day unless authorized by the host town; such work could extend through June 15 subject to consent from the local Department of Public Works (DPW).<br><br>System repairs typically involve work on transmission cables which are accessed through |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Land Use and Coastal Infrastructure (Continued) | Installation of duct bank beneath paved roadways will require only minimal disturbance to the adjacent road shoulder and is expected to be completed without significant alteration to any land or infrastructure.<br><br>HDD operations may result in minor, temporary impacts to seawalls, and/or parking and access facilities in the immediate vicinity of the Landfall Site. Establishment of the Project's O&M Facilities may cause temporary and localized impacts in the immediate vicinity of the Facility. | manholes at the installed splice vaults, or within the fenced perimeter of the substation, thus they can be completed within the installed transmission infrastructure without impacts to surrounding land uses or coastal infrastructure.<br><br>After decommissioning, the O&M Facilities can be easily repurposed for continued use by Vineyard Wind or another site operator. |
| Navigation and Vessel Traffic | Project-related activities may impact navigation capacity and vessels transiting to and from ports along the south coast of Massachusetts, Cape Cod and the Islands, and Rhode Island.<br><br>Temporary restrictions on non-Project related vessels transiting in the immediate vicinity of the Project's construction vessels may be necessary. Aside from this, no significant disruptions to the Project Region's established navigation patterns or aids to navigation are anticipated during the construction or decommissioning phases.<br><br>When less maneuverable Project vessels are transiting confined navigation channels, non-Project related vessels transiting the channel may infrequently need to alter course or adjust their departure/arrival times to avoid navigational conflicts. Ferries operating between Hyannis and the island of Nantucket may need to make minor adjustments to accommodate cable laying vessels working in the OECC.<br><br>AIS data suggests that commercial vessel traffic through the WDA is infrequent, and construction, operations, and decommissioning activities are not anticipated to affect such vessel traffic. During the O&M | The Project is sited within the MA WEA, which, after public comment, was developed to avoid shipping lanes and USCG-designated Traffic Separation Schemes.<br><br>Vineyard Wind will continue to work with ferry operators, harbor pilots, other vessel operators, the New Bedford Harbor Development Commission, the New Bedford Harbor Master, USCG, and other entities to ensure disruption to commercial vessel traffic and navigation is minimized to the greatest extent practicable. Vineyard Wind will develop and implement a communication plan to engage these stakeholders.<br><br>Vineyard Wind will work to coordinate a vessel traffic management plan, as necessary, to ensure construction and installation vessel operations align with established port operations. Vineyard Wind has also engaged with marine pilots to coordinate construction and installation vessel approaches to the Project Region, as required by state and federal law, and to minimize impacts to commercial vessel traffic and navigation.<br><br>To minimize hazards to navigation, all Project-related vessels, equipment, and appurtenances will display the required navigation lighting and day shapes. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Navigation and Vessel Traffic (Continued) | phase, the presence of WTGs and ESPs may increase risks to navigation, and commercial vessels may select alternate routes around the WDA rather than navigating through the WDA.<br><br>The O&M Facilities will require deep-water access and quayside facilities. However, because these siting requirements are consistent with existing working ports, the O&M Facilities are not expected to affect commercial vessel traffic.<br><br>Upon installation of the offshore export cable system, anchoring of vessels in proximity to the OECC is not recommended, but any anchoring limitations along the OECC are not anticipated to affect commercial vessel traffic. | Offshore Wind Mariner Updates and NTM will be distributed by Vineyard Wind and the USCG to notify recreational and commercial vessels of construction and installation activities. Local port communities and local media will be notified and kept informed as the construction progresses. Updated navigational charts (paper and electronic) with the location of the Project will be issued to stakeholders. The Project's website will be updated regularly to provide information on the construction zone, scheduled activities, and specific Project information.<br><br>To aid mariners navigating the WDA, WTGs and ESPs will contain sound signals and be lit, marked, and maintained as PATONs.<br><br>The WTGs are laid out in a grid-like pattern with spacing of 0.76-1.0 nm between turbines. In consultation with local fishermen and the USCG, corridors in a northwest/southeast and northeast/southwest direction have been maintained.<br><br>Temporary safety zones may be established around work areas during the construction and installation phase to improve safety in the vicinity of active work areas. This proposed safety zone would be adjusted as construction work areas change within the WDA, allowing fishermen and other stakeholders to make use of the portions of the WDA not being used for construction and installation activities.<br><br>Vineyard Wind will work with the USCG to develop a communication plan for search and rescue evacuations and other emergency response situations. To mitigate potential impacts to search and rescue aircraft operating in the WDA, the Project will have a strict operational protocol with the USCG that requires the Project to secure the WTG (stop the blades from rotating) within a specified time upon request from the USCG. |

Table 4.2-1 Summary of Potential Impacts and Avoidance, Minimization, and Mitigation Measures (Continued)

| Resource | Potential Impacts | Avoidance, Minimization, and Mitigation Measures |
|---|---|---|
| Other Uses (Marine Minerals, Military Use, Aviation, Offshore Energy) | No aspects of the Project are anticipated to affect national security, including USCG or Navy interests.<br><br>At various points during construction and possibly decommissioning, equipment and turbines located in the construction staging area, on vessels en route to the WDA, and at the WDA may have an effect on flight operations.<br><br>In conformance with the Project's Lease, the Project does not propose activities that will unreasonably interfere with or endanger activities or operations carried out under any lease or grant issued or maintained pursuant to the OCSLA.<br><br>One of the power cables servicing the Island of Nantucket, which is owned by National Grid, may be crossed depending on the final Landfall Site chosen for installation.<br><br>Given the limited geographic areas of the WDA and the OECC, any future sand and mineral extraction activities proposed in the Offshore Project Area are not anticipated to be affected.<br><br>Because the closest NEXRAD (Next-Generation Radar) facility to the WDA is approximately 97 km (60 mi), there are no anticipated impacts to radar systems associated with the WTGs that would require the implementation of mitigation measures.<br><br>Impacts associated with operations and maintenance of the Project are not anticipated to have adverse effects on national security, aviation and air traffic, offshore energy, sand and mineral extraction, cables and pipelines, or radar systems. | The Project is located in the MA WEA, which was selected by BOEM after an exhaustive process with a goal of minimizing conflicts among existing uses and the environment. BOEM has coordinated with DoD on its final MA WEA.<br><br>To minimize impacts to other uses within the Project Area, Vineyard Wind will implement BMPs when practicable and develop comprehensive communications plans to keep the relevant parties informed throughout the construction and installation phase of the Project. See BMPs # 41 – 44 in Table 4.2-2.<br><br>Vineyard Wind has consulted with the Navy and has been informed that the Project does not raise concerns for the Navy. Vineyard Wind will continue to work cooperatively with USCG and Navy personnel to address any navigation, operations, or other concerns with decommissioning activities. Vineyard Wind and the USCG will provide Offshore Wind Mariner Updates and NTMs that describe Project-related activities that may be of interest to national security interests, including Navy personnel operating within the Project Region.<br><br>The Project will follow standard techniques for adequately protecting the National Grid cable, the newly installed offshore export cable, and any cable and/or pipeline that is installed prior to decommissioning. |

In addition to or in agreement with the avoidance, minimization, and mitigation measures described in Table 4.2-1 above, the Project will comply with BOEM's best management practices ("BMPs") outlined in Appendix A of *Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP)* (2016). Table 4.2-2 identifies how the Project will address or adhere to all of BOEM's BMPs. However, it is important to recognize that the Project will implement additional BMPs beyond those prescribed by BOEM, as described in Table 4.2-1 above.

**Table 4.2-2 BOEM's Best Management Practices**

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Preconstruction Planning** | |
| 1 | Minimize the area disturbed by preconstruction site monitoring and testing activities and installations. | Vineyard Wind's Site Assessment Plan ("SAP") proposes the use of up to two meteorological and/or oceanographic buoys, which minimize disturbed areas. Similarly, Vineyard Wind's preconstruction geophysical and geotechnical work is designed to minimize impacts in accordance with approved survey plans and lease requirements. Wildlife studies have employed minimally invasive techniques for observing species and habitat presence. |
| 2 | Contact and consult with the appropriate affected federal, state, and local agencies early in the planning process. | During the development of the Construction and Operation Plan ("COP") (and other permit filings), Vineyard Wind has engaged with federal, state, and local agencies to identify and address any issues of potential concern. This extensive engagement has informed the design of the Project and the activities presented in the COP. See Section 6 of Volume I for a list of meetings that were in addition to ongoing phone and email consultations with the relevant agencies. |
| 3 | Consolidate necessary infrastructure requirements whenever practicable. | Vineyard Wind has made every effort to consolidate infrastructure requirements. This is perhaps most evident with respect to the use of the most technologically-efficient wind turbine generators ("WTGs") currently demonstrated for offshore use, which reduces the offshore infrastructure necessary this amount of energy production. Similarly, all onshore and offshore export cables will be installed in a single corridor. |
| 4 | Develop a monitoring program to ensure that environmental conditions are monitored during construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts are mitigated. | The Project will be carefully monitored during construction, operation, and decommissioning. Resource specific monitoring plans are discussed throughout Volume III of the COP. The Environmental Management System is discussed in Section 4.2.2 of Volume I. Adaptive management strategies, based on ongoing monitoring results, will be established. A general discussion of proposed adaptive management strategies pertinent to each resource are located in the individual sections throughout Volume III of the COP. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| | Best Management Practice | Project Activities |
|---|---|---|
| | **Seafloor Habitats** | |
| 5 | Conduct seafloor surveys in the early phases of a project to ensure that the alternative energy project is sited appropriately to avoid or minimize potential impacts associated with seafloor instability or other hazards. | The Project is located within the Massachusetts Wind Energy Area ("MA WEA"), which BOEM has identified as appropriate for development of wind energy. In addition, Vineyard Wind has conducted geophysical and geotechnical surveys to confirm that site conditions are suitable for the Project. See COP Volume II for detailed discussions of site conditions. |
| | **Seafloor Habitats** | |
| 6 | Conduct appropriate pre-siting surveys to identify and characterize potentially sensitive seafloor habitats and topographic features. | Pre-siting surveys have been conducted to identify and characterize potentially sensitive seafloor habitats and topographic features. See COP Volume II and Sections 6.5 and 6.6 of Volume III for detailed findings. No sensitive seafloor habitats have been identified within the Wind Development Area ("WDA"). |
| 7 | Avoid locating facilities near known sensitive seafloor habitats, such as coral reefs, hard-bottom areas, and chemosynthetic communities. | No sensitive seafloor habitats have been identified within the WDA. The Offshore Export Cable Corridor ("OECC") has been designed to avoid as much sensitive habitat as possible including all mapped eelgrass. Some coarse material will be crossed in the area of Muskeget Channel. A small area of mapped hard-bottom is located off the Covell's Beach Landfall Site. If this is the final landfall, it will be mostly avoided by the use of horizontal directional drilling ("HDD"). |
| 8 | Avoid anchoring on sensitive seafloor habitats. | Anchored vessels will not be used as primary construction and installation vessels within the WDA. Any anchoring that does occur within the WDA will occur within the Area of Potential Effect (APE) defined in Volume II-C. Anchoring may be used along the OECC during offshore export cable installation, within the APE defined in Volume II-C. If used, anchored vessels will avoid sensitive seafloor habitats to the maximum extent practicable. |
| 9 | Employ appropriate shielding for underwater cables to control the intensity of electromagnetic fields. | Cables will be configured as shown in Figure 3.1-17 of Volume I. In addition, cable casing and burial will serve to greatly mitigate potential electromagnetic field impacts. |
| 10 | Reduce scouring action by ocean currents around foundations and to seafloor topography by taking all reasonable measures and employing periodic routine inspections to ensure structural integrity. | Scour protection, consisting of rock or stone, will be laid around each WTG and electrical service platform foundation, and will be routinely inspected. |
| 11 | Avoid the use of explosives when feasible to minimize impacts to fish and other benthic organisms. | Explosives are not intended to be used during the construction, operation, or decommissioning of the Project. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| | Best Management Practice | Project Activities |
|---|---|---|
| | Marine Mammals | |
| 12 | Take all reasonable actions to minimize seabed disturbance and sediment dispersion during cable installation. | A number of cable installation techniques are being considered that will both minimize seabed disturbance and sediment dispersion and prioritize cable burial. See Section 4.2.3.3.2 of Volume I for detailed discussions of disturbance and sediment dispersion minimization. |
| 13 | Evaluate marine mammal use of the proposed project area and design the project to minimize and mitigate the potential for mortality or disturbance. The amount and extent of ecological baseline data required will be determined on a project basis. | The location of the MA WEA was selected to minimize and mitigate impact to marine mammals. Section 6.7.1 of Volume III contains an extensive discussion of marine mammal abundance, status, distribution, and occurrence potentially within the Project Area based on multi-year studies of marine mammal use of the site. The Project has been designed with an understanding of marine mammal presence in the Project Area. |
| 14 | Vessels related to project planning, construction, and operation shall travel at reduced speeds when assemblages of cetaceans are observed. Vessels will also maintain a reasonable distance from whales, small cetaceans, and sea turtles, and these will be determined during site-specific consultations. | Vineyard Wind will adhere to legally mandated speed, approach, and other vessel requirements in the Offshore Project Area. As safe and practicable, the National Oceanic and Atmospheric Administration's vessel strike guidance will also be implemented. |
| 15 | Minimize potential vessel impacts to marine mammals and turtles by requiring project-related vessels to follow the NMFS Regional Viewing Guidelines while in transit. Operators shall be required to undergo training on applicable vessel guidelines. | Project vessels will comply with the National Marine Fisheries Service ("NMFS") Regional Viewing Guidelines while in transit. In addition, vessel operators will undergo training on applicable guidelines. |
| 16 | Take efforts to minimize disruption and disturbance to marine life from sound emissions, such as pile driving, during construction activities. | Vineyard Wind will develop mitigation that will effectively minimize and avoid impacts to marine mammals from pile driving noise. For example, current best practice noise attenuation methods for constructing offshore wind, such as bubble curtains, will be considered. Vineyard Wind also plans to evaluate new and available monitoring technologies as part of the permitting processes. |
| 17 | Avoid and minimize impacts to marine species and habitats in the project area by posting a qualified observer on site during construction activities. This observer will be approved by BOEM and NMFS. | BOEM and NMFS qualified observers will be employed during pile driving activities. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Fish Resources and Essential Fish Habitats** | |
| 18 | Conduct pre-siting surveys (may use existing data) to identify important, sensitive, and unique marine habitats in the vicinity of the projects; they will then design the project to avoid, minimize, or otherwise mitigate adverse impacts to these habitats. | Pre-siting surveys have been conducted in the WDA and OECC. Section 6.6 of Volume III contains a discussion of marine habitats in the vicinity of the Project. Appendix III-F contains a discussion of essential fish habitat. Volume II also describes additional site-specific surveys. The location of the MA WEA was selected to minimize and mitigate impacts to important, sensitive, and unique marine habitats. The OECC has been routed to minimize impacts to sensitive habitats. |
| 19 | Minimize construction activities in areas containing anadromous fish during migration periods. | Avoidance, minimization, and mitigation measures for all fish species are discussed in Section 6.6.2 of Volume III. |
| 20 | Minimize seafloor disturbance during construction and installation of the facility and associated infrastructure. | Seafloor disturbance will be minimized to the extent practicable as described in Section 6.5 of Volume III. |
| | **Sea Turtles** | |
| 21 | Minimize potential vessel impacts to marine mammals and sea turtles by requiring project-related vessels to follow the NMFS Regional Viewing Guidelines while in transit. Operators shall be required to undergo training on applicable vessel guidelines. | Project vessels will comply with the NMFS Regional Viewing Guidelines while in transit. In addition, vessel operators will undergo training on applicable guidelines. |
| 22 | Take efforts to minimize disruption and disturbance to marine life from sound emissions, such as pile driving, during construction activities. | As discussed in Section 6.7.2.1.3 of Volume III of the COP Vineyard Wind will develop mitigation that will effectively minimize and avoid impacts to sea turtles from pile driving noise. |
| 23 | Locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches. | Cable landfalls and onshore facilities are not located near known sea turtle nesting beaches. |
| | **Avian Resources** | |
| 24 | Evaluate avian use in the project area and design the project to minimize or mitigate the potential for bird strikes and habitat loss. The amount and extent of ecological baseline data required will be determined on a project-to-project basis. | The location of the MA WEA was selected to minimize and mitigate impacts to avian species. Section 6.1 of Volume III contains a discussion of inland birds and Sections 6.2 and 6.4 of Volume III contain a detailed discussion of coastal and marine birds. Appendix III-C contains extensive data on avian use of the Project Area. The avian information has informed the Project design and potential mitigation measures. The offshore location of the WTGs avoids impacts to many bird species. |
| 25 | Take measures to reduce perching opportunities. | Based on site specific studies, avian activity is minimized due to the distance from shore. Therefore, perching concerns are likewise minimized. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Avian Resources** | |
| 26 | Locate cable landfalls and onshore facilities so as to avoid impacts to known nesting beaches of sensitive species during the breeding season. | The analysis in Section 6.4 of Volume III shows that construction activities would not result in impacts to nesting beaches during the breeding season. |
| 27 | Comply with Federal Aviation Administration (FAA) and USCG requirements for lighting while using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on avian species. | Lighting has been designed to minimize impacts on avian species. Section 3.1.1 of Volume I and Section 6.2 of Volume III describe the proposed lighting scheme that is in accordance with FAA and US Coast Guard ("USCG") requirements. |
| | **Acoustic Environment** | |
| 28 | Plan site characterization surveys by using the lowest sound levels necessary to obtain the information needed. | Site characterization studies conducted to-date have used the lowest sound levels necessary to obtain the information needed. Field verification results have shown minimal noise generated from geophysical equipment. |
| 29 | Take efforts to minimize disruption and disturbance to marine life from sound emissions, such as pile driving, during construction activities. | Vineyard Wind will develop mitigation that will effectively minimize and avoid impacts to marine life during construction. See Sections 6.6, 6.7, and 6.8 of Volume III. |
| 30 | Employ, to the extent practicable, state-of-the-art, low-noise turbines or other technologies to minimize operational sound effects. | Vineyard Wind will deploy commercially available turbine technology. Impacts from operational sound are expected to be insignificant. See Section 6.7.2.2 of Volume III. |
| | **Fisheries** | |
| 31 | Work cooperatively with commercial/recreational fishing entities and interests to ensure that the construction and operation of a project will minimize potential conflicts with commercial and recreational fishing interests. | Vineyard Wind has engaged extensively with various port authorities; federal, state and local authorities, and other key stakeholders; including recreational fishermen and boaters, commercial fishermen, harbormasters, marine pilots , and other port operators to identify concerns and minimize potential conflicts. This outreach has informed the Project design and proposed activities. A working Fisheries Communication Plan has been developed, a draft of which is found in Appendix III-E. |
| 32 | Review planned activities with potentially affected fishing organizations and port authorities to prevent unreasonable fishing gear conflicts. Minimize conflict with commercial fishing activity and gear by notifying registered fishermen of the location and time frame of the project construction activities well in advance of mobilization; they will also provide updates throughout the construction period. | The Fisheries Communication Plan is found in Appendix III-E. In addition, fishermen have previously been informed of geophysical and geotechnical surveys through handouts, public presentations, working groups, advertisements, and active outreach by Fisheries Representatives and Fisheries Liaisons. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Fisheries** | |
| 33 | Use practices and operating procedures that reduce the likelihood of vessel accidents and fuel spills. | Vineyard Wind is firmly committed to full compliance with applicable environmental protection regulations and codes. Environmental protection measures that reduce the likelihood of vessel accidents and fuel spills are discussed in Section 4.2.2 of Volume I. |
| 34 | Avoid or minimize impacts to the commercial fishing industry by marking applicable structures (e.g., wind turbines, wave generation structures) with USCG-approved measures (e.g., lighting) to ensure safe vessel operation. | The WTGs will be appropriately marked in accordance with USCG-approved measures (e.g., lighting) to ensure safe vessel operation. See Section 7.8 of Volume III and Appendix III-I. |
| 35 | Avoid or minimize impacts to the commercial fishing industry by burying cables, where practicable, to avoid conflict with fishing vessels and gear operation. If cables are buried, inspect cable burial depth periodically during project operation to ensure that adequate coverage is maintained to avoid interference with fishing gear/activity. | Cables will be buried to target depths of 1.5-2.5 meters (4.9-8.2 feet), which will avoid conflict with fishing vessels and gear operation. In areas where sufficient cable burial depths cannot be achieved, cables will be covered with concrete mattresses or similar protection that will preclude conflict with fishing vessels and gear operation. Cables will be routinely monitored during the operations period. See Section 4.3.2 of Volume I, which includes a representative schedule of inspection and maintenance activities. |
| | **Coastal Habitats** | |
| 36 | Avoid hard-bottom habitats, including seagrass communities and kelp beds, where practicable, and restore any damage to these communities. | No sensitive seafloor habitats have been identified within the WDA. Export cable routes have been designed to avoid as much sensitive habitat as possible including all mapped eelgrass. Some coarse material will be crossed in the area of Muskeget Channel. A small area of mapped hard-bottom is located off the Covell's Beach Landfall Site. If this is the final Landfall Site, it will be mostly avoided by the use of HDD. |
| 37 | Implement turbidity reduction measures to minimize effects to hard-bottom habitats, including seagrass communities and kelp beds, from construction activities. | Due to the coarse-grained nature of surficial sediments within the OECC, any Project-generated turbidity related to cable installation or the transition from HDD is expected to be temporary and limited in spatial scope. See Section 5.2 of Volume III and Appendix III-A. |
| 38 | Minimize effects to seagrass and kelp beds by restricting vessel traffic to established traffic routes. | No sensitive seafloor habitats have been identified within the WDA. The OECC has been designed to avoid as much sensitive habitat as possible including all mapped eelgrass. Vessel travel during construction, operations, and decommissioning is therefore not likely to affect seagrass. If sensitive resources are known along transit routes, vessels will be advised to avoid the area to the greatest extent practicable. See Section 6.4 of Volume III. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Coastal Habitats** | |
| 39 | Minimize impacts to wetlands by maintaining buffers around wetlands, implementing BMPs from erosion and sediment control, and maintaining natural surface drainage patterns. | Through careful route selection and proper use of construction techniques such as HDD, the Project is designed to avoid potential wetlands impacts to the maximum extent practicable, and to minimize and mitigate for unavoidable impacts. See Sections 6.1 and 6.4 of Volume III. |
| | **Electromagnetic Fields** | |
| 40 | Use submarine cables that have proper electrical shielding and bury the cables in the seafloor, when practicable. | Cables will be configured as shown in Figure 3.1-17 of Volume I. In addition, cable casing and burial will serve to greatly mitigate potential EMF impacts. |
| | **Transportation and Vessel Traffic** | |
| 41 | Site alternative energy facilities to avoid unreasonable interference with major ports and USCG-designated Traffic Separation Schemes. | The Project is sited within the MA WEA, which, after public comment, was developed to avoid shipping lanes and USCG-designated Traffic Separation Schemes. |
| 42 | Meet FAA guidelines for sighting and lighting of facilities. | Section 3.1.1 of Volume I describes the proposed lighting, which is in accordance with FAA guidelines. |
| 43 | Place proper lighting and signage on applicable alternative energy structures to aid navigation per USCG circular NVIC 07-02 (USCG 2007) and comply with any other applicable USCG requirements. | The WTGs will be appropriately lit and marked in accordance with USCG-approved measures (e.g., lighting) to ensure safe vessel operation. See Section 7.8 of Volume III and Appendix III-I. |
| 44 | Conduct all necessary studies of potential interference of proposed wind turbine generators with commercial air traffic control radar systems, national defense radar systems, and weather radar systems; they must also identify possible solutions. | Vineyard Wind undertook an Aviation Impact Analysis to understand potential inference with commercial air traffic and radar systems, which can be found in Appendix III-J. Mitigation measures are discussed in Section 7.9 of Volume III. |
| | **Visual Resources** | |
| 45 | Address key design elements, including visual uniformity, use of tubular towers, and proportion and color of turbines. | The WTGs are uniformly tubular towers that will be no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey in color to reduce their visibility from against the horizon. Section 3.1.1 of Volume I provides the dimensions and coloring of turbines. |
| 46 | Use appropriate viewshed mapping, photographic and virtual simulations, computer simulation, and field inventory techniques to determine, with reasonable accuracy, the visibility of the proposed project. Simulations should illustrate sensitive and scenic viewpoints. | Viewshed mapping, photographic and virtual simulations, computer simulation, and field inventory techniques have been used to determine the visibility of the Project. The simulations illustrate sensitive and scenic viewpoints See Section 7.4 of Volume III and Appendices II-H.a and H.b. |
| 47 | Comply with FAA and USCG requirements for lighting while minimizing the impacts through appropriate application. | Section 3.1.1 of Volume I describes the proposed lighting that is in accordance with FAA and USCG requirements. Details of how and when the lights will be activated to minimize visual impacts will be determined in consultation with BOEM, FAA, and USCG. |

Table 4.2-2 BOEM's Best Management Practices (Continued)

| # | Best Management Practice | Project Activities |
|---|---|---|
| | **Visual Resources** | |
| 48 | Seek public input in evaluating the visual site design elements of proposed wind energy facilities. | Vineyard Wind conducted outreach on visual impacts and visual simulations on both Martha's Vineyard and Nantucket in August and September of 2017, respectively. Notices advertising the meetings were placed in the local newspapers. |
| 49 | Within FAA guidelines, directional aviation lights that minimize visibility from shore should be used. | Vineyard Wind is working to reduce the lighting to lessen the potential impacts of nighttime light on aesthetic concerns. The Project will use either an Aircraft Detection Lighting System that is activated automatically by approaching aircraft or a system that automatically adjusts lighting intensity to accommodate visibility conditions if commercially available and approved by BOEM and the FAA. |
| | **Operations** | |
| 50 | Prepare waste management plans, hazardous material plans, and oil spill prevention plans, as appropriate, for the facility. | Draft waste management plans, hazardous material plans, and oil spill prevention plans have been prepared and will be updated prior to construction. See Section 4.2 of Volume I and Appendix I-A. |