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Coastal Virginia Offshore Wind Commercial Project Draft Environmental Impact Statement Volume 2

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Coastal Virginia Offshore Wind Draft Environmental Impact Statement

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LIST OF APPENDICES

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Appendix A. Required Environmental Permits and Consultations

A.1. Required Environmental Permits

Table A-1 includes a summary of federal, state, and local permits or approvals that are required for Project implementation.

Table A-1 Required Environmental Permits for the Proposed Project

Agency/Regulatory Authority	Permit/Approval	Status
Federal (Portions of the Project within Federal Jurisdiction)		
BOEM	COP Approval	COP filed with BOEM on December 17, 2020. Updates to the COP were submitted on June 29, 2021, October 29, 2021, December 3, 2021, and May 6, 2022. BOEM's decision to approve, approve with modifications, or disapprove the COP is anticipated by September 1, 2023.
FAA	FAA Form 7460-1, Notice of Proposed Construction or Alteration (for Hazard to Air Navigation Determination)	Submitted on April 5, 2022, and determinations received on May 10, 2022.
NMFS	MMPA Section 101(a)(5) Letter of Authorization	Dominion Energy submitted a Letter of Authorization application to NMFS on February 16, 2022. The application was reviewed and considered complete on August 12, 2022. NMFS published a Notice of Receipt in the *Federal Register* on September 15, 2022.
USACE - Norfolk District	CWA Section 404 Permit and RHA Section 10 Permit	The initial RHA Section 10 and CWA Section 404 application was submitted on May 17, 2022. The complete application was received on August 31, 2022 and USACE published a Public Notice on September 15, 2022. Issuance of the permit decision is anticipated for Q3 2023.
USACE - Norfolk District	CWA Section 408 Permit	The initial application was submitted on May 17, 2022. A revised application was submitted on July 15, 2022 and USACE determined it was complete on August 1, 2022. Issuance of the permit decision is anticipated for Q3 2023.

Agency/Regulatory Authority	Permit/Approval	Status
USCG	PATON authorization	Planned.
USCG	Local Notice to Mariners per Ports and Waterways Safety Act	Planned.
USEPA	CAA OCS Air Permit	Initial application submitted on March 15, 2022. Submittal of the complete application is anticipated in Q3 2022.
State (Portions of the Project within State Jurisdiction)		
VMRC	Submerged Land Permit	Planned.
SCC	Certificate of Public Convenience and Necessity	Application submitted on November 5, 2021 and approved on August 5, 2022.
VDEQ, NCDEQ	CZMA Section 307 Consistency Certification	VDEQ review was started December 12, 2021. A decision is anticipated on November 24, 2022 (stay agreed upon from March 24, 2022, to September 1, 2022).
VDEQ	Virginia Water Protection Individual Permit	Planned.
VDEQ	CWA Section 401 Water Quality Certification	Planned.
VDEQ	Conformity Determination	Formal determination of applicability will result from further discussion with USEPA and VDEQ.
VDEQ	Emergency Generator General Permit	Planned.
VDEQ	Construction Stormwater General Permit Authorization	Planned.
VDEQ	Stormwater Pollution Prevention Plan	Planned.
VDEQ	Erosion and Sediment Control Plan	Planned.
VDCR	Virginia Scenic Rivers and invasive species consultation; invasive species management plan	Planned.
VDWR	Natural heritage/protected species consultation	Planned.
VDHR	Historic properties consultation	Planned.
VDACS	Consultation	Planned.
VDOF	Consultation	Planned.
Local (Portions of the Project within Local Jurisdiction)		
City of Virginia Beach	Floodplain Development Permit	Planned.
City of Virginia Beach	Land Disturbance Permit	Planned.
City of Virginia Beach	Conditional Use Permit/Site Plan Review	Planned.

Agency/Regulatory Authority	Permit/Approval	Status
Chesapeake	Floodplain Development Permit	Planned.
Chesapeake	Conditional Use Permit/Site Plan Review	Planned.
Local Wetlands Board Virginia Beach	Local Wetlands Approvals	Planned.
Various Virginia Counties / Municipalities, and Virginia Department of Transportation	Transportation permits (use of wide load and similar vehicles on public roads)	Planned.

BOEM = Bureau of Energy Management; COP = Construction and Operations Plan; FAA = Federal Aviation Administration; MMPA = Marine Mammal Protection Act; CWA = Clean Water Act; NCDEQ = North Carolina Department of Environmental Quality; Q = quarter; RHA = Rivers and Harbors Act; SCC = State Corporation Commission; USACE = U.S. Army Corps of Engineers; USCG = U.S. Coast Guard; USEPA = U.S. Environmental Protection Agency; VCADS = Virginia Department of Agriculture and Consumer Services; VDEQ = Virginia Department of Environmental Quality; VDHR = Virginia Department of Historic Resources; VDOF = Virginia Department of Forestry; VDOR = Virginia Department of Forestry; VMRC = Virginia Marine Resources Commission

A.2. Consultation and Coordination

A.2.1 Introduction

This section discusses public and agency involvement leading up to the preparation and publication of the Draft Environmental Impact Statement (EIS), including formal consultations, cooperating agency exchanges, the public scoping comment period, and correspondence. This section discusses public involvement in the preparation of this EIS, including BOEM’s responses to public comments, formal consultations, and cooperating agency exchanges. Interagency consultation, coordination, and correspondence throughout the development of this Draft EIS occurred primarily through virtual meetings, teleconferences, and written communications (including email). BOEM coordinated with numerous agencies throughout the development of this document, as listed in Section A.2.3.2, *Cooperating Agencies*.

A.2.2 Consultations

A.2.2.1 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) requires that any applicant for a required federal license or permit to conduct an activity, within the coastal zone or within the geographic location descriptions (i.e., areas outside the coastal zone in which an activity would have reasonably foreseeable coastal effects), affecting any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a state’s federally approved coastal management program. The Virginia Coastal Zone Management Program (CZMP) was established in 1986 and is administered by VDEQ, which serves as the lead agency for the network of Virginia state agencies and local governments that administer the CZMP. The North Carolina CZMP was established in 1978 and is administered by the North Carolina Division of Coastal Management, which serves as the lead agency for the network of North Carolina state agencies and local governments that administer the CZMP. Dominion Energy submitted a Coastal Zone consistency certification in the Coastal Virginia Offshore Wind Project (CVOW-C) COP. Appendix P (Dominion Energy 2021) provides the data and information necessary to certify that the construction, operations and maintenance (O&M), and decommissioning of the Project will be consistent with the CZMP, in accordance with CZMA § 307(c)(3)(A) and 15 Code of Federal Regulations (CFR) § 930, subpart D. VDEQ and the North Carolina DCM will review the reasonably foreseeable effects of the

Project on coastal use or resources for consistency with the enforceable policies of the Virginia and North Carolina CZMPs. The state's concurrence is required before BOEM may approve or approve with conditions the CVOW-C COP per 30 CFR 585.628(f) and 15 CFR 930.130(1).

A.2.2.2 Endangered Species Act

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [U.S.C.] 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (USFWS), depending upon the jurisdiction. Pursuant to 50 CFR 402.07, BOEM has accepted designation as the lead federal agency for the purposes of fulfilling interagency consultation under Section 7 of the ESA for listed species under the jurisdiction of NMFS and USFWS. BOEM is consulting on the proposed activities considered in this Draft EIS with both NMFS and USFWS and has prepared biological assessments for listed species under their respective jurisdictions.

A.2.2.3 Government-to-Government Tribal Consultation

Executive Order 13175 commits federal agencies to engage in government-to-government consultation with tribes when federal actions have tribal implications, and Secretarial Order No. 3317 requires U.S. Department of the Interior agencies to develop and participate in meaningful consultation with federally recognized tribes where a tribal implication may arise. A June 29, 2018, memorandum outlines BOEM's current tribal consultation policy (BOEM 2018). This memorandum states that "consultation is a deliberative process that aims to create effective collaboration and informed federal decision-making" and is in keeping with the spirit and intent of the National Historic Preservation Act (NHPA) and National Environmental Policy Act (NEPA), Executive and Secretarial Orders, and U.S. Department of the Interior Policy (BOEM 2018). BOEM implements tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and other engagement.

On July 2, 2021, BOEM contacted the Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, Absentee-Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Shinnecock Indian Nation, Narragansett Indian Tribe, Pamunkey Indian Tribe, Chickahominy Indian Tribe, Chickahominy Indian Tribe – Eastern Division, Upper Mattaponi Indian Tribe, Rappahannock Tribe, Nansemond Indian Nation, Tuscarora Nation, and Monacan Indian Nation by email and mail with information about the Project, an invitation to be a consulting party to the NHPA Section 106 review of the COP, and the Notice of Intent to prepare an EIS. BOEM also used this correspondence to notify of its intention to use the NEPA process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review.

BOEM hosted a government-to-government consultation meeting with the Rappahannock Indian Tribe, Pamunkey Indian Tribe, Nansemond Indian Nation, Chickahominy Indian Tribe, Upper Mattaponi Indian Tribe, Monacan Indian Nation, Delaware Nation, Delaware Tribe of Indians, Mashpee Wampanoag Tribe, Eastern Band Cherokee Indians, Passamaquoddy Tribe, Mashantucket (Western) Pequot Tribal Nation, and Cultural Heritage Partners on September 27, 2021. During the meeting, BOEM presented information about both the CVOW-C and Kitty Hawk Wind projects and discuss scoping comments received from federally recognized tribes for both projects.

A.2.2.4 National Historic Preservation Act

Section 106 of the NHPA (54 U.S.C. 306108) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. BOEM has determined that the proposed Project is an undertaking subject to Section 106 review. The construction of WTGs and OSS, installation of inter-array cables, and development of staging areas are ground- or seabed-disturbing activities that may adversely affect archaeological resources. The presence of WTGs may also introduce visual elements out of character with the historic setting of historic structures or landscapes; in cases where historic setting is a contributing element of historic properties' eligibility for the NRHP, the Project may adversely affect those historic properties.

The Section 106 regulations at 36 CFR 800.8 provide for use of the NEPA substitution process to fulfill a federal agency's NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. This process is commonly known as "NEPA substitution for Section 106", and BOEM is using this process and documentation required for the preparation of this EIS and the ROD to comply with Section 106. Appendix O, *Summary of Finding of [No] Adverse Effect for Historic Properties*, of this Draft EIS contains BOEM's Finding of Adverse Effect, which includes a description and summary of BOEM's consultation so far. BOEM will continue consulting with the Virginia State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation (ACHP), federally recognized tribes, and the consulting parties regarding the Finding of Adverse Effect and the resolution of adverse effects. BOEM has conducted and will be conducting Section 106 consultation meeting(s) on the Finding of Adverse Effect and the resolution of adverse effects, and the agency will be requesting the consulting parties to review and comment on the Finding of Adverse Effect and proposed resolution measures.

BOEM fulfilled public involvement requirements for Section 106 of the NHPA through the NEPA public scoping and public meetings process, pursuant to 36 CFR 800.2(d)(3). The Scoping Summary Report (BOEM 2021), available on BOEM's Project-specific website, summarizes comments on historic preservation issues. On June 28, 2021, BOEM contacted ACHP, Virginia Department of Historic Resources, and North Carolina SHPO to provide Project information, notify of BOEM's intention to use the NEPA process to fulfill Section 106 obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6, and invite these organizations to be consulting parties.

On June 28, 2021, BOEM corresponded with 59 points of contact from governments, organizations, and non-federally recognized tribes by mail and email. The correspondence included information about the Project, an invitation to be a consulting party to the NHPA Section 106 review of the COP, and the Notice of Intent to prepare an EIS. BOEM also used this correspondence to notify of its intention to use the NEPA process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review. To aid those consulting parties not familiar with the NEPA substitution process, BOEM developed a *National Environmental Policy Act (NEPA) Substitution for Section 106 Consulting Party Guide* (available at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/NEPA-Substitution-Consulting-Party-Guide.pdf).

On July 2, 2021, BOEM contacted the following federally recognized tribes by email and mail with information about the Project, an invitation to be a consulting party to the NHPA Section 106 review of the COP, and the Notice of Intent to prepare an EIS: the Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, Absentee-Shawnee Tribe of Indians of Oklahoma, Delaware Nation, Delaware Tribe of Indians, Shinnecock Indian Nation, Narragansett Indian Tribe, Pamunkey Indian Tribe, Chickahominy Indian Tribe, Chickahominy Indian Tribe – Eastern Division, Upper Mattaponi Indian Tribe, Rappahannock Tribe, Nansemond Indian Nation, Tuscarora Nation, and Monacan Indian Nation. BOEM also used this correspondence to notify of its intention to use the NEPA process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review.

Participants that have accepted consulting party status for the NHPA Section 106 Consultation are listed in Table A-2.

Table A-2 NHPA Section 106 Consulting Parties

Participants in the Section 106 Process	Participating Consulting Parties
SHPOs and state agencies	Virginia Department of Historic Resources Advisory Council on Historic Preservation
Federal agencies or facilities	Bureau of Safety and Environmental Enforcement National Park Service, Interior Region 1 U.S. Army Corps of Engineers, Eastern Virginia Regulatory Section U.S. Navy Region Mid-Atlantic U.S. Coast Guard U.S. Fish and Wildlife Service U.S. Fleet Forces Command Virginia Army National Guard Colonial National Historic Park NASA Wallops Flight Facility U.S. Fish and Wildlife Service Back Bay National Wildlife Refuge U.S. Fish and Wildlife Service Chincoteague National Wildlife Refuge U.S. Fish and Wildlife Service Eastern Shore of Virginia National Wildlife Refuge
Federally recognized tribes	Chickahominy Indian Tribe Chickahominy Indian Tribe – Eastern Division Delaware Nation Monacan Indian Nation Nansemond Indian Nation Pamunkey Indian Tribe Rappahannock Indian Tribe Upper Mattaponi Indian Tribe
Local governments	Accomack County City of Norfolk City of Virginia Beach Town of Chincoteague Town of Eastville
Non-federally recognized tribes	Coharie Tribe Lumbee Tribe of North Carolina Nottoway Indian Tribe of Virginia Patawomeck Indian Tribe of Virginia
Nongovernmental organizations or groups	Council of Virginia Archaeologists Eastern Shore of Virginia Historical Society Nansemond River Preservation Alliance Preservation Virginia Virginia African American Cultural Center

A.2.2.5 Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), federal agencies are required to consult with NMFS on any action that may result in adverse effects on Essential Fish Habitat (EFH). NMFS regulations implementing the EFH provisions of the MSA can be found at 50 CFR 600. As provided for in 50 CFR 600.920(b), BOEM has accepted designation as the lead agency for the purposes of fulfilling EFH consultation obligations under Section 305(b) of the MSA. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with NMFS. BOEM developed an EFH Assessment concurrent with the Draft EIS and transmitted the EFH Assessment to NMFS on August 31, 2022. NMFS anticipates receipt of the complete EFH Assessment from BOEM and initiation of the EFH consultation on March 20, 2023.

A.2.2.6 Marine Mammal Protection Act

Section 101(a) of the MMPA (16 U.S.C. 1361) prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 U.S.C. 1372(a)(l), (a)(2)). Sections 101(a)(5)(A) and (D) of the MMPA provide exceptions to the prohibition on take, which give NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals, provided certain findings are made and statutory and regulatory procedures are met. Incidental Take Authorizations may be issued as either (1) regulations and associated Letters of Authorization, or (2) an Incidental Harassment Authorization. Letters of Authorization may be issued for up to a maximum period of 5 years, and Incidental Harassment Authorizations may be issued for a maximum period of 1 year. NMFS has also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals (50 CFR 216) and has published application instructions that prescribe the procedures necessary to apply for an Incidental Take Authorization. Applicants seeking to obtain authorization for the incidental take of marine mammals under NMFS' jurisdiction must comply with these regulations and application instructions in addition to the provisions of the MMPA.

Once NMFS determines an application is adequate and complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on the affected marine mammal species or stocks and an immitigable impact on their availability for taking for subsistence uses. NMFS must also prescribe the "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, and on the availability of those species or stocks for subsistence uses, as well as monitoring and reporting requirements.

Dominion Energy submitted a Letter of Authorization application to NMFS on February 16, 2022. The application was reviewed and considered complete on August 12, 2022. NMFS published a Notice of Receipt in the *Federal Register* on September 15, 2022.

A.2.3 Development of the Draft Environmental Impact Statement

This section provides an overview of the development of the Draft EIS, including public scoping, cooperating agency involvement, and distribution of the Draft EIS for public review and comment.

A.2.3.1 Scoping

On July 2, 2021, BOEM issued a Notice of Intent (NOI) to prepare an EIS consistent with NEPA regulations (42 U.S.C. 4321 et seq.) to assess the potential impacts of the Proposed Action and alternatives (83 *Federal Register* 13777). The NOI commenced a public scoping process for identifying issues and potential alternatives for consideration in the EIS. The formal scoping period was from July 2, 2021 through August 2, 2021. BOEM held three virtual public scoping meetings to solicit feedback and identify issues and potential alternatives for consideration in the EIS. Throughout this timeframe, federal agencies, state and local governments, and the general public had the opportunity to help BOEM identify potential significant resources and issues, impact producing factors (IPFs), reasonable alternatives (e.g., size, geographic, seasonal, or other restrictions on construction and siting of facilities and activities), and potential mitigation measures to analyze in the EIS, as well as provide additional information. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the NHPA (54 U.S.C. 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), which requires federal agencies to assess the effects of projects on historic properties. Additionally, BOEM informed its Section 106 consultation by seeking public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the COP (Dominion Energy 2022). The NOI requested comments from the public in written form, delivered by hand or by mail, or through the http://regulations.gov web portal.

BOEM held three virtual scoping meetings on July 12, 14, and 20, 2021. BOEM reviewed and considered all scoping comments in the development of the Draft EIS and used the comments to identify alternatives for analysis. A Scoping Summary Report (BOEM 2021) summarizing the submissions received and the methods for analyzing them is available on BOEM's website at https://www.boem.gov/renewable-energy/state-activities/CVOW-C. In addition, all public scoping submissions received can be viewed online at http://www.regulations.gov by typing "BOEM-2021-0040" in the search field. As detailed in the Scoping Summary Report, the resource areas or NEPA topics most referenced in the scoping comments include the NEPA/public involvement process; recreation and tourism; mitigation and monitoring; commercial fisheries and for-hire recreational fishing; birds; demographics, employment and economics; and others.

A.2.3.2 Cooperating Agencies

BOEM invited other federal agencies and state, tribal, and local governments to consider becoming cooperating agencies in the preparation of the Draft EIS. According to Council on Environmental Quality (CEQ) guidelines, qualified agencies and governments are those with "jurisdiction by law or special expertise" (CEQ 1981). BOEM asked potential cooperating agencies to consider their authority and capacity to assume the responsibilities of a cooperating agency, and to be aware that an agency's role in the environmental analysis neither enlarges nor diminishes the final decision-making authority of any other agency involved in the NEPA process. BOEM also asked agencies to consider the "Factors for Determining Cooperating Agency Status" in Attachment 1 to CEQ's January 30, 2002 Memorandum for the Heads of Federal Agencies (CEQ 2002). BOEM held interagency meetings on August 19, 2021, October 18, 2021, and December 17, 2021, to discuss the environmental review process, schedule, responsibilities, consultation, and potential alternatives.

In response to BOEM's invitation to be a cooperating agency, the National Park Service requested to support the environmental review as a participating agency instead. The following federal agencies and state, tribal, and local governments have supported preparation of the Draft EIS as cooperating agencies:

- NMFS
- USACE
- Bureau of Safety and Environmental Enforcement (BSEE)
- USEPA
- USCG
- US Navy
- USFWS

- U.S. Department of Defense (DOD)
- Virginia Mines Minerals & Energy Department (VA DMME)

NMFS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that have the potential to affect marine resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to the MMPA, as amended (16 U.S.C. 1361 et seq.); the regulations governing the taking and importing of marine mammals (50 CFR 216); the ESA (16 U.S.C. 1531 et seq.); and the regulations governing the taking, importing, and exporting of threatened and endangered species (50 CFR 222–226). In accordance with 50 CFR 402, NMFS also serves as the Consulting Agency under Section 7 of the ESA for federal agencies proposing action that may affect marine resources listed as threatened or endangered. NMFS has additional responsibilities to conserve and manage fishery resources of the United States, which include the authority to engage in consultations with other federal agencies pursuant to the MSA and 50 CFR 600 when proposed actions may adversely affect EFH. The MMPA is the only authorization for NMFS that requires NEPA compliance, which may be met via adoption of BOEM's EIS and issuance of the Record of Decision (ROD).

USACE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to Sections 10 and 14 of the RHA and Section 404 of the CWA. As an offshore wind energy project, the Project needs to be situated offshore in the water. Consequently, the fill activities associated with the Project—which consist of the inter-array cables, armoring at the base of the WTG foundations, protective cable armoring for the export cables, and temporary cofferdams—are water dependent. Issuance of Section 10 or Section 404 permits requires NEPA compliance, which will be met via adoption of BOEM's EIS and issuance of the ROD.

BSEE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect marine resources under its jurisdiction by law and special expertise.

USEPA is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise, including air quality and water quality.

USCG is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect navigation and safety issues that fall under its jurisdiction by law and special expertise.

US Navy is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect issues that fall under its jurisdiction by law and special expertise.

USFWS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. USFWS also serves as the Consulting Agency under Section 7 of the ESA for federal agencies proposing actions that may affect terrestrial resources listed as threatened or endangered.

DOD is serving as a cooperating agency pursuant to 40 CFR 1501.8 because it has special expertise with respect to potential impacts that may occur as a result of the Proposed Action.

VA DMME is serving as a cooperating agency pursuant to 40 CFR 1501.8 because it has special expertise with respect to potential impacts that may occur as a result of the Proposed Action.

A.2.3.3 Distribution of the Draft Environmental Impact Statement for Review and Comment

The Draft EIS is available in electronic format for public viewing at https://www.boem.gov/renewable-energy/state-activities/CVOW-C. Hard copies and digital copies of the Draft EIS can be requested by contacting the Program Manager, Office of Renewable Energy in Sterling, Virginia. Publication of this Draft EIS initiates a 60-day comment period where government agencies, members of the public, and interested stakeholders can provide comments and input. BOEM will accept comments in any of the following ways.

- In hard copy form, delivered by mail, enclosed in an envelope labeled "CVOW-C EIS" and addressed to Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166. Comments must be received or postmarked no later than February 14, 2023.
- Through the regulations.gov web portal by navigating to https://www.regulations.gov/ and searching for docket number "BOEM-2022-0069". Click the "Comment Now!" button to the right of the document link. Enter your information and comment, then click "Submit."
- By attending one of the public hearings at the locations and dates listed in the NOA and providing written or verbal comments. BOEM will hold three virtual meetings to solicit feedback and identify issues for consideration in preparing the Final EIS.

BOEM will use comments received during the public comment period to inform its preparation of the Final EIS, as appropriate. EIS notification lists for the Project are provided in Appendix K, *List of Agencies, Organizations, and Persons to Whom Copies of the Statement are Sent*.

A.3. References Cited

Bureau of Ocean Energy Management (BOEM). 2018. *Tribal Consultation Guidance*. June 29, 2018. Available: https://www.boem.gov/sites/default/files/about-boem/Public-Engagement/Tribal-Communities/BOEM-Tribal-Consultation-Guidance-with-Memo.pdf.

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Appendix B. List of Preparers and Reviewers

Table B-1 Bureau of Ocean Energy Management Contributors

Name	Role/Resource Area
NEPA Coordinator	
Houghton, Bonnie	Environmental Protection Specialist
Resource Scientists and Contributors	
Baker, Kyle	Marine Mammals; Sea Turtles
Bigger, David	Birds; Bats; Coastal Habitat and Fauna
Brune, Genevieve	Land Use and Coastal Infrastructure
Denes, Sam	Marine Acoustician
Dobbs, Kerby	Other Uses – Marine Minerals
Draher, Jennifer	Water Quality
Draher, Jennifer	Oceanographer; Technical Design Elements
Fulling, Gregory	Marine Mammals; Sea Turtles
Heinze, Martin	Demographics, Employment, and Economics
Hildreth, Emily	Policy, Environmental Planning
Horrell, Chris	Marine Archaeologist
Houghton; Bonnie	Other Uses – Military, Aviation
Jensen, Brandon	Benthic Resources: Commercial Fisheries and For-Hire Recreational Fishing; Finfish, Invertebrates, and Essential Fish Habitat
Jensen, Mark	Demographics, Employment, Economics; Recreation and Tourism
Krevor, Brian	CZMA, NEPA Team Lead
MacDuffee, Dave	Chief, Projects, and Coordination Branch
McCarty, John	Visual Resources
Moshier, Marissa	Historian
Oliver, Elizabeth	Tribal Liaison
Ololade, Ajilore	Navigation and Vessel Traffic
Schnitzer, Laura K	Archaeologist, Section 106 Coordinator
Stokely, Sarah	Cultural Resources Team Lead
Wolf, Jacob	Air Quality

NEPA = National Environmental Policy Act; CZMA = Coastal Zone Management Act

Table B-2 USACE Support Staff to BOEM Contributors

Name	Role/Resource Area
NEPA Coordinators	
McCormick, John	Project Manager
Woodward, Justine	NEPA Coordinator
Resource Scientists and Contributors	
Colvin, Brandon	Scenic and Visual Resources
Martin, Zach	Marine Mammals; Sea Turtles
Perdue, Kathy	Coastal Habitat and Fauna; Wetlands

Name	Role/Resource Area
Schulte, Dave	Benthic Resources; Coastal Habitat and Fauna; Commercial Fisheries and For-Hire Recreational Fishing
Woodward, Justine	Birds; Bats; Other Uses

Table B-3 Reviewers

Name	Title	Agency
Andersen, Troy	Supervisory Fish & Wildlife Biologist, Virginia Field Office	USFWS
Argo, Emily	Biologist	USFWS, Virginia Field Office
Brown, William Y.	Chief Environmental Officer	BOEM
Christopher, Al	Director, Energy Team	VA DOE
Creelman, Matthew	District 5 Secondary Point of Contact District	USCG
Davis, Jamie	NEPA Reviewer	USEPA
Giordano, Juliette	Environmental Compliance Program Point of Contact	BSEE
Krueger, Mary	Energy Specialist	NPS Interior Region 1, North Atlantic - Appalachian
Ledwin, Jane	Infrastructure Streamlining Coordinator	USFWS
McCulloch, Tom	Assistant Director, Federal Property Management Section, Office of Federal Agency Programs	ACHP
Miller, Martin	Ecological Services	USFWS
Monroe, Lori	Solicitor	DOI
Morin, Michelle	Chief, Environment Branch for Renewable Energy	BOEM
Nevshehirlian, Stepan	Chief, Environmental Assessment Branch (NEPA)	USEPA
Sample, Steven	Executive Director, DOD Siting Clearinghouse	DOD
Schulz, Cindy	Field Office Supervisor, Virginia Field Office	USFWS
Supplee, Gwendolyn	Air Permitting Contact, Permits Branch	USEPA
Traver, Carrie	Lead NEPA Reviewer	USEPA
Tuxbury, Sue	Fishery Biologist/Wind Coordinator, Greater Atlantic Regional Fisheries Office Habitat and Ecosystems Services Division	NMFS
Vail-Muse, Stephanie	Regional Energy Coordinator	USFWS
Vorkoper, Stephen	Solicitor	DOI
Waller, Blake	NAS Oceana Environmental Program Director	US Navy
Woodward, Justine	Biologist	USACE
Woodward, Nicole	Environmental Scientist, Project Manager-Southern Virginia Regulatory Section	USACE

USFWS = U.S. Fish and Wildlife Service BOEM = Bureau of Ocean Energy Management; VA DOE = Virginia Department of Energy; USCG = U.S. Coast Guard; USEPA = U.S. Environmental Protection Act; BSEE = Bureau of Safety and Environmental Enforcement; NPS = National Park Service; ACHP = Advisory Council on Historic Preservation; DOI = U.S. Department of the Interior; DOD = U.S Department of Defense; NMFS = National Marine Fisheries Service; USACE = U.S. Army Corps of Engineers

Table B-2 Consultants

Name	Company	Role/Resource Area
Baer, Sarah	ICF	Demographics, Employment, and Economics; Environmental Justice
Bartlett, Alex	ICF	Deputy Project Manager; Water Quality; Wetlands
Barkaszi, Mary Jo	CSA	Marine Mammals; Sea Turtles
Brown, Sheri	ICF	Scenic and Visual Resources
Byram, Saadia	ICF	Editor
Cady, Robert	CSA	Bats; Birds
Cherry, Jesse	ICF	Publications Specialist
Cherry, Ken	ICF	Editor
Clermont, Jason	CSA	Commercial Fisheries and For-Hire Recreational Fishing
Cox, Deneisha	ICF	Administrative Record
Diller, Elizabeth	ICF	Project Director
Dodillet, Grace	CSA	Coastal Habitat and Fauna
Douglas, Robert	CSA	Benthic Resources
Erickson, Robert	CSA	Coastal Habitat and Fauna
Ernst, David	ICF	Air Quality/Climate
Fownes, Jennifer	ICF	Project Coordinator; Other Uses (Marine Minerals, Military Use, Aviation); Planned Activities Scenario
Gleaton, Soniya	ICF	Comment Processing
Graham, Bruce	CSA	Benthic Resources
Ha, Anthony	ICF	Publications Specialist
Hartigan, Kayla	CSA	Sea Turtles
Hatfield, Teresa	ICF	Navigation and Vessel Traffic; Environmental and Physical Setting
Irvin, Elizabeth	ICF	Editor
Jablon, Rebecca	ICF	Demographics, Employment, and Economics; Environmental Justice
Johnson, David	ICF	Water Quality; Wetlands
Johnson, Lissa	ICF	Geographic Information Systems
Jost, Rebecca	ICF	Recreation and Tourism
Lanza, Robert, P.E.	ICF	Planned Activities Scenario; QA/QC
Lassell, Susan	ICF	Cultural Resources and Section 106 Lead
Le, Alyssa	ICF	Land Use and Coastal Infrastructure
Lundstrom, Kristen	ICF	Editor
McCoy, Maureen	ICF	Section 106 Support, Architectural History
Mendoza, Tiffany	ICF	Public Involvement
Munaretto, Claire	ICF	Demographics, Employment, and Economics; Environmental Justice
Muntz, Alice	ICF	Section 106 Support, Terrestrial and Marine Archaeology
Paulson, Merlyn	ICF	Scenic and Visual Resources
Piggott, Jennifer	ICF	Public Involvement
Read, Brent	ICF	Geographic Information Systems

Name	Company	Role/Resource Area
Schanel, Pam	ICF	Project Manager
Stevens, Tara	CSA	Marine Mammals
Stutts, Ben	ICF	Recreation and Tourism
Tiggelaar, John	CSA	Commercial Fisheries and For-Hire Recreational Fishing

QA/QC = quality assurance/quality control

Appendix C. References Cited and Glossary

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C.2. Glossary

Term	Definition
affected environment	Environment as it exists today that could be affected by the proposed Project
algal blooms	Rapid growth of the population of algae, also known as algae bloom
allision	A moving ship running into a stationary ship
anthropogenic	Generated by human activity
Applicant Proposed Measure (APM)	Applicant proposed measures to avoid, minimize, and mitigate potential impacts
archaeological resource	Historical place, site, building, shipwreck, or other archaeological site on the landscape
below grade	Below ground level
benthic	Related to the bottom of a body of water
benthic resources	The seafloor surface, the substrate itself, and the communities of bottom-dwelling organisms that live within these habitats
cable landing location	Location where the offshore export cable transitions to the onshore export cable
Cetacea	Order of aquatic mammals made up of whales, dolphins, porpoises, and related lifeforms
coastal habitat	Coastal areas where flora and fauna live, including salt marshes and aquatic habitats
coastal waters	Waters in nearshore areas where bottom depth is less than 98.4 feet (30 meters)
coastal zone	The lands and waters starting at 3 nautical miles from the land and ending at the first major land transportation route
commercial fisheries	Areas or entities raising and catching fish for commercial profit
commercial-scale wind energy facility	Wind energy facility usually greater than 1 MW that sells the produced electricity
criteria pollutant	One of six common air pollutants for which USEPA sets NAAQS: CO, lead, NO_2, ozone, particulate matter, or SO_2
critical habitat	Geographic area containing features essential to the conservation of threated or endangered species
cultural resource	Historical districts, objects, places, sites, buildings, shipwrecks, and archaeological sites on the American landscape, as well as sites of traditional, religious, or cultural significance to cultural groups, including Native American tribes
culvert	A structure, usually a tunnel, allowing water to flow under an obstruction (e.g., road, trail)
cumulative impacts	Impacts that could result from the incremental impact of a specific action, such as the proposed Project, when combined with other past, present, or reasonably foreseeable future actions or other projects; can occur from individually minor, but collectively significant actions that take place over time
demersal	Living close to the ocean floor
design envelope	The range of proposed Project characteristics defined by the applicant and used by BOEM for purposes of environmental review and permitting

Term	Definition
dredging	Removal of sediments and debris from the bottom of lakes, rivers, harbors, and other waterbodies
duct bank	Underground structure that houses the onshore export cables, which consists of polyvinyl chloride pipes encased in concrete
ecosystem	Community of interacting living organisms and nonliving components (such as air, water, soil)
electromagnetic field	A field of force produced by electrically charged objects and containing both electric and magnetic components
embayment	Recessed part of a shoreline
endangered species	A species that is in danger of extinction in all or a significant portion of its range
Endangered Species Act-listed species	Species listed under the ESA of 1973 (as amended)
environmental protection measure	Measure proposed to avoid or minimize potential impacts
ensonification	The process of filling with sound
environmental consequences	The potential direct, indirect, and cumulative impacts that the construction, O&M, and decommissioning of the proposed Project would have on the environment
environmental justice communities	Minority and low-income populations affected by the proposed Project
epifauna	Fauna that lives on the surface of a seabed (or riverbed), or is attached to underwater objects or aquatic plants or animals
essential fish habitat	Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (50 CFR 600)
export cables	Cables connecting the wind facility to the onshore electrical grid power
export cable corridor	Area identified for routing the entire length of the onshore and offshore export cables
federal aids to navigation	Visual references operated and maintained by USCG, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation
finfish	Vertebrate and cartilaginous fishery species, not including crustaceans, cephalopods, or other mollusks
for-hire commercial fishing	Commercial fishing on a for-hire vessel (i.e., a vessel on which the passengers make a contribution to a person having an interest in the vessel in exchange for carriage)
for-hire recreational fishing	Fishing from a vessel carrying a passenger for hire who is engaged in recreational fishing
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.
geomagnetic	Relating to the magnetism of Earth
hard-bottom habitat	Benthic habitats composed of hard-bottom (e.g., cobble, rock, and ledge) substrates

Term	Definition
historic property	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
historical resource	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
horizontal directional drilling	Trenchless technique for installing underground cables, pipes, and conduits using a surface-launched drilling rig
hull	Watertight frame or body of a ship
infauna	Fauna living in the sediments of the ocean floor (or river or lake beds)
inter-array cables	Cables connecting the wind turbine generators to the electrical service platforms
interconnection cables	Cables connecting from the switching station to the onshore substation; interconnection cables would be installed as either all overhead or a combination of overhead and underground (hybrid)
inter-link cables	Cables connecting the electrical service platforms to one another
invertebrate	Animal with no backbone
jacket foundation	Latticed steel frame with three or four supporting piles driven into the seabed
jack-up vessel	Mobile and self-elevating platform with buoyant hull
jet excavation	Process of moving or removing soil with a jet
jet plowing	Plowing in which the jet plow, with an adjustable blade, or plow rests on the seafloor and is towed by a surface vessel; the jet plow creates a narrow trench at the designated depth, while water jets fluidize the sediment within the trench; in the case of the proposed Project, the cables would then be feed through the plow and laid into the trench as it moves forward; the fluidized sediments then settle back down into the trench and bury the cable
jointing bay	Provides a clean dry environmental for jointing the offshore and onshore cables and provides protection to the cable jointing during operation
knot	Unit of speed equaling 1 nm per hour
landfall site	The shoreline landing site at which the offshore cable transitions to onshore
Lease Area	Commercial Lease of Submerged Lands for Renewable Energy Development on the OCS Offshore Virginia, Lease number OCS-A-0483 Approximately 112,799 acres. Approximately 27 statute miles (23.75 nautical miles) off Virginia Beach.
marine mammal	Aquatic vertebrate distinguished by the presence of mammary glands, hair, three middle ear bones, and a neocortex (a region of the brain)
marine waters	Waters in offshore areas where bottom depth is more than 98.4 feet (30 meters)
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

Term	Definition
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.
monopile or monopile foundation	A long steel tube driven into the seabed that supports a tower
nautical mile	A unit used to measure sea distances and equivalent to approximately 1.15 miles (1.85 kilometers)
offshore export cable	Cables that transfer electricity from the offshore substations to the cable landing location
offshore infrastructure	Turbines, offshore substations, and inter-array and offshore export cables
offshore Project area	Lease Area and offshore export cable corridors
offshore substation (OSS)	The interconnection point between the WTGs and the export cable; the necessary electrical equipment needed to connect the inter-array cables to the offshore export cables
onshore export cable	Underground cables that transfer electricity from the cable landing location to the onshore substation
onshore Project area	Onshore Project components including cable landing locations, onshore export cable corridors, onshore substation, switching station, and interconnection cables and cable routes
onshore substation	Substation connecting the proposed Project to the existing bulk power grid system
operations and maintenance facilities	Would include offices, control rooms, warehouses, shop space, and pier space
Outer Continental Shelf	All submerged land, subsoil, and seabed belonging to the United States but outside of states' jurisdiction
pile	A type a foundation akin to a pole
pile driving	Installing foundation piles by driving them into the seafloor
pinnipeds	Carnivorous, semiaquatic marine mammals with fins, also known as seals
pin pile	Small-diameter pipe driven into the ground as foundation support
plume	Column of fluid moving through another fluid
private aids to navigation	Visual references on structures positioned in or near navigable waters of the United States, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation; permits for the aids are administered by USCG
Project area	The combined onshore and offshore area where proposed Project components would be located
Project Design Envelope (PDE)	The PDE identifies a reasonable range of design parameters for proposed components and installation techniques for the Project
protected species	Endangered or threatened species that receive federal protection under the ESA of 1973 (as amended)
SCADA system	Supervisory Control and Data Acquisition system
scour protection	Protection consisting of rock and stone that would be placed around all foundations to stabilize the seabed near the foundations as well as the foundations themselves

Term	Definition
scrublands	Plant community dominated by shrubs and often also including grasses and herbs
sessile	Attached directly by the base
silt substrate	Substrate made of a granular material originating from quartz and feldspar, and whose size is between sand and clay
soft-bottom habitat	Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble, rock, ledge) substrates, as well as biogenic habitat (e.g., eelgrass, mussel beds, worm tubes) created by structure-forming species
substrate	Earthy material at the bottom of a marine habitat; the natural environment that an organism lives in
suspended sediments	Very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom; such material remains in suspension due to the upward components of turbulence and currents, or by suspension
switching station	Aboveground onshore facility that collects power and converts an underground onshore export cable configuration to an overhead interconnection cable configuration
threatened species	A species that is likely to become endangered within the foreseeable future
tidal energy project	Project related to the conversion of the energy of tides into usable energy, usually electricity
tidal flushing	Replacement of water in an estuary or bay because of tidal flow
trawl	A large fishing net dragged by a vessel at the bottom or in the middle of sea or lake water
turbidity	A measure of water clarity
utility right-of-way	Registered easement on private land that allows utility companies to access the utilities or services located there
vibracore	Technology/technique for collecting core samples of underwater sediments and wetland soils
viewshed	Area visible from a specific location
visual resource	The visible physical features on a landscape, including natural elements such as topography, landforms, water, vegetation, and manmade structures
wetland	Land saturated with water; marshes; swamps
wind energy	Electricity from naturally occurring wind
wind energy area	Areas with significant wind energy potential and defined by BOEM
wind turbine generator (WTG)	Component that puts out electricity in a structure that converts kinetic energy from wind into electricity

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Appendix D. Analysis of Incomplete or Unavailable Information

In accordance with Section 1502.21 of the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA), when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an Environmental Impact Statement (EIS) and when information is incomplete or unavailable, the agency shall make clear that such information is lacking. When incomplete or unavailable information was identified, the U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM) considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed. If essential to a reasoned choice among the alternatives, BOEM considered whether it was possible to obtain the information and if the cost of obtaining it was exorbitant. If it could not be obtained or if the cost of obtaining it was exorbitant, BOEM applied acceptable scientific methodologies to inform the analysis in light of this incomplete or unavailable information. For example, conclusive information on many impacts of the offshore wind industry may not be available for years, and certainly not within the contemplated timeframe of this NEPA process. In its place, subject matter experts have used the scientifically credible information available and generally accepted scientific methodologies to evaluate impacts on the resources while this information is unavailable.

D.1. Incomplete or Unavailable Information Analysis for Resource Areas

D.1.1 Air Quality

Although a quantitative emissions inventory analysis of the region, or regional modeling of pollutant concentrations, over the next 35 years would more accurately assess the overall impacts of the changes in emissions from the Project, any action alternative would lead to reduced emissions regionally and can only lead to a net improvement in regional air quality. The differences among action alternatives with respect to direct emissions due to construction, operations and maintenance (O&M), and decommissioning of the Project are expected to be small. As such, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the potential air quality and climate impacts of the Project. Therefore, BOEM does not believe that there is incomplete or unavailable information on air quality that is essential to a reasoned choice among alternatives.

D.1.2 Bats

Habitat use and distribution varies between season and species, and, as a result, there will always be some level of incomplete information on the distribution and habitat use of bats in both the onshore and offshore portions of the analysis area. Additionally, there is some level of uncertainty regarding the potential collision risk to individual bats that may be present within the offshore portions of the analysis area, as the U.S offshore wind is a new industry with only two offshore wind projects having been constructed at the time of this analysis. However, sufficient information on collision risk to bats observed at land-based U.S. wind projects exists, and it was used along with empirical data, including regional bat acoustic studies conducted from coastal, island, vessel, or offshore structure locations and regional telemetry data from recent studies focusing on listed species, to assess the likelihood of offshore occurrence, seasonal patterns, and bat species composition (see Appendix O-1 of the Construction and Operations Plan [COP]; Dominion Energy 2022). Dominion Energy is conducting Acoustic Thermographic Offshore Monitoring of birds and bats as part of the CVOW-Pilot Project adjacent to the commercial lease area to advance the understanding of avian and bat activity offshore. As described in Section 3.5 of the EIS, the likelihood of an individual bat encountering an operating wind turbine generator (WTG) during migration is low and, therefore, the differences among action alternatives with respect to bats for the Project are expected to be small. Dominion Energy has consulted with state and federal agencies and will conduct presence/absence surveys (acoustic and/or mist-net) for bats along portions of the Interconnection Cable Route Alternatives that will require tree removal beginning in May 2022 to better understand bat presence in the Onshore Project Area. As such, the analysis provided in the Final EIS is sufficient to support sound scientific judgments and informed decision-making related to the distribution and use of the onshore and offshore portions of the analysis area as well as to the potential for collision risk of bats. Therefore, in light of the data currently being collected and data planned to be collected, BOEM does not believe that there is incomplete or unavailable information on bat resources that is essential to a reasoned choice among alternatives.

D.1.3 Benthic Resources

Although there is uncertainty regarding the spatial and temporal distribution of benthic (faunal) resources and periods during which they might be especially vulnerable to disturbance, Dominion's surveys of benthic resources and BOEM studies (COP, Appendix D, Dominion Energy 2022; BOEM 2012; BOEM 2015) provided a suitable basis for generally predicting the species, abundances, and distributions of benthic resources within the geographic analysis area. Uncertainty also exists regarding the impact of some impact-producing factors (IPFs) on benthic resources. For example, specific stimulus-response related to acoustics and electromagnetic fields (EMFs) is not well studied, although there is some information from benthic monitoring at the Block Island Wind Farm and other studies (Hutchinson et al. 2018; PNNL 2013; Love et al. 2015, 2016) that allows for a broad understanding of the impacts. Similarly, specific secondary impacts, such as changes in diets throughout the food chain resulting from habitat modification and synergistic behavioral impacts from multiple IPFs, are not fully known. Again, results of benthic monitoring at the Block Island Wind Farm provide general knowledge of the overall impacts of these IPFs combined, if not individually. Therefore, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the overall impacts. For these reasons, BOEM does not believe that there is incomplete or unavailable information on benthic resources that is essential to a reasoned choice among alternatives.

D.1.4 Birds

There is incomplete information on the exact migratory routes of passerines and shore birds that fly over the Atlantic Outer Continental Shelf (OCS) (including those that fly at night) where some may fly overland or along the coast before crossing the ocean. In addition, there will always be some level of incomplete information on the distribution and habitat use of marine birds in the offshore portions of the analysis area, as habitat use and distribution varies between season, species, and years. However, a risk assessment framework was used to quantitatively evaluate adverse impacts of the Project on bird resources in the geographic analysis area (Section 3.7 of the EIS). The risk assessment utilized a weight-of-evidence approach and combined an assessment of exposure and behavioral vulnerability (including both displacement and collision) within the context of the literature to establish potential risk (see Appendix O-1 of the COP; Dominion Energy 2022). In addition, because U.S. offshore wind is a new industry, as described above for bats, there will be some level of uncertainty regarding the potential for collision risk and avoidance behaviors for some of the bird species that may be present within the offshore portions of the analysis area until information can be gained from operational projects.

Similarly, the U.S. Fish and Wildlife Service (USFWS) Biological Assessment (BA) (BOEM 2022) also provides a qualitative analysis of collision risk for the Project because relatively few individual birds from each of the listed species are likely (if at all) to enter into the proposed wind farm. Further, sufficient information on collision risk and avoidance behaviors observed in related species at European offshore wind projects is available and was used to analyze and corroborate the potential for these impacts as a result of the proposed Project (e.g., Petersen et al. 2006; Skov et al. 2018; see Appendix O-1 of the

COP; Dominion Energy 2022). As such, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to distribution and use of the offshore portions of the analysis area as well as to the potential for collision risk and avoidance behaviors in bird resources. Further, the similarity between the WTG layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM does not believe that there is incomplete or unavailable information on avian resources that is essential to a reasoned choice among alternatives.

D.1.5 Coastal Habitat and Fauna

Although the preferred habitats of terrestrial and coastal fauna are generally known, specific data on abundances and distributions within the geographic analysis area of various fauna within these habitats are likely to remain unknown without site-specific surveys. However, the species inventories and other general information about the area provide an adequate basis for evaluating the fauna likely to inhabit the onshore geographic analysis area. Additionally, the onshore activities proposed involve only common, industry-standard activities for which impacts are generally understood. Therefore, BOEM believes that the analysis provided in Section 3.8 of the EIS is sufficient to make a reasoned choice among the alternatives.

D.1.6 Commercial Fisheries and For-Hire Recreational Fishing

Fisheries are managed using a number of assumptions due to a partial understanding of fish stock dynamics and effects of environmental factors on fish populations. The commercial fisheries information used in this assessment has additional limitations including, but not limited to, reliance on self-reported fishery-dependent data and lack of economic baseline data. Vessel trip report data only provide an approximation because this information is self-reported and may not account for all trips. Available historical fisheries data lack consistency, making comparisons challenging. However, these data represent the best available data, and, in combination with other fisheries-dependent and independent data, sufficient information exists to support the findings presented in this EIS.

Recent annual revenue exposed for for-hire recreational fishing deriving directly from the Lease Area is also not currently available, although the majority of effort is centered around the triangle reefs area. The economic analysis conducted by BOEM of recreational for-hire boats, as well as for-hire and private-boat angler trips that might be affected by the overall Virginia Wind Energy Area (WEA), including the Lease Area, was conducted for 2007–2012 (Kirkpatrick et al. 2017). Although these data are presented in the COP and used for impact determinations in Section 3.9, updated data for the period of 2013 to the present are not explicitly available for the Lease Area. Using this study, coupled with recreational fishing surveys (e.g., the National Oceanic and Atmospheric Administration's [NOAA] Marine Recreational Information Program), BOEM does not believe that there is incomplete or unavailable information on commercial fisheries and for-hire recreational fishing resources that is essential to a reasoned choice among alternatives.

D.1.7 Cultural Resources

BOEM requires detailed information regarding the nature and location of historic properties that may be affected by an applicant's proposed activity in order to conduct review of the COP under Section 106 of National Historic Preservation Act (NHPA) (54 United States Code 306108; BOEM 2020). The assessment of effects from the proposed Project on historic properties is reliant on the identification and analysis of cultural resources in the geographic area in which these activities are proposed to take place (referred to as the *area of potential effects* [APE]). BOEM has determined there is sufficient information on cultural resources within the APE for the proposed Project that allows for the assessment of impacts, analysis and comparison of alternatives, and preliminary completion of a determination of effects on historic properties. However, BOEM has identified areas of presently unavailable information that would better inform and increase the specificity of the analysis.

For the Terrestrial Archaeological Resource Assessment (TARA), BOEM requires a complete inventory of terrestrial archaeological resources within the terrestrial APE to assess Project impacts and complete the analysis of alternatives based on specific historic properties. Dominion Energy will be using a process of phased identification and evaluation of historic properties as defined in 36 CFR 800.4(b)(2) to provide BOEM with the full completion of historic property identification in the terrestrial APE. (COP, Appendices DD; Dominion Energy 2022). Any thus-far known terrestrial archaeological resources identified as being located within the terrestrial APE are provided in the TARA. However, completion of Phase IB archaeological surveys during the phased process may lead to the identification of additional archaeological resources in the terrestrial APE. Findings from the phased process are anticipated to be presented in the Final EIS for this Project. However, some information pertaining to terrestrial archaeological resources will not be available until after completion of the Final EIS. BOEM will use a Memorandum of Agreement (MOA) to establish commitments for reviewing the sufficiency of any supplemental terrestrial archaeological investigations as phased identification; assessing effects on historic properties; and implementing measures to avoid, minimize, or mitigate effects in these areas prior to construction.

In conclusion, BOEM has determined there is sufficient information on cultural resources within the geographic analysis area and APE for the analysis in this Draft EIS to support a reasoned choice among alternatives. BOEM anticipates receiving additional information that would better inform the analysis through Dominion Energy's phased identification process as defined in 36 CFR 800.4(b)(2) and ongoing consultation.

D.1.8 Demographics, Employment, and Economics

There is some incomplete information relating to future offshore wind activities within the geographic analysis area, specifically for the number of WTGs and foundations, area of seafloor disturbance, and construction timeline. Best estimates or placeholders have been used for the current analysis; however, this missing information is not related to the Proposed Action. Therefore, BOEM does not believe that there is specific incomplete or unavailable information on demographics, employment, and economics that is essential to a reasoned choice among alternatives.

D.1.9 Environmental Justice

Evaluations of impacts on environmental justice communities rely on the assessment of impacts on other resources. As a result, incomplete or unavailable information related to other resources, such as visual and scenic resources, as described in this document, also affect the completeness of the analysis of impacts on environmental justice communities. BOEM is attempting to obtain all information essential to a reasoned choice among alternatives for environmental justice impacts.

D.1.10 Finfish, Invertebrates, and Essential Fish Habitat

Assessing and predicting the temporal and spatial distribution and abundance of marine motile finfish or invertebrates within an area as large as the proposed CVOW-C Lease Area will lead to some unexplained variability. Using resource survey data collected within the Lease Area (Dominion Wind Energy 2021), BOEM (2012, 2014, and 2015) assessments, and inter-agency broad-scale monitoring studies (Guida et al. 2017) have furnished a sufficient basis to assess and predict the finfish and invertebrate resources within the geographic analysis area. Information outlining the Endangered Species Act (ESA)-listed species, Essential Fish Habitat (EFH), and Habitats Areas of Particular Concern (HAPCs) will support the EIS in the BA and EFH Assessments. The Draft EIS and Draft EFH Assessment do not include or provide impact estimates per specific EFH features of concern (e.g., sand waves, megaripples, trough habitat, and isolated mud and gravel). Estimates for these benthic habitat features should be provided in the Final EIS and EFH assessments. Impacts on the ESA and EFH managed species should not be affected in a greater or lesser manner for the finfish or invertebrates discussed in the EIS. Specific impact discussions for the ESA and EFH species are provided in the BA and EFH Assessments (BOEM 2022).

The effects of EMF and noise such as pile driving on invertebrates is not well documented. The effects of sound and the thresholds of exposure have not been defined for fish and invertebrate juvenile and larvae stages as they have for adult finfish (Hawkins and Popper 2017; Weilgart 2018). The available studies concerning sound impacts related to pile driving specifically have been performed in test tanks and not in natural conditions, leaving some ambiguity as to the exact effect of noise impacts on the behavior of finfish invertebrate in an in-situ sitting. Other related impacts concerning habitat modification and the concomitant change in community structure and secondary impacts of the offshore food chain are not well studied for the geographic analysis area. The assessment utilized studies within the Mid-Atlantic Bight and European temperate waters that focused on monitoring the invertebrate and finfish assemblage dynamics and food-chain linkages. Using these studies provided a better understanding of how the benthic resources and communities within the proposed Lease Area may change and what impacts these changes may produce. Although these studies supported a better understanding of how these resources may be affected, the National Marine Fisheries Service (NMFS) has identified uncertainties of the scale of the broader geographic resource impacts and made recommendations for designing studies and pre-, during, and post-construction monitoring efforts to be used to identify and assess the potential effects on the finfish, invertebrate, and EFH resources within the geographic analysis area. NMFS has recommended that offshore wind energy projects incorporate and support the Northeast Fisheries Science Center scientific surveys (NMFS surveys), incorporating and developing a programmatic approach to mitigate impacts on these NMFS surveys and develop a broader geographical understanding of habitat modifications made by wind energy project structures.

Overall, the analysis of the IPFs presented in this EIS is sufficient to support sound scientific judgment and informed decision-making related to the impacts discussed and presented. Therefore, BOEM does not believe that there is incomplete or unavailable information on finfish, invertebrate, and EFH resources that is essential to a reasoned choice among alternatives.

D.1.11 Land Use and Coastal Infrastructure

There is no incomplete or unavailable information related to the analysis of impacts on land use and coastal infrastructure.

D.1.12 Marine Mammals

NMFS has summarized the current information about marine mammal population status, occurrence, and use of the region in its stock assessment reports for the Atlantic OCS and Gulf of Mexico (Hayes et al. 2019, 2020, 2021; NMFS 2021). These studies provided a suitable basis for predicting the species, abundances, and distributions of marine mammals in the geographic analysis area. The *Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment 2021* (NMFS 2021) indicated that there are insufficient data to determine population trends for most marine mammal species found regularly in the coastal and oceanic waters of Virginia, with the exception of the humpback whale (*Megaptera novaeangliae*; increasing population trend) and North Atlantic right whale (*Eubalaena glacialis*; decreasing population trend). As a result, there is uncertainty regarding how Project activities and cumulative effects may affect these populations. In addition to species distribution information, effects of some IPFs on marine mammals are also uncertain or ambiguous, as described below.

Potential effects of EMF have not been scaled to consider impacts on marine mammal populations or their prey in the geographic analysis area (Taormina et al. 2018), and no scientific studies have been conducted that examine the effects of altered EMF on marine mammals. However, although scientific studies summarized by Normandeau et al. (2011) demonstrate that marine mammals are sensitive to, and can detect, small changes in magnetic fields (as described in Section 3.15 of the EIS), potential impacts would likely only occur within a few feet of cable segments. The current literature does not support a conclusion that EMF could lead to changes in behavior that would cause significant adverse effects on marine mammal populations.

The behavioral effects of anthropogenic noises on marine mammals are increasingly being studied; however, behavioral responses vary depending on a variety of factors such as life stage, previous experience, and current behavior (e.g., feeding, nursing) and are therefore difficult to predict. In addition, the current NMFS disturbance criteria apply a single threshold for all marine mammals for impulsive noise sources and do not consider the overall duration, exposure, or frequency distribution of the sound to account for species-dependent hearing acuity. While elevated underwater sound could startle or displace animals, behavioral responses are not necessarily predictable from source levels alone (Southall et al. 2007).

In addition, research regarding the potential behavioral effects of pile-driving noise has generally focused on harbor porpoises and seals; studies that examine the behavioral responses of baleen whales to pile driving are absent from the literature. Based on available research, most studies conclude that, although pile-driving activities could cause avoidance behaviors or disruption of feeding activities, individuals would likely return to normal behaviors once the activity had stopped. However, uncertainty remains regarding the long-term cumulative acoustic impacts associated with multiple pile-driving projects that may occur over a number of years. This also applies to other project activities such as vessel movements (including vessel noise), high-resolution geophysical (HRG) surveys, geotechnical drilling, dredging activities, and wind turbine operational noise that may elicit behavioral reactions in marine mammals. As a result, it is not possible to predict with certainty the potential long-term behavioral effects on marine mammals from Project-related pile-driving or other activities, as well as ongoing concurrent and cumulative pile-driving and other activities.

To address this uncertainty, the assessment in the EIS used the best available information when considering behavioral effects related to underwater noise. To better characterize these impacts, all potential types of behavioral responses, as well as the context within which these responses may occur, were considered following guidance from applicable studies (Ellison et al. 2012, 2015; Southall et al. 2021) and used in conjunction with the NMFS disturbance threshold, as described in Section 3.15. For the assessment of large baleen whales, studies on other impulsive noises (e.g., seismic sources) were used to inform the potential behavioral reactions to pile-driving noise. Monitoring studies would provide insight into species-specific behavioral reactions to Project-generated underwater noise. Long-term monitoring of concurrent and multiple projects could inform the understanding of long-term effects and subsequent consequences from cumulative underwater noise activities on marine mammal populations.

There is a lack of research regarding the responses of large whale species to extensive networks of new structures due to the novelty of this type of development on the Atlantic OCS. Although over 2,100 new structures are anticipated from multiple offshore wind projects in the geographic analysis area under the planned activities scenario, it is expected that spacing will allow large whales to access areas within and between wind facilities. No physical obstruction of marine mammal migration routes or habitat areas are anticipated, but whether avoidance of offshore wind lease areas will occur due to new structures is unknown. Additionally, while there is some uncertainty regarding how hydrodynamic changes around foundations may affect prey availability, these changes are expected to have limited impacts on the local conditions around WTG foundations. It is anticipated that the presence of structures on the Atlantic OCS will also lead to localized changes in fishing activities and vessel traffic in the vicinity of the WTG foundations. The potential consequences of these impacts on marine mammals of the Atlantic OCS are currently unknown. Monitoring studies would provide insight into species-specific avoidance behaviors and other potential behavioral reactions to Project structures.

At present, this EIS has no basis to conclude that these IPFs would result in significant adverse impacts on most marine mammal populations. The life history and stock status of the North Atlantic right whale combined with ongoing, planned non-wind, and planned wind activities in the Atlantic OCS could result in severe population-level effects that may compromise the viability of the species. However, given the complex interconnectedness of individual IPFs, the exact level and extent of impacts on the North Atlantic right whale is impossible to predict with certainty. To address data gaps identified above, BOEM extrapolated or drew assumptions from known information for similar species and studies, as presented in Section 3.15 and in the BA submitted to NMFS (BOEM 2022). The information and methods used to predict potential impacts to marine mammal species represent the best available information. The analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making. Therefore, BOEM does not believe that there is incomplete or unavailable information on marine mammal resources that is essential to a reasoned choice among alternatives.

D.1.13 Navigation and Vessel Traffic

The navigation and vessel traffic impact analysis in the EIS is based on one year (January 1, 2019, to December 31, 2019) of Automatic Identification System (AIS) data from vessels required to carry AIS (i.e., those 65 feet [19.8 meters] or greater in length), as well as Vessel Monitoring System (VMS) data to infer commercial fishing and recreational vessel transits. Fishing vessels at least 65 feet (19.8 meters) long were not required to carry AIS until March 2015 (80 *Federal Register* 5282); therefore, AIS data prior to March 2015 are more limited than data available after March 2015. To account for some gaps in the data due to limitations of the AIS carriage requirements, the risk model included VMS data and Vessel Trip Reports required by NOAA to account for both current and future traffic not represented in the data (COP, Section 4, Table 4.4-19; Dominion Energy 2022).

The combination of AIS and VMS data described above with informed assumptions about smaller vessel numbers represents the best available vessel traffic data and is sufficient to enable BOEM to make a reasoned choice among alternatives.

As stated in Section 3.16, WTG and offshore service station (OSS) structures could potentially interfere with marine radars. Marine radars have varied capabilities and the ability of radar equipment to properly detect objects is dependent on radar type, equipment placement, and operator proficiency; however, trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all would enable safe navigation with minimal loss of radar detection (USCG 2020). Based on the foregoing, BOEM does not believe that there is incomplete or unavailable information on navigation and vessel traffic that is essential to a reasoned choice among alternatives.

D.1.14 Other Uses

As the design for the onshore project components is finalized, Dominion Energy will provide results from the Federal Aviation Administration's (FAA) Obstruction Evaluation Notice Criteria Tool, and this analysis will be incorporated into the EIS.

The proposed Project lies within the Atlantic Test Range Geographical Area of Concern, with the potential to impact test capabilities of the Advanced Dynamic Aircraft Measurement System at Patuxent River Naval Air Station. The Department of the Navy requests continued coordination on the undersea cable route and cable landing location, and notification of whether there are plans to put monitoring equipment on the undersea cables, and coordination on the use of foreign-owned or controlled vendors in the Project. Discussions with the Department of Defense are ongoing based on the findings of this informal review, and results will be incorporated into the EIS.

D.1.15 Recreation and Tourism

Evaluations of impacts on recreation and tourism rely on the assessment of impacts on other resources. As a result, incomplete or unavailable information related to visual and scenic resources, navigation and vessel traffic, commercial fisheries, and for-hire recreational fishing, as described in this document, also affect the completeness of the analysis of impacts on recreational tourism. BOEM is attempting to obtain all information essential to a reasoned choice among alternatives for recreation and tourism impacts.

D.1.16 Sea Turtles

There is incomplete information on the distribution and abundance of sea turtle species that occur in the Atlantic OCS and the Lease Area. The NMFS BA (BOEM 2022) provides a thorough overview of the available information about potential species occurrence and exposure to Project-related IPFs. The studies summarized therein provide a suitable basis for predicting potential species occurrence, relative abundance, and probable distribution of sea turtles in the geographic analysis area.

Some uncertainty exists about the effects of certain IPFs on sea turtles and their habitats. The effects of EMF on sea turtles are not completely understood. However, the available relevant information is summarized in the BOEM-sponsored report by Normandeau et al. (2011). Although the thresholds for EMF disturbing various sea turtle behaviors are not known, the evidence suggests that impacts may only occur within close proximity to the cables, and no adverse effects on sea turtles have been documented to occur from the numerous submarine power cables around the world. In addition, no nesting beaches, critical habitat, or other biologically important habitats were identified in the offshore export cable corridor.

There is also uncertainty about sea turtle responses to proposed Project construction activities, and data are not available to evaluate potential changes to movements of juvenile and adult sea turtles due to elevated suspended sediments. However, although some exposure may occur, total suspended solid impacts would be limited in magnitude and duration and would occur within the range of exposures periodically experienced by these species. On this basis, any resulting impact on sea turtle behavior due to sediment plumes would likely be too small to be biologically meaningful, and no adverse impacts would be expected (NOAA 2020). Certain types of dredgers, specifically trail suction hopper dredgers, may also pose an entrainment risk for sea turtles during installation of Project cables; however, there is still uncertainty regarding what methodology will be employed for each project and where these activities would occur. Some potential exists for sea turtle displacement, but it is unclear if this would result in adverse impacts (e.g., because of lost foraging opportunities or increased exposure to potentially fatal vessel interactions). Additionally, it is currently unclear whether concurrent construction of multiple projects, increasing the extent and intensity of impacts over a shorter duration, or spreading out project construction with lower-intensity impacts over multiple years would result in the least potential harm to sea turtles. There is also uncertainty regarding the cumulative acoustic impacts associated with pile-driving activities. It is unknown whether sea turtles affected by construction activities would resume normal feeding, migrating, or breeding behaviors once daily pile-driving activities cease, or if secondary impacts would continue. Under the planned activities scenario, individual sea turtles may be exposed to acoustic impacts from multiple projects in a single day or from one or more projects over the course of multiple days. Although the consequences of these exposure scenarios have been analyzed with the best available information, some level of uncertainty remains due to the lack of observational data on species' responses to pile driving.

Some uncertainty exists regarding the potential for sea turtle responses to FAA hazard lights and navigation lighting associated with offshore wind development. Dominion Energy would limit lighting on WTGs and OSSs to minimum levels required by regulation for worker safety, navigation, and aviation. Although sea turtles' sensitivity to these minimal light levels is unknown, sea turtles do not appear to be adversely affected by oil and gas platform operations, given their propensity for resting at these structures (Gitschlag and Herczeg 1994; NRC 1994), which produce far more artificial light than offshore wind structures. The placement of new structures would be far from nesting beaches, so no impacts on nesting female or hatchling sea turtles are anticipated.

Considerable uncertainty exists about how sea turtles would interact with the long-term changes in biological productivity and community structure resulting from the reef effect of offshore wind farms across the geographic analysis area. Artificial reef and hydrodynamic impacts could influence predator-prey interactions and foraging opportunities in ways that influence sea turtle behavior and distribution. Also, the extent of sea turtle entanglement on artificial reefs and shipwrecks is not captured in sea turtle stranding records, and the significance and potential scale of sea turtle entanglement in lost fishing gear are not quantified. These impacts are expected to interact with the ongoing influence of climate change on sea turtle distribution and behavior over broad spatial scales, but the nature and significance of these interactions are not predictable. BOEM anticipates that ongoing monitoring of offshore energy structures will provide some useful insights into these synergistic effects.

To address data gaps identified above, BOEM extrapolated or drew assumptions from known information for similar species and studies, as presented in Section 3.19, and in the BA submitted to NMFS (BOEM 2022). The information and methods used to predict potential impacts on sea turtle species represent the best available information. Therefore, the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project with respect to its impacts on sea turtles. For these reasons, BOEM does not believe that there is incomplete or unavailable information on turtles that is essential to a reasoned choice among alternatives.

D.1.17 Scenic and Visual Resources

No incomplete or unavailable information related to the analysis of impacts on scenic and visual resources was identified.

D.1.18 Water Quality

There is no incomplete or unavailable information related to the analysis of impacts on water quality.

D.1.19 Wetlands

There is no incomplete or unavailable information related to the analysis of impacts on wetlands.

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Appendix E. Project Design Envelope and Maximum-Case Scenario

Dominion Energy would implement a Project Design Envelope (PDE) concept. This concept allows Dominion Energy to define and bracket proposed Project characteristics for environmental review and permitting while maintaining a reasonable degree of flexibility for selection and purchase of Project components, such as wind turbine generators (WTGs), foundations, submarine cables, and offshore substation (OSS).[1]

The Bureau of Ocean Energy Management (BOEM) invited Dominion Energy and other lessees to submit Construction and Operations Plans (COPs) using the PDE concept—providing sufficiently detailed information within a reasonable range of parameters to analyze a "maximum-case scenario" within those parameters for each affected environmental resource. BOEM identified and verified that the maximum-case scenario based on the PDE provided by Dominion Energy and analyzed in this Draft Environmental Impact Statement (EIS) could reasonably occur if approved. This approach is intended to provide flexibility for lessees and allow BOEM to analyze environmental impacts in a manner that minimizes the need for subsequent environmental and technical reviews. In addition, the PDE approach may enable BOEM to expedite review by beginning National Environmental Policy Act (NEPA) evaluations of COPs before a lessee has finalized all of its design decisions.

This Draft EIS assesses the impacts of the reasonable range of Project designs that are described in the Dominion Energy COP by using the maximum-case scenario process. The maximum-case scenario analyzes the aspects of each design parameter that would result in the greatest impact for each physical, biological, and socioeconomic resource. This Draft EIS considers the interrelationship between aspects of the PDE rather than simply viewing each design parameter independently. This Draft EIS also analyzes the cumulative impacts of the maximum case scenario alongside other reasonably foreseeable past, present, and future actions.

A summary of Dominion Energy's PDE parameters is provided in Table E-1. Table E-2 details the full range of maximum-case design parameters for the proposed Project and which parameters are relevant to the analysis for each EIS section in Chapter 3, *Affected Environment and Environmental Consequences.*

Table E-1. Summary of PDE Parameters

Project Parameter Details
General (Layout and Project Size)
• 176 to 205 WTGs • Wind farm nameplate capacity ranging from 2,500 to 3,000 MW • Anticipated to begin offshore construction in 2023 (scour protection, offshore cables) and 2025 (WTGs) • Construction of the Project is expected to be complete within approximately 3 years
WTGs and Foundations
• Siemens Gamesa Renewable Energy SG 14-222 DD WTG with power boost technology • 14- to 16-MW WTGs characterized as "minimum" and "maximum" capacity

[1] Additional information and guidance related to the PDE concept can be found here: https://www.boem.gov/Draft-Design-Envelope-Guidance/.

Project Parameter Details
• Rotor diameter ranging from 725 to 761 feet (221 to 232 meters) • Hub height from MSL ranging from 446 to 489 feet (136 to 149 meters) • Turbine tip height from MSL ranging from 804 to 869 feet (245 to 265 meters) • Installation of monopiles through pile-driving • Scour protection installed around WTG monopile foundation installation vessels to include jack-up, platform support, crew transfer, tugs, crew transfer, barges, heavy-lift vessels, fall pipe vessels, walk-to-work, and other support vessel types as necessary
Inter-Array Cables
• Up to 66- kV cables buried 3.3 to 9.8 feet (1 to 3 meters) beneath the seabed • Up to 300 miles (484 kilometers) total length of Inter-Array Cables (average inter-array cable length of 5,868 feet [1,789 meters] between turbines) • Installation by jet trenching, chain cutting, trench former, and/or other available technologies • Installation vessels to include deep draft cable lay, walk-to-work, crew transfer, trenching support, burial tool, survey, multipurpose support vessels, and other support vessel types as necessary
Offshore Export Cables
• Up to nine 230-kV export cables buried 3.3 to 16.4 feet (1 to 5 miles) beneath the seabed; with additional cover in some sections, total burial depth may be up to 24.6 feet (7.5 meters) • Nine export cables (in a single corridor), with alternatives • Up to 416.9 miles (671 kilometers) total length of offshore export cable • Installation by jet trenching, plowing, chain cutting, trench former, direct steerable pipe thrusting, and/or other available technologies • Installation vessels to include pull-in support barge, tug, multipurpose support, survey, shallow draft cable lay, hydroplow, crew transfer, deep-draft, walk-to-work, trenching support, burial tool vessels, and other support vessel types, as necessary • Cable protection at the cable crossings
Offshore Substations and Foundations
• Two to three OSS • OSS installed atop piled jacket foundations • Scour protection installed at all foundation locations • Installation vessels to include barge, tug, transport, heavy lift, anchor handling, jack-up vessels, platform support, and other support vessel types, as necessary
Onshore Facilities
• Landfall of offshore export cable(s) would be completed via Trenchless Installation • Maximum area of temporary disturbance for cable landing location: 2.8 acres (1.1 hectares maximum temporary workspace at the Nearshore Trenchless Installation Area approximately 8.8 acres [3.6 hectares]). • Construction work area for the switching station: maximum of approximately 45.4 acres (18.4 hectares) • Construction work area for the upgrades at the onshore substation (existing Dominion Energy Fentress substation): maximum of approximately 18.5 acres (7.5 hectares) • Maximum onshore export cable length of approximately 4.41 miles (7.10 kilometers) • Maximum interconnection cable length of approximately 14.2miles (22.9 kilometers) • Maximum area of temporary disturbance for onshore export cable route of approximately 26.6 acres (10.8 hectares) acres (27.6 hectares)[1] • Maximum area of permanent disturbance for onshore export cable route of approximately 1.0 acres

Project Parameter Details
(0.4 hectares)[2] • Maximum area of temporary disturbance for Interconnection Cable Route Option 1 of approximately 0 acres (0 hectares)[2] • Maximum area of permanent disturbance for Interconnection Cable Route Option 1 of approximately 1 acre (0.4 hectare)[3] • Maximum area of temporary disturbance for Hybrid Interconnection Cable Route Option 6 of approximately 29.0 acres (11.7 hectares)[4] • Maximum area of permanent disturbance for Hybrid Interconnection Cable Route Option 6 of approximately 4.2 acres (1.7 hectares)[5]

MSL = mean sea level; kV = kilovolt; MW = megawatt; WTG = wind turbine generator; OSS = offshore substation

[1]For the purposes of this analysis, the estimated temporary disturbance for the Onshore Export Cable Route is associated with the areas of the route that are surface trenched (60-foot-wide trench for ~3.7 miles).
[2]For the purposes of this analysis, the estimated permanent disturbance for the Onshore Export Cable Route is associated with the permanent structures (i.e., manhole vaults).
[3]For the purposes of this analysis, the total permanent disturbance for Interconnection Cable Route Option 1 is associated with the new permanent structures (i.e., transmission towers) to be installed within the new/proposed right-of-way. For the purposes of this analysis, it is assumed that no other land disturbance will occur within the Interconnection Cable Route.
[4]For the purposes of this analysis, the estimated temporary disturbance for Hybrid Interconnection Cable Route Option 6 is associated with the area of the underground portion of the route that is surface trenched.
[5]For the purposes of this analysis, the estimated permanent disturbance for Hybrid Interconnection Cable Route Option 6 is associated with the permanent structures (i.e., manhole vaults for the underground portion of the route and transmission towers for the overhead portion of the route).

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Table E-2. Maximum-Case Design Parameters for the Coastal Virginia Offshore Wind Commercial Project (an "X" indicates that the parameter is relevant to an EIS resource analysis)

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
WIND FARM																				
Wind farm nameplate capacity (MW)	3,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WIND TURBINES																				
Parameters per Turbine																				
Number of WTGs	205	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
WTG generating capacity (MW)	16	X	X		X								X	X			X	X		
Cut-in wind speed (miles per hour)	11.2		X		X															
Cut-out wind speed (miles per hour)	67.1		X		X															
Turbine tip height from MSL (feet)	869		X		X		X	X				X		X	X	X		X		
Hub height from MSL (feet)	489		X		X		X	X				X		X	X	X		X		
Rotor diameter (feet)	761		X		X		X	X				X		X	X	X		X		
Distance from bottom of turbine tip to HAT (feet)	115		X		X		X	X				X		X	X	X		X		
Parameters per Turbine Foundation (Monopile)																				
Monopile diameter per foundation (feet)	31			X			X	X			X		X	X			X		X	
Base diameter with scour protection (feet)	230			X	X		X				X		X	X			X		X	
Seabed penetration (feet)	197			X			X	X			X		X	X			X		X	
Diameter at HAT (feet)	36			X			X	X			X		X	X			X	X		
Maximum hammer energy (kilojoule)	4,000		X	X	X		X				X		X	X			X		X	
Maximum Total Impacts for Turbine Foundations (Monopile)																				
Number of monopiles	205	X	X	X	X		X	X				X	X	X	X	X	X	X	X	
Number of transition pieces	205		X		X		X	X								X		X		
Platform supply vessel: Bubble curtain installation (noise mitigation) temporary impacts (acres)	148.1			X			X				X		X	X			X			
Noise monitoring buoys temporary impacts (acres)	0.8			X			X				X		X	X			X			
Heavy lift vessel (HLV) monopile construction and installation	0.0																			
Feeder spread – monopile feeder	0.0																			
JUV WTG loading temporary impacts (acres) [1]	16.19			X	X		X				X		X	X	X		X		X	
JUV WTG construction and installation temporary impacts (acres) [1]	48.7			X	X		X				X		X	X	X		X		X	
W2W WTG commissioning temporary impacts (acres)	0.0														X					
WTG foundation permanent impacts (acres)	4.39			X	X		X	X			X		X	X	X		X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
WTG scour protection permanent impacts (acres)	179.3			X	X		X				X		X	X			X		X	
OFFSHORE SUBSTATIONS																				
Topside Offshore Substations																				
Number of substations	3	X	X	X	X		X	X			X	X	X	X	X	X	X	X	X	
Width of topside main structure (feet)	203		X	X	X		X	X			X	X	X	X			X	X		
Length of topside main structure (feet)	242		X	X	X		X	X			X	X	X	X			X	X		
Height (feet)	177		X		X		X	X				X		X	X					
Base height above HAT (feet) (air gap)	151		X		X		X	X				X		X	X			X		
Offshore Substation Foundations (Piled Jackets)																				
Number of structures	3	X	X	X	X		X	X			X	X	X	X	X	X	X	X	X	
Number of piles per offshore substation	4		X	X	X		X	X			X		X	X			X		X	
Pile diameter (feet)	9.0			X	X		X	X			X		X	X			X		X	
Base dimensions (feet)	306.8 x 283.8			X			X	X			X		X	X			X		X	
Scour protection diameter per leg (feet)	230			X			X	X			X		X	X			X		X	
Seabed penetration (feet)	269			X			X	X			X		X	X			X		X	
Seabed footprint without scour protection per offshore substation foundation (square feet)	87,070			X			X	X			X		X	X			X		X	
Seabed footprint with scour protection per offshore substation foundation (square feet)	497,092			X			X	X			X		X	X			X		X	
Dimensions at lowest astronomical tide (feet)	98.4 x 131.2			X			X	X			X		X	X			X	X		
Maximum Total Impacts for OSS Foundations																				
Maximum temporary construction footprint per OSS (acres)	3.74			X	X		X	X			X		X	X			X		X	
OSS jacket footprint permanent impact (acres)	0.41			X							X		X	X			X			
Vessels Associated with OSS																				
Fallpipe vessel scour protection temporary impact (acres) [2]	0		X	X	X		X				X		X	X	X		X		X	
Pin pile template temporary impact (acres)	1.9		X	X	X		X				X		X	X	X		X		X	
HLV OSS pre-piling temporary impact (acres) [2]	0		X		X		X				X		X	X	X		X		X	
HLV OSS jacket construction and installation temporary impact (acres) [2]	0		X		X		X				X		X	X	X		X		X	
Feeder spread OSS jacket supply temporary impact (acres) [2]	0		X		X		X				X		X	X	X		X		X	
HLV offshore substation topside construction and installation temporary impact (acres) [2]	0		X		X		X				X		X	X	X		X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Feeder spread offshore substation topside supply temporary impact (acres)[2]	0		X		X		X				X		X	X	X		X		X	
CTV/JUV offshore substation commissioning temporary impact (acres)	3.6		X	X	X	X	X				X		X	X	X		X		X	
OFFSHORE CABLES																				
Inter-Array Cable Parameters																				
Number of cables	230			X			X	X			X	X	X	X	X		X		X	
Length per cable (feet)	31,804	X		X			X	X			X	X	X	X	X		X		X	
Total length of cable (miles)	300.7	X		X			X	X			X	X	X	X	X		X		X	
Operating voltage (kV)	66			X			X				X	X	X	X			X			
Cable diameter (inches)	7.9			X			X	X			X	X	X	X	X		X		X	
Target burial depth (feet)	9.8			X			X	X			X	X	X	X	X		X		X	
Trench width – temporary (feet)	16.4			X			X	X			X	X	X	X	X		X		X	
Seabed footprint (cable) – temporary (acres)	48			X			X	X			X	X	X	X	X		X		X	
Seabed footprint (UXO Survey/Removal) (temporary) (acres)	5			X			X	X			X	X	X	X	X		X		X	
Temporary impact footprint (acres)	1,781.8			X			X	X			X		X	X			X		X	
Pre-lay grapnel run temporary impact (acres)	2,385.5			X			X	X			X		X	X			X		X	
Offshore Export Cable Parameters																				
Number of cables	9			X			X	X			X		X	X			X		X	
Total length of cable (miles)	416.9	X		X			X	X			X		X	X	X	X	X		X	
Operating voltage (kV)	230			X			X				X		X	X			X		X	
Cable diameter (inches)	11.4			X			X	X			X		X	X			X		X	
Burial depth (feet)	16.4			X			X	X			X		X	X			X		X	
Trench width – temporary (feet)	32.8			X			X	X			X		X	X			X		X	
Total corridor length from the lease area to the cable landing location (miles)	49.01	X		X			X	X			X		X	X	X	X	X		X	
Area of construction corridor (offshore work area to offshore substations) (acres)	2,635.37			X			X	X			X		X	X	X	X	X		X	
Requested operational right-of-way (feet)	2,953			X			X				X		X	X			X			

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Maximum Total Temporary Impacts for Vessels Associated with Inter-Array Cables and Offshore Export Cables																				
Pontoon - nearshore export cable installation anchor handling (acres)	355																			
Cable lay vessel (cable laying and wet end storage) (acres)	131.7			X			X	X			X	X	X	X	X	x	X		X	
Cable lay vessel (affects same area as pre-lay grapnel run) (acres)	131.5		X	X	X		X				X		X	X	X		X	X	X	
Cable trenching jetting vessel (multiple burial passes would impact same area and are thus counted a single time) (acres)	2,892.4		X	X	X		X				X		X	X	X		X	X	X	
Cable joining vessel for joining offshore export cable and interarray cable (acres) [2]	3		X		X		X				X		X	X	X		X	X	X	
Cable lay vessel for wet end storage (acres)	0.2		X	X	X		X				X		X	X	X		X	X	X	
Support vessel for pre-lay grapnel run (acres)	1,393		X	X	X		X				X		X	X	X		X	X	X	
ONSHORE COMPONENT CONSTRUCTION IMPACTS																				
Length of onshore trenchless installation work area at cable landing location area (feet)	2,500			X		X			X	X		X			X	X		X	X	X
Maximum area of temporary disturbance for cable landing location offshore trenches installation punch-out (acres)	80	X	X		X	X		X	X			X				X		X	X	X
Construction work area for switching station (acres)	45.4	X	X		X	X		X	X			X						X	X	X
Construction work area for the upgrades at existing Fentress onshore substation (acres)	26.9	X	X		X	X		X	X			X						X	X	X
Maximum onshore export cable length (miles)	4.1	X	X		X	X		X	X			X						X	X	X
Maximum interconnection cable length (miles)	14.2	X	X		X	X		X	X	X		X			X	X			X	X
Maximum area of temporary disturbance for onshore export cable route (acres)	26.6	X	X		X	X		X	X			X						X	X	X
Maximum area of temporary disturbance for interconnection cable route (acres)	0	X	X		X	X		X	X	X		X			X	X			X	X
Duration of onshore export cable installation (months)	24	X	X		X	X		X	X			X				X		X	X	X
Duration of onshore interconnection cable installation (months)	15	X	X		X	X		X	X			X				X		X	X	X
Duration of switching station construction (months)	24	X	X		X	X		X	X			X				X		X	X	X
Duration of onshore substation upgrade construction (months)	24	X	X		X	X		X	X			X				X		X	X	X

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
OPERATIONS AND MAINTENANCE																				
Commercial project lifespan (years)	33	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Number of offshore emergency generators	3	X																	X	
Offshore emergency generator capacity (kW)	500 each	X																	X	
Number of onshore switching station emergency generators	3	X	X		X	X		X				X							X	
Onshore switching station emergency generator capacity (kW)	260 each	X	X		X	X		X				X							X	
Number of onshore substation emergency generators	3	X	X		X	X		X				X							X	
Onshore substation emergency generator capacity (kW)	150, 310, and 410	X	X		X	X		X				X							X	
Onshore substation electric switchgear sulfur hexafluoride quantity (pounds)	35,137	X																	X	
Switching station electric switchgear sulfur hexafluoride quantity (pounds)	26,000	X																	X	
Offshore substation sulfur hexafluoride quantity 66 kV gas insulated switchgear (pounds)	13,227	X																	X	
Offshore substation sulfur hexafluoride quantity 235 kV gas insulated switchgear (pounds)	15,210	X																	X	

[1] Adjusted for 205 WTG positions. COP Table 3.4-1 (Dominion Energy 2022) provides acreage for 176 WTG positions.
[2] Floating marine spread (COP Table 3.4-3; Dominion Energy 2022).
CVT = Crew Vessel Transfer; HAT = Highest Astronomical Tide; HLV = heavy lift vessel; JUV = jack-up vessel; kV = kilovolt; kW = kilowatt; MW = megawatt; WTG = wind turbine generator; W2W = Multirole Subsea Support Vessel with Walk to Work.

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Appendix F. Planned Activities Scenario

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CONTENTS

Attachments

Tables

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F.1. Ongoing and Planned Activities Scenario

This appendix describes the other ongoing or planned activities that could occur within the analysis area for each resource and contribute to baseline conditions and trends for resources considered in this Environmental Impact Statement (EIS). The Coastal Virginia Offshore Wind Commercial Project (CVOW-C or Project) comprises the construction, operation and maintenance (O&M), and conceptual decommissioning of a wind energy project located within the Bureau of Ocean Energy Management's (BOEM) Renewable Energy Lease No. OCS-A-0483, located in federal waters approximately 23.75 nautical miles (nm) (27 statute miles: 44 kilometers) off of the Virginia Beach coastline.

The geographic analysis area varies for each resource as shown below in Table F-1. BOEM anticipates that impacts could occur between the start of Project construction in 2023 and the completion of Project decommissioning in approximately 2047. The geographic analysis area is defined by the impact-producing factor (IPF) with the maximum geographic area of impact, for example sound during pile driving. For the mobile resources—bats, birds, finfish and invertebrates, marine mammals, and sea turtles—the species potentially impacted are those that occur within the area of impact of the Proposed Action. The geographic analysis area for these mobile resources is the general range of the species. The purpose is to capture the cumulative impacts on each of those resources that are impacted by the Proposed Action as well as the impacts that would still occur under the No Action Alternative.

In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nautical miles (miles used specifically for marine navigation). This appendix uses statute miles more commonly and refers to them simply as *miles*, whereas nautical miles are referred to by name.

Table F-1 Resource-Specific Geographic Analysis Areas

Resource	Geographic Analysis Area	Rationale
Air quality	The airshed within 25 miles (40 kilometers) of the Wind Turbine Area (WTA) (corresponding to the outer continental shelf permit area) and the airshed within 15.5 miles (25 kilometers) of the Onshore Project area and ports that may be used for the Project (Figure 3.4-1).	The geographic analysis area encompasses the geographic region subject to USEPA review as part of an OCS permit for the Project under the Clean Air Act. The geographic analysis area also considers potential air quality impacts associated with the onshore construction areas and the mustering port(s) outside of the OCS permit area. Given the generally low emissions of the sea vessels and equipment that would be used during proposed construction activities, any potential air quality impacts would likely be within a few miles of the source. BOEM selected the 15.5-mile (25-kilometer) distance to provide a reasonable buffer.

Resource	Geographic Analysis Area	Rationale
Bats	The U.S. coastline from Maine to Florida, extending 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland (Figure 3.5-1). While some historic, anecdotal observations of bats up to 1,212 miles (1,951 kilometers) offshore of North America exist, recent offshore observations of tree bats range from 10.5 to 26 miles (17 to 42 kilometers) (Hatch et al. 2013). As such, the geographic analysis area for bats consists of the U.S. East Coast, from Maine to Florida, to capture migratory species, and extends 100 miles (161 kilometers) offshore.	The geographic analysis area for bats was established to capture most of the movement range for migratory species. The offshore limit was established to capture the migratory movements of most species in this group, while the onshore limit covers onshore habitats used by species that may be affected by onshore and offshore components of the proposed Project. Tree bats are long-distance migrants; their range includes the majority of the Atlantic coast from Florida to Maine. While these species have been documented traversing the open ocean and have the potential to encounter wind turbine generators (WTGs), use of offshore habitat is thought to be limited and generally restricted to spring and fall migration. The onshore limit of the geographic scope is intended to cover a majority of the onshore habitat used by those species that may encounter the Project during the majority of their life cycles.
Benthic resources	A 10-mile (16.1-kilometer) buffer around the Wind Turbine Area and a 330-foot (101-meter) buffer around the Offshore Export Cable Route and Inshore Export Cable Route corridors (Figure 3.6-1).	The geographic analysis area is based upon where the most widespread impact (namely, suspended sediment) from the proposed Project could affect benthic resources. This area would account for some transport of water masses and for benthic invertebrate larval transport due to ocean currents. Although sediment transport beyond 10 miles (16.1 kilometers) is possible, sediment transport related to proposed Project activities would likely to be on a smaller spatial scale than 10 miles (16.1 kilometers).
Birds	The U.S. coastline from Maine to Florida, extending 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland (Figure 3.7-1).	The geographic analysis area for birds was established to capture resident species and migratory species that winter as far south as South America and the Caribbean, and those that breed in the Arctic or along the Atlantic coast that travel through the area. The offshore limit was established to cover the migratory movement of most species in this group. The onshore limit was established to cover onshore habitats used by the species that may be affected by onshore and offshore components of the proposed Project.

Resource	Geographic Analysis Area	Rationale
Coastal habitat and fauna	A 1.0-mile (1.6-kilometer) buffer of the Onshore Project area [1] (Figure 3.8-1).	BOEM expects the resources in this area to have small home ranges. These resources are unlikely to be affected by impacts outside their home ranges.
Commercial fisheries and for-hire recreation fishing	Commercial fisheries: the boundaries of the management areas of the South Atlantic Fishery Management Council (SAFMC) from the South Carolina / Georgia border northward, the Mid-Atlantic Fishery Management Council (MAFMC), and the New England Fishery Management Council (NEFMC) for all federal fisheries within the U.S. Exclusive Economic Zone (EEZ) (from 3 to 200 nautical miles [5.6 to 370 kilometers; 3.5 to 230 miles] from the coastline and all adjacent state waters (from 0 to 3 nautical miles [0 to 5.6 kilometers; 0 to 3.5 miles]) from the coastline (Figure 3.9-1). For-hire recreational fisheries: all areas managed by the NEFMC south of Cape Cod, Massachusetts, the MAFMC and the SAFMC to Cape Hatteras, North Carolina, including all adjacent state waters (from 0 to 3 nautical miles [0 to 5.6 kilometers; 0 to 3.5 miles] from the coastline) (Figure 3.9-2).	The boundaries for the commercial fisheries geographic analysis area were developed to consider impacts on federally permitted vessels operating in all fisheries in state and EEZ waters surrounding the proposed Project, vessels from the Project area that may transit to fishing grounds in other Atlantic regions, as well as potential impacts on federally managed species of commercial importance that have ranges which overlap with the Project area.
Cultural, historical, and archaeological	The Area of Potential Effect (APE) for terrestrial and marine archaeology and analysis of visual effects on historic properties (Figure 3.10-1).	The Area of Potential Effect is a geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.
Demographics, employment, and economic characteristics	The cities closest to the Onshore and Offshore Project areas and the cities where potential port cities are located, including: City of Chesapeake, City of Hampton; City of Newport News; City of Norfolk; City of Portsmouth; and City of Virginia Beach, Virginia (Figure 3.11-1).	These cities are the most likely to experience beneficial or adverse economic impacts from the proposed Project.
Environmental justice	The cities closest to the Onshore and Offshore Project areas and the cities where potential port cities are located, including City of Chesapeake, City of Hampton, City of Newport News, City of Norfolk, City of Portsmouth, and City of Virginia Beach, Virginia. (Figure 3.12-1).	The geographic analysis area would be the same as the demographic, employment, and economic characteristics analysis area, as these cities, and environmental justice communities located within are the most likely to experience impacts from the proposed Project.
Finfish, invertebrates, and essential fish habitat	The Northeast Shelf Large Marine Ecosystem (LME),[2] which extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras,	This area is likely to capture the majority of the movement range for most species in this group.

Resource	Geographic Analysis Area	Rationale
	North Carolina, and Southeast Shelf Large Marine Ecosystem, which extends from Cape Hatteras to Florida. The northern portion of the geographic analysis area includes only U.S. waters (Figure 3.13-1).	
Land use and coastal infrastructure	City of Chesapeake, City of Hampton, City of Newport News, City of Norfolk, City of Portsmouth, and City of Virginia Beach, Virginia, and municipal boundaries surrounding the ports that may be used for the Project (Figure 3.14-1).	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with proposed onshore facilities and ports.
Marine mammals	The Scotian Shelf, Northeast Shelf, and Southeast Shelf Large Marine Ecosystems (Figure 3.15-1).	This area is likely to capture the majority of the movement range for most species in this group.
Navigation and vessel traffic	Coastal and marine waters within 10 miles (16.1 kilometers) of the Offshore Project area, as well as waterways leading to ports that may be used by the Project (Figure 3.16-1).	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, operations and maintenance, and conceptual decommissioning.
Other uses	**Aviation and Air Traffic, Military and National Security, and Radar Systems:** Areas within 10 miles (16.1 kilometers) of the Offshore Export Cable Route Corridor, Interconnection Cable Route Corridor, Onshore Export Cable Route Corridor, and Wind Turbine Area and Lease Area, as well as Norfolk International Airport; Newport News/Williamsburg International Airport; U.S. Naval Air Station, Norfolk; Naval Air Station Oceana; Naval Auxiliary Landing Field Fentress; and Dam Neck Annex, Virginia Beach (Figure 3.17-1). **Cables and Pipelines:** Areas within 1 mile (1.6 kilometers) of the Offshore Export Cable Route Corridor, Interconnection Cable Route Corridor, Onshore Cable Route Corridor, Wind Turbine Area, and the Lease Area that could affect future siting or operation of cables and pipelines (Figure 3.17-1). **Scientific Research and Surveys:** Same analysis area as finfish, invertebrates, and essential fish habitat (Figure 3.17-1). **Marine Minerals:** Areas within 0.25 mile (0.4 kilometer) of the offshore corridor and WTA that could affect marine minerals extraction (Figure 3.17-1).	These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, operations and maintenance, and conceptual decommissioning.

Resource	Geographic Analysis Area	Rationale
Recreation and tourism	The geographic analysis area includes the 40-mile (64.4-kilometer) visual analysis area measured from the borders of the Wind Turbine Area (Figure 3.18-**1**).	This geographic analysis area was selected to coincide with the CVOW-C visual impact assessment visual analysis area corresponding to the theoretical limits of project visibility.
Sea turtles	The Northeast and Southeast Shelf Large Marine Ecosystems (Figure 3.19-1).	This area is likely to capture the majority of the movement range for most species in this group.
Scenic and visual resources	The geographic analysis area includes the 40-mile (64.4-kilometer) visual analysis area measured from the borders of the Wind Turbine Area (Figure 3.20-1).	This geographic analysis area was selected to coincide with the CVOW-C visual impact assessment visual analysis area to address Project visibility from sensitive resources and encompass all locations where BOEM anticipates direct and indirect impacts associated with Project construction, operations and maintenance, and conceptual decommissioning.
Water quality	**Offshore**, the geographic analysis area includes the coastal and marine waters within a 10-mile (16-kilometer) buffer around the Offshore Project area and a 15.5-mile (25-kilometer) buffer around the ports that may be used by the Project. **Onshore,** the geographic analysis area includes any sub-watershed that is intersected by the Onshore Project area (Figure 3.21-1).	The offshore geographic analysis area accounts for some transport of water masses due to ocean currents. The onshore geographic analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operation activities of the proposed project.
Wetlands	Subwatersheds that intersect the Onshore Project area (Figure 3.22-1).	This area encompasses all wetlands and surface waters that are most likely to experience impacts from the proposed Project.

[1] Includes landfalls, onshore export cable route corridors, onshore substations, grid interconnections, and O&M facility.

[2] Large Marine Ecosystems are delineated based on ecological criteria including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and the National Oceanic and Atmospheric Administration uses them as the basis for ecosystem-based management.

F.2. Ongoing and Planned Activities

This section includes a list and description of ongoing and planned activities that could contribute baseline conditions and trends within the geographic analysis area for each resource topic analyzed in this EIS. Projects or actions that are considered speculative per the definition provided in 43 Code of Federal Regulations (CFR) 46.30[1] are noted in subsequent tables but excluded from the cumulative impact analysis in Chapter 3 of the EIS.

Ongoing and planned activities described in this section consist of 10 types of actions: (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) marine minerals use and ocean-dredged material disposal; (5) military use; (6) marine transportation; (7) fisheries use and management; (8) global climate change; (9) oil and gas activities; (10) onshore development activities; and (11) research, monitoring, and survey activities.

BOEM analyzed the possible extent of future other offshore wind energy development activities on the Atlantic Outer Continental Shelf (OCS) to determine reasonably foreseeable cumulative effects measured by installed power capacity. Table F2-1 in Attachment 2 represents the status of projects as of August 1, 2022. The methodology for developing the scenario is the same as for the Vineyard Wind 1 project and details of the scenario development are described in the Vineyard Wind 1 Final EIS (BOEM 2021e).

F.2.1 Offshore Wind Energy Development Activities

F.2.1.1. Site Characterization Studies

A lessee is required to provide the results of site characterization activities with its site assessment plan (SAP) and Construction and Operations Plan (COP). Lessees have up to 5 years to perform site characterization activities before they must submit a COP (30 CFR 585.235(a)(2)). For the purposes of the cumulative effects analysis, BOEM makes the following assumptions for survey and sampling activities:

- Site characterization would occur on all existing leases and potential export cable routes.
- Site characterization would likely take place in the first 3 years following execution of a lease, based on the fact that a lessee would likely want to generate data for its COP at the earliest possible opportunity.
- Lessees would likely survey most or all of the proposed lease area during the 5-year site assessment term to collect required geophysical information for siting of a meteorological tower, two buoys, and commercial facilities (wind turbines). The surveys may be completed in phases, with the meteorological tower and buoy areas likely to be surveyed first.
- Lessee would not use air guns, which are typically used for deep penetration two-dimensional or three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources (BOEM 2016).

[1] 43 CFR 46.30 – Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a responsible official of ordinary prudence would take such activities into account in reaching a decision. The federal and non-federal activities that BOEM must take into account in the analysis of cumulative impacts include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by BOEM. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

Table F-2 describes the typical site characterization surveys, the types of equipment and method used, and which resources the survey information would inform.

Table F-2 Site Characterization Survey Assumptions

Survey Type	Survey Equipment and Method	Resource Surveyed or Information Used to Inform
High-resolution geophysical surveys	Side-scan sonar, sub-bottom profiler, magnetometer, multi- beam echosounder	Shallow hazards, archaeological, Bathymetric charting, benthic habitat
Geotechnical/ sub-bottom sampling	Vibracores, deep borings, cone penetration tests	Geological
Biological	Grab sampling, benthic sled, underwater imagery/ sediment profile imaging	Benthic habitat
	Aerial digital imaging; visual observation from boat or airplane	Birds, marine mammals, sea turtles
	Ultrasonic detectors installed on survey vessels used for other surveys	Bats
	Visual observation from boat or airplane	Marine fauna (marine mammals and sea turtles)
	Direct sampling of fish and invertebrates	Fish and invertebrates

Source: BOEM (2016).

F.2.1.2. Site Assessment Activities

After SAP approval, a lessee can evaluate the meteorological conditions, such as wind resources, with the approved installation of meteorological towers and buoys. Meteorological buoys have become the preferred meteorological and oceanographic (metocean) data collection platform for developers, and BOEM expects that most future site assessments will use buoys instead of towers (BOEM 2021f). The installation and operation of meteorological buoys involves substantially less activity and a much smaller footprint than the construction and operation of a meteorological tower. Site assessment activities have been approved or are in the process of being approved for multiple lease areas consisting of one to three meteorological buoys per SAP (Table F2-1 in Attachment 2). Site assessment would likely take place starting within 1 to 2 years of lease execution, because preparation of an SAP (and subsequent BOEM review) takes time. The No Action Alternative and cumulative analyses consider these site assessment activities.

F.2.1.3. Construction and Operation of Offshore Wind Facilities

Table F2-1 in Attachment 2 lists all offshore wind development activities that BOEM considers reasonably foreseeable by lease areas and projects.

F.2.2 Commercial Fisheries Cumulative Fishery Effects Analysis

Table F-3 details the future construction of offshore wind projects from Maine to North Carolina including Atlantic Shores South and Ocean Wind 2 that are proposed offshore New Jersey adjacent to Ocean Wind, and Empire Wind 1 and Empire Wind 2 that are proposed offshore New York. Also included are all of the projects currently in various stages of planning within BOEM’s offshore leases from Massachusetts to North Carolina, including the future development of Atlantic Shores North. Projected construction dates for each offshore wind project are listed in Table F2-1 in Attachment 3, and each project will require a National Environmental Policy Act (NEPA) process with an EIS or environmental assessment prior to approval.

Table F-3 summarizes (1) the incremental number of construction locations that are projected to be active in each region during each year between 2021 and 2030; (2) the number of operational turbines in each region at the beginning of each year between 2021 and 2030; and (3) the total number of active construction locations and operational turbines across the Atlantic OCS by year.

Note that the Kitty Hawk Offshore Wind and Kitty Hawk South projects are included despite their location in the National Marine Fisheries Service (NMFS) South Atlantic Region. Fishing vessels operating in fisheries managed by the NMFS Greater Atlantic Regional Office regularly harvest in this area. It is also likely that vessels participating in fisheries managed by the NMFS Southeast Regional Office will be affected by the Kitty Hawk Offshore Wind and Kitty Hawk South projects, although revenues from these fisheries have not been included in the Fishery Management Plan Revenue Exposure Analysis (BOEM 2020).

BOEM assumes proposed offshore wind projects will include the same or similar components as the proposed Project: wind turbines, offshore and onshore cable systems, offshore substations (OSSs), onshore O&M facilities, and onshore interconnection facilities. BOEM further assumes that other potential offshore wind projects will employ the same or similar construction, O&M, and conceptual decommissioning activities as the proposed Project. However, future offshore wind projects would be subject to evolving economic, environmental, and regulatory conditions. Lease areas may be split into multiple projects, expanded, or removed, and development within a particular lease area may occur in phases over long periods of time (e.g., Kitty Hawk Offshore Wind and Kitty Hawk South). Research currently being conducted in combination with data gathered regarding physical, biological, socioeconomic, and cultural resources during development of initial offshore wind projects in the United States could affect the design and implementation of future projects, as could advancements in technology. For the cumulative impact analysis, all proposed projects included in Table F2-1 in Attachment 2 are analyzed in Chapter 3 of this EIS. For a list of mitigation measures that were considered in the impact analysis in Chapter 3 of this EIS, please see EIS Appendix H, *Mitigation and Monitoring*.

Table F-3 Offshore Wind Project Construction Schedule (dates shown as of July 14, 2022)

<table>
<tr><th rowspan="2">Project/Region</th><th colspan="11">Number of Foundations</th></tr>
<tr><th>Before 2021</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th><th>2028</th><th>2029</th><th>2030 and Beyond</th></tr>
<tr><td>Aquaventis (state waters)</td><td>-</td><td>-</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Block Island (state waters)</td><td>5</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Estimated annual NE State Waters construction</td><td>5</td><td>0</td><td>0</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Estimated O&M total</td><td>5</td><td>5</td><td>5</td><td>5</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td></tr>
<tr><td colspan="12">Massachusetts/Rhode Island Region</td></tr>
<tr><td>Vineyard Wind 1 part of OCS-A 0501</td><td>-</td><td>-</td><td>-</td><td>63</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>South Fork, OCS-A 0517</td><td>-</td><td>-</td><td>-</td><td>13</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Sunrise, OCS-A 0487</td><td>-</td><td>-</td><td>-</td><td>-</td><td>95</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Revolution, part of OCS-A 0486</td><td>-</td><td>-</td><td>-</td><td colspan="2">102</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e. Park City Wind])</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="3">64</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e. Commonwealth Wind])</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="3">82</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Mayflower OCS-A 0521</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>149</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Beacon Wind 1, part of OCS-A 0520</td><td>-</td><td>-</td><td>-</td><td>-</td><td colspan="5">79</td><td></td><td></td></tr>
</table>

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Beacon Wind 2, part of OCS-A 0520	-	-	-	-	-	78		-	-	-	-
Bay State Wind, part of OCS-A 0500	-	-	-	-	-	112					
OCS-A 0500 remainder	-	-	-	-	-	232					
OCS-A 0487 remainder	-	-	-	-	-						
Liberty Wind, part of OCS-A 0522	-	-	-	-	-						
Estimated annual Massachusetts/Rhode Island construction	**0**	**0**	**0**	**178**	**320**	**571**	**0**	**0**	**0**	**0**	**0**
Estimated O&M total	**0**	**0**	**0**	**0**	**178**	**498**	**1,069**	**1,069**	**1,069**	**1,069**	**1,069**
New York/New Jersey Region											
Ocean Wind 1, OCS-A 0498	-	-	-	-	101	-	-	-	-	-	-
Atlantic Shores South, OCS-A 0499	-	-	-	-	-	11	200		-	-	-
Ocean Wind 2, part of OCS- A 0532	-	-	-	-	-	-	113				
Empire Wind 1, part of OCS-A 0512	-	-	-	58				-	-	-	-
Empire Wind 2, part of OCS-A 0512	-	-	-	91					-	-	-
Atlantic Shores North, OCS-A 0549	-	-	-	-	-	-	160				
OW Ocean Winds East LLC, OCS-A 0537	-	-	-	-	-	-	102				
Attentive Energy LLC OCS-A 0538	-	-	-	-	-	-	104				
Bight Wind Holdings, LLC OCS-A 0539	-	-	-	-	-	-	148				

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Atlantic Shores Offshore Wind Bight, LLC OCS-A 0541	-	-	-	-	-	-	95				
Invenergy Wind Offshore LLC, OCS-A 0542	-	-	-	-	-	-	99				
Vineyard Mid-Atlantic LLC, OCS-A 0544	-	-	-	-	-	-	104				
Estimated annual New York/ New Jersey construction	**0**	**0**	**0**	**149**	**101**	**11**	**1,125**	**0**	**0**	**0**	**0**
Estimated O&M total	**0**	**0**	**0**	**0**	**149**	**250**	**261**	**1,386**	**1,386**	**1,386**	**1,386**
Delaware/Maryland Region											
Skipjack, OCS-A 0519	-	-	-	-	17	-	-	-	-	-	-
US Wind, OCS-A 0490	-	-	-	-	126				-	-	-
GSOE I, OCS-A 0482	-	-	-	93							
OCS-A 0519 remainder	-	-	-								
Estimated annual Delaware/Maryland construction	**0**	**0**	**0**	**93**	**143**	**0**	**0**	**0**	**0**	**0**	**0**
Estimated O&M total	**0**	**0**	**0**	**0**	**93**	**236**	**236**	**236**	**236**	**236**	**236**
Virginia/North Carolina Region											
CVOW, OCS-A 0497	2	-	-	-	-	-	-	-	-	-	-
CVOW-C, OCS-A 0483	-	-	-	208					-	-	-
Kitty Hawk, OCS-A 0F	-	-	-	-	70						
Kitty Hawk Wind South, OCS-A 0508 remainder	-	-	-	-	-	-	-	123			

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Estimated annual Virginia/North Carolina construction	**2**	**0**	**0**	**208**	**70**	**0**	**0**	**123**	**0**	**0**	**0**
Estimated O&M total	**2**	**2**	**2**	**2**	**210**	**280**	**280**	**280**	**403**	**403**	**403**
Estimated annual total construction	**7**	**0**	**0**	**630**	**634**	**582**	**1,125**	**123**	**0**	**0**	**0**
Estimated O&M total	**7**	**7**	**7**	**7**	**637**	**1,271**	**1,853**	**2,978**	**3,101**	**3,101**	**3,101**

F.2.3 Incorporation by Reference of Cumulative Impacts Study and the Analyses Therein

BOEM has completed a study of IPFs on the North Atlantic OCS to consider in an offshore wind development cumulative impacts scenario (BOEM 2019). That study is incorporated in this documented by reference. The study identifies cause-and-effect relationships between renewable energy projects and resources potentially affected by such projects. It further classifies those relationships into a manageable number of IPFs through which renewable energy projects could affect resources. It also identifies the types of actions and activities to be considered in a cumulative impacts scenario. The study identifies actions and activities that may affect the same physical, biological, economic, or cultural resources as renewable energy projects and states that such actions and activities may have the same IPFs as offshore wind projects.

The BOEM (2019) study identifies the relationships between IPFs associated with specific past, present, and reasonably foreseeable actions and activities in the North Atlantic OCS to consider in a NEPA cumulative impacts scenario. These IPFs and their relationships were utilized in the EIS analysis of cumulative impacts, and the application of which IPF applied to which resource was decided by BOEM.

As discussed in the BOEM (2019) study, reasonably foreseeable activities other than offshore wind projects may also affect the same resources as the proposed Project or other offshore wind projects, possibly via the same IPFs or via IPFs through which offshore wind projects do not contribute. This Appendix F lists reasonably foreseeable non-offshore wind activities that may contribute to the cumulative impacts of the proposed Project.

F.2.4 South Carolina Activities

BOEM held a Regional Carolina Task Force meeting on July 21, 2021. The meeting focused on:

- Past and present of Carolina Long Bay offshore wind development;
- Approach for possible offshore South Carolina lease sale; and
- Discussion with federal, tribal, state, and local government officials.

The meeting outlined the basic principles and major decision points BOEM is considering for offshore renewable energy leasing in the Carolina Long Bay area of South Carolina. The meeting also provided a forum for discussion and information to ensure BOEM is informed about regional Task Force members' interests and provided opportunities for public input about the topics being considered by the Task Force. BOEM is also conducting environmental studies offshore South Carolina including ecological baseline studies, and has completed other studies of the Mid-Atlantic region including evaluation of visual impacts on cultural resources in the North Atlantic, Mid-Atlantic, and Florida Straits.

BOEM announced a lease sale for two lease areas in the Carolina Long Bay, and on May 11, 2022, BOEM held an offshore wind auction for the two lease areas (BOEM 2022). The lease areas were awarded to Total Energies Renewables USA, LLC (OCS-A 0545) (54,937 acres) and Duke Energy Renewables Wind, LLC (OCS-A 0546) (55,154 acres) (DOI 2022).

F.2.5 Undersea Transmission Lines, Gas Pipelines, and Other Submarine Cables

Anthropogenic hazards, including in-service and abandoned submarine telecommunication cables that may be present in the offshore export cable corridor and in the vicinity of the Lease Area, will be identified through the geophysical and geotechnical (G&G) survey campaigns were conducted in 2020 and 2021, and additional campaigns are scheduled to be conducted for the Lease Area. Based on general knowledge of the Offshore Project area and prior survey efforts associated with the Project and the adjacent CVOW Pilot Project, Dominion Energy anticipates anthropogenic hazards to be present in the Offshore Project area to some capacity. In-depth descriptions of anthropogenic hazards will be provided in the supplemental filing once the future G&G survey campaigns have been completed.

F.2.6 Dredging and Port Improvement Projects

The following dredging projects have been proposed or studied at ports that may be used by the Project in Virginia and South Carolina, and are either in operation or are considered reasonably foreseeable:

- A channel deepening project at the Port of Virginia is currently underway with the U.S. Army Corps of Engineers (USACE) and a private contractor engaged in dredging approximately 1.1 million cubic yards (841,010 cubic meters) of sediment from the federal channel in Norfolk Harbor and Newport News, Virginia (USACE 2019). The project is anticipated to be completed in 2024, resulting in a channel depth of over 50 feet (15 meters) in the harbor, which will allow it to accommodate two ultra-large container vessels simultaneously (Virginia Port Authority 2021). The Norfolk dredging project is anticipated to be completed by 2024 (Port of Virginia 2022).
- In 2017, the USACE, Charleston District, awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot (16-meter) depth at the entrance channel to Charleston harbor in South Carolina. The project also involves widening a turning basin in the port. The project will support and enhance the military readiness of Charleston harbor and joint base Charleston and allow Post-Panamax vessels to call upon the harbor (USACE 2021b). The Port of Charleston dredging project is anticipated to be completed in 2022 (South Carolina Ports 2022).

F.2.7 Marine Minerals Use and Ocean-Dredged Material Disposal

The closest lease requests in BOEM's Marine Minerals Program for sand borrow areas for beach replenishment are by the Department of the Army/Corps of Engineers and Maryland Department of Natural Resources for Ocean City Maryland (Weaver Shoal) with a requested volume of 1,300,000 cubic yards (993,921 cubic meters); and by Dare County, North Carolina (Towns of Duck, Southern Shores, Kitty Hawk, and Kill Devil Hills) for a requested volume of 6,600,000 cubic yards (5,046,062 cubic meters) (BOEM 2021c). One project, USACE Norfolk District and City of Virginia Beach, Virginia, for renourishment of beach along the Sandbridge Beach, Virginia Beach, Virginia Shoreline (volume 2,200,000 cubic yards [1,682,020 cubic meters]) has been completed, and an active project in Carteret County, North Carolina (Bogue Banks beaches, including Emerald Isle, Indian Beach, Salter Path, Pine Knoll Shores, and Atlantic Beach), with a volume of 2,000,000 cubic yards (1,529,110 cubic meters), commenced operation in March 2019 and is expected to operate through calendar year 2022.

To help meet the sand resource needs of coastal communities, BOEM-funded reconnaissance, and design-level OCS studies along the East Coast from Rhode Island to Florida have identified potential future sand resources in many areas. Sand resources identified nearest the Project include OCS locations offshore of all of the beaches noted above; many of these potential sand resources are located within 5 miles of the Project Lease Area and associated planned infrastructure (e.g., export cables).

The U.S. Environmental Protection Agency (USEPA) Region 3 (including Delaware, Maryland, Pennsylvania, and Virginia), and USEPA Region 4 (including North Carolina and South Carolina) are responsible for designating and managing ocean disposal sites for materials offshore in the region of the Project. The USACE issues permits for ocean disposal sites; all ocean sites are for the disposal of dredged material permitted or authorized under the Marine Protection, Research, and Sanctuaries Act (16 United States Code [USC] 1431 et seq. and 33 USC 1401 et seq.). There are two active projects along the Virginia Coast with dredge disposal sites located offshore Norfolk, Virginia (Norfolk site) and Virginia Beach, Virginia (Dam Neck site) (USACE 2021).

F.2.8 National Security and Military Use

The Lease Area is within the Virginia Capes Range Complex and the Virginia Capes Operating Area (OPAREA). The Virginia Capes (VACAPES) Range Complex is comprised of the VACAPES OPAREA, which is located offshore of the states of Virginia, North Carolina, Maryland, and Delaware. The VACAPES OPAREA consists of surface and subsurface waters, special use airspace, mobile targets and target control facilities, and instrumentation facilities. The facility is a designated air traffic control facility, and is required to provide air traffic separation consistent with the guidelines used by Federal Aviation Administration controllers. The VACAPES OPAREA extends from the shoreline seaward to approximately 200 miles (322 kilometers) from land at its farthest point; the subsurface portion of the VACAPES OPAREA has the same boundaries as the surface water portion. This Range Complex is used for the U.S. Atlantic Fleet training and testing exercises and supports training and testing by other services, primarily the U.S. Air Force; the AEGIS Combat Systems Center (ACSC) is also located in this area. Instrumented areas within the Range Complex include the Oceana Tactical Aircrew Training System (TACTS) Range; Warning Areas within the Range Complex include Warning Area 50 (W-50) and Warning Area 72 (W-72). The Range Complex is controlled by the Fleet Area Control and Surveillance Facility Virginia Capes, Naval Air Station, Oceana. Subsurface, surface, and surface to air exercises are conducted in the VACAPES OPAREA. Naval operations include Naval Air Station Oceana and Naval Air Station Dam Neck Annex in the City of Virginia Beach and Naval Auxiliary Landing Field Fentress in the City of Chesapeake.

F.2.9 Marine Transportation

Marine transportation in the region is diverse and sourced from many ports and private harbors. Commercial vessel traffic in the region includes research, tug/barge, liquid tankers (such as those used for liquid petroleum), cargo, military and search-and-rescue vessels, and commercial fishing vessels. Recreational vessel traffic includes cruise ships, sailboats, and charter boats. A number of federal agencies, state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing research offshore including oceanographic, biological, geophysical, and archaeological surveys. The Mid-Atlantic Regional Planning Body (RPB) (comprising Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia as well as federally recognized Tribes) anticipates that regional commercial shipping may increase and navigation routes may change in response to increasing demand for larger ships to transport goods (Mid-Atlantic Regional Planning Body 2016). The Port of Virginia recently completed land-side projects to expand cargo and rail capacity and a dredging project to increase depth of Norfolk Harbor to 55 feet is scheduled for completion in 2024 (Port of Virginia 2020b).

F.2.10 National Marine Fisheries Service Activities

Research and enhancement permits may be issued for marine mammals protected by the Marine Mammal Protection Act (MMPA) and for threatened and endangered species under the Endangered Species Act (ESA). NMFS is anticipated to continue issuing research permits under Section 10(a)(1)(A) of the ESA to allow take of certain ESA-listed species for scientific research. Scientific research permits issued by NMFS currently authorize studies on ESA-listed species in the Atlantic Ocean. Current fisheries management and ecosystem monitoring surveys conducted by or in coordination with the Northeast Fisheries Science Center (NEFSC) could overlap with offshore wind lease areas in the Mid-Atlantic region.

Surveys include (1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; (2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; (3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; and

(4) the NEFSC Ecosystem Monitoring Program, a more than 40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units. Given the potential impacts on National Oceanic and Atmospheric Administration (NOAA) Fisheries scientific surveys resulting from offshore wind development, BOEM and NOAA have committed to addressing these impacts through the implementation of a programmatic mitigation approach that is currently under development.

The regulatory process administered by NMFS, which includes stock assessments for all marine mammals and 5-year reviews for all ESA-listed species, assists in informing decisions on take authorizations and the assessment of project-specific and cumulative impacts that consider past, present, and reasonably foreseeable future actions in biological opinions. Stock assessments completed regularly under the MMPA include estimates of potential biological removal that stocks of marine mammals can sustainably absorb. MMPA take authorizations require that a proposed action have no more than a negligible impact on species or stocks, and that a proposed action impose the least practicable adverse impact on the species. MMPA authorizations are reinforced by monitoring and reporting requirements so that NMFS is kept informed of deviations from what has been approved. Biological opinions for federal and non-federal actions are similarly grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. These processes help to ensure that, through compliance with these regulatory requirements, a proposed action would not have a measurable impact on the conservation, recovery, and management of the resource.

F.2.10.1. Directed Take Permits for Scientific Research and Enhancement

NMFS issues permits for research on protected species for scientific purposes. These scientific research permits include the authorization of directed take for activities such as capturing animals and taking measurements and biological samples to study their health, tagging animals to study their distribution and migration, photographing and counting animals to get population estimates, taking animals in poor health to an animal hospital, and filming animals. NMFS also issues permits for enhancement purposes; these permits are issued to enhance the survival or recovery of a species or stock in the wild by taking actions that increase an individual’s or population’s ability to recover in the wild. Scientific research and enhancement permits have been issued previously for satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans, research on reproduction, mortality, health, and conservation issues for North Atlantic Right Whales, and research on population dynamics of harbor and grey seals. Reasonably foreseeable future impacts from scientific research and enhancement permits include physical and behavioral stressors (e.g., restraint and capture, marking, implantable and suction tagging, biological sampling).

F.2.10.2. Fisheries Use and Management

NMFS implements regulations to manage commercial and recreational fisheries in federal waters, including those within which the Project would be located; the State of Virginia regulates commercial fisheries in state waters (within 3 nautical miles [5.6 kilometers; 3.5 miles] of the coastline). Aquaculture in Virginia is permitted by the Virginia Marine Resources Commission. No shellfish aquaculture leases presently occur in the vicinity of the Virginia Beach onshore interconnection locations and no future leases are anticipated (Virginia Marine Resources Commission 2021).

The Project overlaps NMFS’ Mid-Atlantic regional council that manages federal fisheries: Mid-Atlantic Fisheries Management Council (MAFMC) includes New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina ((MARCO 2016). The council manages species with many fishery management plans that are frequently updated, revised, and amended and coordinate with each other to jointly manage species across jurisdictional boundaries (MAFMC 2019). Many of the fisheries managed by the council are fished for in state waters or outside of the Mid-Atlantic region, so the council works with the Atlantic States Marine Fisheries Commission (ASMFC). ASMFC is composed of the

15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states' marine waters.

The fishery management plans of the MAFMC and ASMFC were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the Mid-Atlantic region.

NMFS also manages highly migratory species (HMS), such as tuna and sharks, that can travel long distances and cross domestic boundaries. Table F-4 summarizes other fishery management plans and actions in the region.

The Maryland Department of Natural Resources (DNR) has developed Fishery Management Plans (FMPs) for Chesapeake Bay species. For coastal migratory species, the MAFMC develops management measures for species mainly found in the Exclusive Economic Zone (EEZ or 3–200 miles [5–321 kilometers] offshore). For species utilizing inshore coastal area (0-3 miles offshore), the ASMFC defines compliance requirements.

The Virginia Maritime Resources Commission – Fisheries Management Division implements state policies affecting recreational and commercial saltwater fisheries in Virginia's tidal waters. Fishery management plans for oyster, blue crab, shad and herring, striped bass, weakfish, bluefish, spotted sea trout, black drum, red drum, spot, and croaker have been completed by the Fisheries Management Division.

Table F-4 Other Fishery Management Plans

Area	Plan and Projects
Atlantic States Marine Fisheries Commission	ASMFC Five-Year Strategic Plan 2019–2023 (ASMFC 2019) ASMFC 2022 Action Plan (ASMFC 2021) Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change (ASMFC 2018)
Maryland	2015 Fishery Management Plans (Legislative Report December 2016) – Chesapeake Bay Fishery Management Plans
Virginia	Virginia Marine Resources Commission – Fisheries Management Division (2021) The Virginia Marine Resources Commission implements current and long-term state policies affecting saltwater fisheries, both recreational and commercial, in Virginia's tidal waters and conservation and enhancement of finfish and shellfish resources
Texas	The Texas Parks and Wildlife Department implements fisheries management programs including operation of hatcheries and development of artificial reefs and habitat projects (TPWD 2021)

F.2.11 Global Climate Change

Climate change results primarily from the increasing concentration of GHGs in the atmosphere, which causes planet-wide physical, chemical, and biological changes, substantially affecting the world's oceans and lands. Changes include increases in global atmospheric and oceanic temperature, shifting weather patterns, rising sea levels, and changes in atmospheric and oceanic chemistry (Blunden and Arndt 2020). Section 7.6.1.4 of the Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf (BOEM 2007) describes global climate change with respect to assessing renewable energy development. Climate change is predicted to affect Northeast fishery species differently (Hare et al. 2016), and the NMFS biological opinion discusses in detail the potential impacts of global climate change on protected species that occur within the Proposed Action Area (NMFS 2013).

The Intergovernmental Panel on Climate Change (IPCC) released a special report in October 2018 that compared risks associated with an increase of global warming of 1.5 degrees Celsius (°C) and an increase of 2°C. The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2°C was associated with greater risks associated with climatic changes such as extreme weather and drought; global sea level rise; impacts on terrestrial ecosystems; impacts on marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts on health, livelihoods, food security, water supply, and economic growth (IPCC 2018).

Table F-5 summarizes regional plans and policies that are in place to address climate change, and Table F-6 summarizes regional resiliency plans.

Table F-5 Climate Change Plans and Policies

Plans and Policies	Summary/Goal
Maryland	
The Greenhouse Gas Emissions Reduction Act 2030 GGRA Plan (February 19, 2021)	The Maryland Greenhouse Gas Emissions Reduction Act of 2016 establishes greenhouse gas emission reduction goals. The Act required the State of Maryland to adopt a final plan by 2019 that reduces statewide greenhouse gas emissions by 40% from 2006 levels by 2030. The 2020 GGRA Plan provides an implementation strategy for the 2030 greenhouse gas emissions reduction goal.
Maryland Renewable Energy Portfolio Standard	The Renewable Portfolio Standard (RPS) Program requires electricity suppliers to meet a prescribed minimum portion of their retail electricity sales with various renewable energy sources, which have been classified within the RPS Statute as Tier 1 and Tier 2 renewable sources. The program is implemented through the creation, sale, and transfer of Renewable Energy Credits (RECs).
Virginia	
Virginia Carbon Rule (June 25, 2020)	Under the Virginia Carbon Rule, Virginia is to establish a greenhouse gas cap-and-trade program and is to join the Regional Greenhouse Gas Initiative (RGGI), a regional cap-and trade program that reduces climate pollution from fossil fuel-fired power plants. The Virginia Department of Environmental Quality (DEQ) issued a Draft Report on March 11, 2022, called for by Virginia Executive Order 9 *Protecting Ratepayers from the Rising Cost of Living Due to the Regional Greenhouse Gas Initiative*, January 15, 2022 (DEQ 2022b). The Draft Report includes an attached draft *Process for Addressing EO-9 Emergency Regulation and Repeal CO_2 Emissions Trading Program*. As of July 2022, no action had been taken by VADEQ re: Virginia's participation in the RGGI.
Virginia Clean Economy Act (April 12, 2020)	The Virginia Clean Economy Act establishes an electric power RPS for Virginia electric power companies to become 100% carbon-free by 2050 and requires closure of coal-fired electric power plants, establishes energy efficiency standards, and promotes offshore wind development and solar and distributed generation.
Virginia Department of Environmental Quality Strategic Plan (2021)	The Virginia DEQ Strategic Plan establishes the Objective to support the commonwealth's resilience efforts by encouraging climate change adaptation through programmatic outreach and requirements, and strategies to make climate change adaptation an explicit, expected outcome of appropriate Virginia agency programs and initiatives. The Virginia DEQ Strategic Plan incorporates climate resilience, adaptation, and mitigation.

Plans and Policies	Summary/Goal
North Carolina	
Executive Order 80: North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy (October 29, 2018)	Executive Order 80 establishes climate goal for North Carolina to strive to accomplish by 2025, including: • Reduce statewide greenhouse gas emissions to 40% below 2005 levels. • Increase the number of registered, zero-emission vehicles (ZEVs) to at least 80,000. • Reduce energy consumption per square foot in state-owned buildings by at least 40% from FY 2002-2003 levels.
Executive Order 80	Executive Order 80 established the Climate Change Interagency Council to help North Carolina cabinet agencies work together to achieve goals established by the Executive Order.
Cabinet-level Plans	North Carolina Cabinet agencies have established Cabinet-level climate plans including the Clean Energy Plan, Climate Risk Assessment and Resilience Plan and Energy, Water and Utility Use Conservation Plan (Department of Environmental Quality); North Carolina Zero Emission Vehicle (ZEV) Plan (Department of Transportation); and Motor Fleet ZEV Plan (Department of Administration).

Table F-6 Resiliency Plans and Policies in the Lease Area

Plans and Policies	Summary
Maryland	
Maryland Commission on Climate Change – Adaptation and Resiliency Workgroup.	The Maryland Commission on Climate Change (MCCC), codified by legislation in 2015, is tasked with advising the Governor and General Assembly on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change, including participation in development of climate action plans. The MCCC is chaired by the Maryland Department of Environment (MDE) Secretary. The Commission is organized into four working groups: Adaptation and Resiliency; Education, Communication, and Outreach; Greenhouse Gas Mitigation; and Science and Technical. The Adaptation and Resiliency Work Group (ARWG) is charged with developing and implementing a comprehensive strategy for reducing Maryland's climate change vulnerability and providing state and local governments with tools to plan for and adapt to climate impacts such as extreme weather and sea level rise.

Plans and Policies	Summary
Virginia	
Virginia CZM Program 2020 Coastal Needs Assessments and FY 2021–2025 Strategies (Section 309)	The Virginia Coastal Zone Management (CZM) Program assesses Virginia's coastal resources and management efforts every 5 years, including coastal hazards and ocean resources. The 5-year grant strategies are applied to result in new enforceable policies to better manage high priority resources or issues; initiatives include responses to results of the Virginia CZM Program Phase I Coastal Hazards Assessment. Climate resiliency was selected by the Coastal Policy Team as a Fiscal Year (FY) 2020–2023 focal area theme to help meet the goals and needs in the statewide resiliency plan.
Virginia Clean Energy and Community Flood Preparedness Act	This Act creates a Virginia Community Flood Preparedness Fund to enhance flood prevention, protection, and coastal resilience.
North Carolina	
North Carolina Climate Risk Assessment and Resilience Plan (June 2020)	This Plan establishes the North Carolina Resilience Strategy, which is a compilation of documents organized into four elements: (1) The North Carolina Science Report, (2) State Agency Resilience Strategies, (3) Statewide Vulnerability Assessment and Resilience Strategies, and (4) the North Carolina Enhanced Hazard Mitigation Plan.
Hazard Mitigation Plan (February 2018)	The Plan identifies hazards that may affect North Carolina, and includes a Planning Process, Risk and Vulnerability Assessment, Mitigation Capability, Mitigation Strategy, and Plan Maintenance, Monitoring, and Implementation.
Texas	
Texas Coastal Resiliency Master Plan (2019)	Texas General Land Office 2019 *Texas Coastal Resiliency Master Plan* is the second installment of a statewide plan to protect and promote a vibrant and resilient Texas coast (GLO 2019). The Resiliency Master Plan identifies eight priority Issues of Concern that encompass risks and threats to the viability of coastal communities, habitats, and industries: • Altered, Degraded or Lost Habitat • Gulf Beach Erosion and Dune Degradation • Bay Shoreline Erosion • Existing and Future Coastal Storm Surge Damage • Coastal Flood Damage • Impact on Water Quality and Quantity • Impact on Coastal Resources • Abandoned or Derelict Vessels, Structures and Debris

F.2.12 Oil and Gas Activities

The proposed Project area is located in the Mid-Atlantic Planning Area of the OCS Oil and Gas Leasing Program (National OCS Program) comprising Delaware, Maryland, Virginia, and North Carolina (BOEM 2021d). There are no active oil and gas leases in the Mid-Atlantic Planning Area. On September 8, 2020, the White House issued a presidential memorandum for the Secretary of the Interior on the withdrawal of certain areas of the United States OCS from leasing disposition for 10 years, including the areas currently designated by BOEM as the South Atlantic and Straits of Florida Planning Areas (The White House 2020a). The South Atlantic Planning Area includes the OCS off South Carolina, Georgia, and northern Florida. On September 25, the White House issued a similar memorandum for the Mid-Atlantic Planning Area that lies south of the northern administrative boundary of North Carolina (The White House 2020b). This withdrawal prevents consideration of these areas for any leasing for purposes of exploration, development, or production during the 10-year period beginning July 1, 2022, and ending June 30, 2032. However, currently, there has been no decision by the Secretary of the Interior regarding future oil and gas leasing in the remainder of the Mid-Atlantic Planning Areas. Existing leases in the withdrawn areas are not affected.

BOEM issues G&G permits to obtain data for hydrocarbon exploration and production; locate and monitor marine mineral resources; aid in locating sites for alternative energy structures and pipelines; identify possible anthropogenic, seafloor, or geological hazards; and locate potential archaeological and benthic resources. G&G surveys are typically classified into categories by equipment type and survey technique. There are currently no such permit applications under review for areas offshore Maryland or North Carolina; there is one permit application for an air gun seismic survey under review for areas offshore Norfolk Virginia (BOEM 2021d).

Several liquefied natural gas (LNG) ports are located on the East Coast of the United States. Table F-7 lists existing, approved, and proposed LNG ports on the East Coast of the United States that provide (or may in the future provide) services such as natural gas export, natural gas supply to the interstate pipeline system or local distribution companies, or storage of LNG for periods of peak demand, or production of LNG for fuel and industrial use (FERC 2018).

Table F-7 Liquid Natural Gas Terminals Located in the Northeastern United States

Terminal Name	Type	Company	Jurisdiction	Distance from Project (approximate)	Status
Everett, Massachusetts	Import terminal	GDF SUEZ—DOMAC	FERC	440 miles northeast	Existing
Offshore Boston, Massachusetts	Import terminal	Neptune LNG	U.S. Department of Transportation Maritime Administration (MARAD)/USCG	440 miles northeast	Existing
Offshore Boston, Massachusetts	Import terminal, authorized to re-export delivered LNG	Excelerate Energy—Northeast Gateway	MARAD/USCG	440 miles northeast (Buoy B)	Existing
Cove Point, Maryland (Chesapeake Bay)	Import terminal Export terminal	Dominion—Cove Point LNG	FERC	142 miles northwest	Existing

Terminal Name	Type	Company	Jurisdiction	Distance from Project (approximate)	Status
Elba Island, Georgia (Savannah River)	Import terminal Export terminal	Southern LNG	FERC	450 miles southwest	Existing
Elba Island, Georgia (Savannah River)	Export terminal	Southern LNG Company	FERC	450 miles southwest	Existing
Jacksonville, Florida	Export terminal	Eagle LNG Partners	FERC	600 miles southwest	Approved, not under construction

Source: FERC (2021a, 2021b).

F.2.13 Onshore Development Activities

Onshore development activities that may contribute to cumulative impacts include visible infrastructure such as onshore wind turbines and cell towers, port development, and other energy projects such as transmission and pipeline projects. Coastal development projects permitted through regional planning commissions, counties, and towns may also contribute to cumulative impacts. These may include residential, commercial, and industrial developments spurred by population growth in the region (Table F-8).

Table F-8 Existing, Approved, and Proposed Onshore Development Activities

Type	Description
Local planning documents	• City of Virginia Beach, Virginia – *2040 Comprehensive Plan*. The City of Virginia Beach is updating the City's Comprehensive Plan. Phase I of the public engagement process (online survey) for the 2040 plan development process has been concluded; the 2040 plan development process public outreach process initiated in 2019 has been suspended since 2020 due to COVID-19 restrictions (City of Virginia Beach Planning Commission 2021a). • City of Virginia Beach. Virginia – *Virginia Beach Resort Area Strategic Action Plan 2030*. The Resort Area Strategic Action Plan (RASAP) was adopted in December 2008 and updated in June 2020. The 2020 RASAP identifies planned and projected development for the Resort Area including private sector development and public works projects such as proposed open space and stormwater management infrastructure upgrades (City of Virginia Beach 2020). • City of Virginia Beach, Virginia – *Strategic Growth Areas*. The City of Virginia Beach Strategic Growth Area (SGA) Office has identified eight SGAs within the City: Burton Station, Centerville. Hilltop, Lynnhaven, Newtown, Pembroke, Resort Area, and Rosemont. Each SGA has a long-range master plan that describes the future vision and guides policy decisions for growth and development in each area (City of Virginia Beach 2017; 2021b). • City of Chesapeake, Virginia – *2035 Comprehensive Plan*. The *Moving Forward Chesapeake 2035 Comprehensive Plan* was adopted by the City Council on February 25, 2014, and amended on November 15, 2016, and December 18, 2018. The Comprehensive Plan includes plan vision; responsible growth strategies; infrastructure, including transportation and utilities; and quality of life, including education, public facilities and services, and parks and recreation planning elements (City of Chesapeake 2018a).

Type	Description
	• City of Chesapeake, Virginia – On June 16, 2020, the City Council approved the *Great Bridge Historic Gateway Overlay District* as an amendment to the City's Zoning Ordinance. The purpose of the Overlay District is to protect and enhance the historic and cultural significance of the Great Bridge community within the City. • City of Chesapeake, Virginia – *South Norfolk Municipal Facilities Study and Development Strategy.* The City of Chesapeake conducted a study of potential municipal facilities in the study area. The municipal facilities study area map extends down Poindexter Street and reaches north on Liberty Street to 16th Street plus south on Bainbridge Boulevard by Holly Avenue (City of Chesapeake 2018b; City of Chesapeake 2018c). • City of Chesapeake, Virginia – The *Indian River Planning Area Study* evaluated current and future land use patterns, impact of land development regulations, market and economic development, and infrastructure standards in the planning area. The planning area is bounded by Interstate 64 and Military Highway to the south, the Elizabeth River to the north, and the adjacent municipalities of Norfolk and Virginia Beach on the west and east (City of Chesapeake 2021c; City of Chesapeake 2021e). • City of Portsmouth, Virginia – The *Portsmouth 2018 Comprehensive Plan* includes a Strategic Plan, Geographic Plan, and Implementation Plan for the City of Portsmouth (City of Portsmouth 2018b). • City of Newport News, Virginia – *One City, One Future 2040 Comprehensive Plan.* The 2040 Plan was adopted by City Council on August 14, 2018. The plan contains City policies on land use, urban design, transportation, housing, public facilities and services, environment, and economic development (City of Newport News 2018a; City of Newport News 2018b).
Onshore wind projects – Virginia	• According to the Virginia Division of Energy there are no onshore commercial scale wind energy projects in Virginia (Virginia Division of Energy 2021).
Onshore wind projects – Texas	• According to the U.S. Wind Turbine Database (USWTDB) Map Viewer, there are approximately 757 commercial onshore wind turbines in 11 wind turbine project areas in San Patricio and Nueces Counties, Texas (USWTDB 2022).
Communications towers – Virginia	• There are 133 towers and 804 antennas within a 3.0-mile (4.8-kilometer) radius of the Portsmouth Marine Terminal (AntennaSearch.com 2022a). • There are 49 towers and 201 antennas within a 3.0-mile (4.8-kilometer) radius of the Newport News Marine Terminal (AntennaSearch.com 2022b). • There are 103 towers and 113 antennas within a 3.0-mile (4.8-kilometer) radius of the Harpers Road Switching Station location (AntennaSearch.com 2022c). • There are 52 towers and 56 antennas within a 3.0-mile (4.8-kilometer) radius of the Fentress Substation location (AntennaSearch.com 2022d). • There are 75 towers and 186 antennas within a 3.0-mile (4.8-kilometer) radius of the proposed cable landing location (AntennaSearch.com 2022e).
Communications towers – Texas	• There are 24 towers and 90 antennas within a 3.0-mile (4.8-kilometer) radius of Ingleside Point, Ingleside, Texas (Port of Ingleside) (AntennaSearch,com 2022f) • There are 35 towers and 67 antennas within a 3.0 mile (4.8 kilometer) radius of Aransas Pass, Texas (Port Aransas) (AntennaSearch.com 2022g) • There are 69 towers and 467 antennas within a 3.0 mile (4.8 kilometer) radius of Harbor Drive, Corpus Christi, Texas (Port of Corpus Christi) (AntennaSearch.com 2022h)

Type	Description
Development projects	• Naval Air Station Oceana Future Base Design – The U.S. Navy and City of Virginia Beach signed an agreement in August 2021 to explore potential commercial leases of land within Naval Air Station Oceana. Under the Future Base Design approximately 350–400 acres (142–162 hectares) could be leased and developed by the private sector (WVEC-TV 2021; WAVY.com 2020). The U.S. Navy estimated that the plan would be implemented over the next 5–7 years. • Naval Auxiliary Landing Field Fentress Encroachment Protection Acquisition Program—The City of Chesapeake (2021d) has identified properties in the vicinity of Naval Auxiliary Landing Field Fentress for acquisition to manage potential land use encroachment conflicts. Specific parcels have been identified for potential acquisition; acquisitions have been conducted subject to available funding (City of Chesapeake (2019).
Port studies/ upgrades – Virginia	A study commissioned by the Virginia Department of Mines Minerals and Energy and published in 2015 evaluated ten Virginia ports for their readiness to accommodate offshore wind manufacturing and construction activities and also evaluated five commercial shipyards for their readiness to manufacture offshore electrical substations. Using requirements including water side infrastructure, onshore infrastructure, and access requirements, five ports in Virginia more identified with a high level of readiness to support offshore wind, including the following: • Portsmouth Marine Terminal • Newport News Marine Terminal (Virginia Port Authority 2022) • Peck Marine Terminal • Virginia Renaissance Center (Jacoby Development 2017) • BASF Portsmouth Portsmouth and Newport News Marine Terminals were identified by the study team to have the highest level of port readiness due to the ample space available to accommodate multiple co-located offshore wind construction and deployment activities (BVG Associates 2015). In January 2020, the State of Virginia leased 40 acres of land within the Portsmouth Marine Terminal to Ørsted to support the CVOW-C Project (*Virginian Pilot* 2020a). The Portsmouth Marine Terminal was temporarily closed to shipping in April 2020 in response to COVID-19 restrictions (*Virginian Pilot* 2020b; Port of Virginia 2020a). The State of Virginia plans to invest $40 million from its 2021 budget to upgrade the Portsmouth Marine Terminal, near Norfolk, Virginia to handle offshore wind manufacturing, handling, and transportation (Reuters 2021).
Port studies/ upgrades – Texas	The Channel Improvement Project for the Port of Corpus Christi, Texas, will increase the channel depth from -47 feet MLLW to -54 feet MLLW and widen it to 530 feet, with an additional 400 feet of barge shelves. The proposed budget of $157.3 million is the largest single-year budgetary allocation from the federal government compared to prior years' budgets. The project has received nearly $250 million in federal appropriations to USACE thus far, with the Port of Corpus Christi appropriating another $190 million in cost share funds. The Channel Improvement Project is a four-phase project, with Phase 1 completed and Phases 2 and 3 under construction in 2022 (Port of Corpus Christi 2022).

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ATTACHMENT F1
ONGOING AND FUTURE NON-OFFSHORE WIND ACTIVITY ANALYSIS

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Tables

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BOEM developed the following tables based on their 2019 study National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf (BOEM 2019), which evaluates potential impacts associated with ongoing and future non-offshore wind activities. The content of these tables has been vetted by cooperating agencies to the SFWF EIS and therefore has been included in whole for their use in impact and cumulative analyses, and for ease in reference by the reader.

Table F1-1 Summary of Activities and the Associated Impact-Producing Factors for Air Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	Accidental releases of air toxics HAPs are due to potential chemical spills. Ongoing releases occur in low frequencies. These may lead to short-term periods of toxic pollutant emissions through surface evaporation. According to the U.S. Department of Energy, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and offshore it was up to less than 70,000 barrels.	Accidental releases of air toxics or HAPS will be due to potential chemical spills. See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. These may lead to short-term periods of toxic pollutant emissions through evaporation. Air quality impacts will be short-term and limited to the local area at and around the accidental release location.
Air emissions: Construction and decommissioning	Air emissions originate from combustion engines and electric power generated by burning fuel. These activities are regulated under the CAA to meet set standards. Air quality has generally improved over the last 30 years; however, some areas in the Northeast have experienced a decline in air quality over the last 2 years. Some areas of the Atlantic coast remain in nonattainment for ozone, with the source of this pollution from power generation. Many of these states have made commitments toward cleaner energy goals to improve this, and offshore wind is part of these goals. Primary processes and activities that can affect the air quality impacts are expansions and modifications to existing fossil fuel power plants, onshore and offshore	The largest air quality impacts over the next 30 years will occur during the construction phase of any one project; however, projects will be required to comply with the CAA. During the limited construction and decommissioning phases, emissions may occur that are above *de minimis* thresholds and will require offsets and mitigation. Primary emission sources will be increased commercial vehicular traffic, air traffic, public vehicular traffic, and combustion emissions from construction equipment and fugitive emissions from construction-generated dust. As projects come online, power generation emissions overall will decline, and the industry as a whole will have a net benefit on air quality.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Air emissions: O&M	activities involving renewable energy facilities, and various construction activities.	Activities associated with operation and maintenance of onshore wind projects will have a proportionally very small contribution to emissions compared to the construction and decommissioning activities over the next 30 years. Emissions will largely be due to commercial vehicular traffic and operation of emergency diesel generators. Such activity will result in short-term, intermittent, and widely dispersed emissions and small air quality impacts.
Air emissions: Power generation emissions reductions		Many Atlantic states have committed to clean energy goals, with offshore wind being a large part of that. Other reductions include transitioning to onshore wind and solar. The No Action Alternative without implementation of other future offshore wind projects would likely result in increased air quality impacts regionally due to the need to construct and operate new energy generation facilities to meet future power demands. These facilities may consist of new natural-gas-fired power plants, coal-fired, oil-fired, or clean-coal-fired plants. These types of facilities would likely have larger and continuous emissions and result in greater regional scale impacts on air quality.
Air Emissions: Greenhouse Gases	The construction, operation, and decommissioning of offshore wind projects would produce GHG emissions (nearly all CO_2) that can contribute to climate change; however, these contributions would be minuscule compared to aggregate global emissions. CO_2 is relatively stable in the atmosphere and generally mixed uniformly throughout the troposphere and stratosphere. Hence the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects will likely decrease GHGs emissions by replacing energy from fossil fuels.	Development of future onshore wind projects will produce a small overall increase in GHG emissions over the next 30 years. However, these contributions would be very small compared to the aggregate global emissions. The impact on climate change from these activities would be very small. As more projects come online, some reduction in GHG emissions from modifications of existing fossil fuel facilities to reduce power generation. Overall, it is anticipated that there would be no cumulative impact on global warming as a result of onshore wind project activities.

% = percent; BOEM = Bureau of Ocean Energy Management; CAA = Clean Air Act; CO = carbon monoxide; draft EIS = draft environmental impact statement; EIS = environmental impact statement;
GHG = greenhouse gas; HAP = hazardous air pollutant; IPF = impact-producing factor; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; NOx = nitrogen oxides; O&M = operations and maintenance; $PM_{2.5}$ = particulate matter with diameters 2.5 microns or smaller; PM_{10} = particulate matter with diameters 10 microns or smaller; ppb = parts per billion; SO_2 = sulfur dioxide; USC = United States Code; USEPA = U.S. Environmental Protection Agency; VOC = volatile organic compounds.

Table F1-2 Summary of Activities and the Associated Impact-Producing Factors for Bats

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded and would result in high-intensity, low-exposure level, long-term, but localized intermittent risk to bats in nearshore waters. Direct impacts are not expected to occur as recent research has shown that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al. 2016). Indirect impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized.	Similar to ongoing activities, noise associated with pile driving activities would be limited to nearshore waters, and these high-intensity, but low-exposure risks would not be expected to result in direct impacts. Some indirect impacts (i.e., displacement from potentially suitable foraging habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized and no population-level effects would be expected.
Noise: Construction	Onshore construction occurs regularly for generic infrastructure projects in the bats geographic analysis area. There is a potential for displacement caused by equipment if construction occurs at night (Schaub et al. 2008). Any displacement would only be temporary. No individual or population-level impacts would be expected. Some bats roosting in the vicinity of construction activities may be disturbed during construction, but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts as frequent roost switching is a common component of a bat’s life history (Hann et al. 2017; Whitaker 1998).	Onshore construction is expected to continue at current trends. Some behavioral responses and avoidance of construction areas may occur (Schaub et al. 2008). However, no injury or mortality would be expected.
Presence of structures: Migration disturbances	There may be few structures scattered throughout the offshore bats geographic analysis area, such as navigation and weather buoys and light towers (NOAA 2020a). Migrating bats can easily fly around or over these sparsely distributed structures, and no migration disturbance would be expected. Bat use of offshore areas is very limited and generally restricted to spring and fall migration. Very few bats would be expected to encounter structures on the OCS and no population-level effects would be expected.	The infrequent installation of future new structures in the marine environment of the next 30 years is expected to continue. As described under *Ongoing Activities*, These structures would not be expected to cause disturbance to migrating tree bats in the marine environment.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Turbine strikes	There may be few structures in the offshore bats geographic analysis area, such as navigation and weather buoys, turbines, and light towers (NOAA 2020a). Migrating tree bats can easily fly around or over these sparsely distributed structures, and no strikes would be expected.	The infrequent installation of future new structures in the marine environment of the next 30 years is expected to continue. As described under *Ongoing Activities*, these structures would not be expected to result in increased collision risk to migrating tree bats in the marine environment.
Land disturbance: onshore construction	Onshore construction activities are expected to continue at current trends. Potential direct effects on individuals may occur if construction activities include tree removal when bats are potentially present. Injury or mortality may occur if trees being removed are occupied by bats at the time of removal. While there is some potential for indirect impacts associated with habitat loss, no individual or population-level effects would be expected.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss and could result in injury or mortality of individuals.

EIS = Environmental Impact Statement; ESP = electrical service platform; IPF = impact-producing factors; NOAA = National Oceanic and Atmospheric Administration; OCS = outer continental shelf; ROW = right-of-way; WTG = wind turbine generator.

Table F1-3 Summary of Activities and the Associated Impact-Producing Factors for Benthic Resources

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a discussion of ongoing accidental releases. Accidental releases of hazmat occur periodically, mostly consisting of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they rarely contact benthic resources. The chemicals with potential to sink or dissolve rapidly often dilute to non-toxic levels before they affect benthic resources. The corresponding impacts on benthic resources are rarely noticeable.	Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. See previous cell and Table F1-22 on water quality for details.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on benthic resources (e.g., competitive disadvantage, smothering) depend on many factors, but can be noticeable, widespread, and permanent.	No future activities were identified within the geographic analysis area other than ongoing activities.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occurs from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. However, there does not appear to be evidence that ongoing releases have detectable impacts on benthic resources.	No future activities were identified within the geographic analysis area other than ongoing activities.
Anchoring	Regular vessel anchoring related to ongoing military, survey, commercial, and recreational activities continues to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and the potential for direct contact to cause injury and mortality of benthic resources, as well as physical damage to their habitats. All impacts are localized; turbidity is temporary; injury and mortality are recovered in the short term; and physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area other than ongoing activities.
EMFs	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the geographic analysis area. Some benthic species can detect EMFs, although EMFs do not appear to present a barrier to movement. The extent of impacts (behavioral changes) is likely less than 50 feet (15.2 meters) from the cable and the intensity of impacts on benthic resources is likely undetectable.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
New cable emplacement/ maintenance	Cable maintenance activities infrequently disturb benthic resources and cause temporary increases in suspended sediment; these disturbances would be local and limited to the emplacement corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities injure and kill benthic resources, and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPFs of Seabed profile alterations and Sediment deposition and burial.)	No future activities were identified within the geographic analysis area other than ongoing activities.
Noise: Onshore/ offshore construction	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: G&G	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: O&M	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can cause injury or mortality to benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	**Ongoing Activities**	**Future Non-Offshore Wind Activities Intensity/Extent**
Noise: Cable laying/trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area. These disturbances would be infrequent over the next 30 years, local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Port utilization: Expansion	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11on finfish, invertebrates, and EFH.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear are periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb, injure, or kill benthic resources, creating small, short-term, localized impacts.	Future new cables would present additional risk of gear loss, resulting in small, short-term, localized impacts (disturbance, injury).
Presence of structures: Hydrodynamic disturbance	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes can adversely affect populations and communities of benthic resources. These impacts are local and permanent.	New cables installed in the geographic analysis area over the next 30 years would likely require hard protection atop portions of the route (see the “new cable emplacement/maintenance” row in this table). Any new towers, buoy, or piers would also create uncommon relief in a mostly flat, sandy seascape. Structure-oriented fishes could be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect populations and communities of benthic resources. These impacts are expected to be local and to be permanent as long as the structures remain.
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously provide uncommon hard-bottom habitat. A large portion is homogeneous sandy seascape but there is some other hard or complex habitat. Benthic species dependent on hard-bottom habitat can benefit on a constant basis, although the new habitat can also be colonized by invasive species (e.g., certain tunicate species). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	See above for quantification and timing. Any new towers, buoy, piers, or cable protection structures would create uncommon relief in a mostly sandy seascape. Benthic species dependent on hard-bottom habitat could benefit, although the new habitat could also be colonized by invasive species (e.g., certain tunicate species). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).

Associated IPFs: Sub-IFPs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: cable infrastructure	The presence of cable infrastructure, especially hard protection atop cables, causes impacts through entanglement/gear loss/damage, fish aggregation, and habitat conversion. Therefore, see those sub-IPFs within Presence of structures.	See other sub-IPFs within Presence of structures.
Discharges	The gradually increasing amount of vessel traffic is increasing the cumulative permitted discharges from vessels. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. However, there does not appear to be evidence that the volumes and extents have any impact on benthic resources.	There is the potential for new ocean dumping/dredge disposal sites in the Northeast. Impacts (disturbance, reduction in fitness) of infrequent ocean disposal to benthic resources are short term because spoils are typically recolonized naturally. In addition, the USEPA has established dredge spoil criteria and it regulates the disposal permits issued by the USACE; these discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated.
Cable emplacement and maintenance; Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, injury, and mortality) on benthic resources through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little impact on benthic resources in the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.
Cable emplacement and maintenance; Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season/time of year. Where dredged materials are disposed, benthic resources are smothered. However, such areas are typically recolonized naturally in the short term. Most sediment dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.	The USACE and private ports may undertake dredging projects periodically. Where dredged materials are disposed, benthic resources are buried. However, such areas are typically recolonized naturally in the short term. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.

BMP = best management practice; BOEM = Bureau of Ocean Energy Management; CO_2 = carbon dioxide; COP = Construction and Operations Plan; EFH = Essential Fish Habitat; EIS = Environmental Impact Statement; EMF = electromagnetic field; ESP = electrical service platform; G&G = Geological and Geophysical; hazmat = hazardous materials; IPF = impact-producing factors; met = meteorological;
NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); USACE = U.S. Army Corps of Engineers; USEPA = U.S. Environmental Protection Agency; WTG = wind turbine generator.

Table F1-4 Summary of Activities and the Associated Impact-Producing Factors for Birds

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a qualitative analysis of these risks. Ongoing releases are frequent/chronic. Ingestion of hydrocarbons can lead to morbidity and mortality due to decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997, Haney et al. 2017, Paruk et al. 2016). Additionally, even small exposures that result in feather oiling can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). These impacts rarely result in population-level impacts.	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the potential risk of accidental releases and associated impacts, including mortality, decreased fitness, and health effects on individuals. Impacts are unlikely to affect populations.
Accidental releases: Trash and debris	Trash and debris are accidentally discharged through onshore sources; fisheries use; dredged material ocean disposal; marine minerals extraction; marine transportation, navigation, and traffic; survey activities; and cables, lines, and pipeline laying on an ongoing basis. In a study from 2010, students at sea collected more than 520,000 bits of plastic debris per square mile. In addition, many fragments come from consumer products blown out of landfills or tossed out as litter. (Law et al. 2010). Birds may accidentally ingest trash mistaken for prey. Mortality is typically a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019).	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. This may result in increased injury or mortality of individuals. However, there does not appear to be evidence that the volumes and extents would have any impact on bird populations.
Light: Vessels	Ocean vessels have an array of lights including navigational lights, deck lights, and interior lights. Such lights can attract some birds. The impact is localized and temporary. This attraction would not be expected to result in an increased risk of collision with vessels. Population-level impacts would not be expected.	Gradually increasing vessel traffic over the next 30 years would increase the potential for bird and vessel interactions. While birds may be attracted to vessel lights, this attraction would not be expected to result in increased risk of collision with vessels. No population-level impacts would be expected.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Light: Structures	Buoys, towers, and onshore structures with lights can attract birds. Onshore structures like houses and ports emit a great deal more light than offshore buoys and towers. This attraction has the potential to result in an increased risk of collision with lighted structures (Huppop et al. 2006). Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in proportion with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Cable emplacement and maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be temporary and generally limited to the emplacement corridor. Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances will be temporary and limited to the emplacement corridor. Suspended sediment could impair the vision of diving birds that are foraging in the water column (Cook and Burton 2010). However, given the localized nature of the potential impacts, individuals would be expected to successfully forage in nearby areas not affected by increased sedimentation and no biologically significant impacts on individuals or populations would be expected.	Future new cables, would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in localized, short-term impacts. The FCC has two pending submarine telecommunications cable applications in the North Atlantic. Impacts would be temporary and localized, with no biologically significant impacts on individuals or populations.
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for birds. With the possible exception of rescue operations and survey aircraft, no ongoing aircraft flights would occur at altitudes that would elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.	Aircraft noise is likely to continue to increase as commercial air traffic increases; however, very few flights would be expected to be at a sufficiently low altitude to elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities could result in diving birds leaving the local area. Non-diving birds would be unaffected. Any displacement would only be temporary during non-migratory periods, but impacts could be greater if displacement were to occur in preferred feeding areas during seasonal migration periods.	Same as ongoing activities, with the addition of possible future oil and gas surveys.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water could result in intermittent, temporary, localized impacts on diving birds due to displacement from foraging areas if birds are present in the vicinity of pile-driving activity. The extent of these impacts depends on pile size, hammer energy, and local acoustic conditions. No biologically significant impacts on individuals or populations would be expected.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Noise: Onshore construction	Onshore construction is routinely used in generic infrastructure projects. Equipment could potentially cause displacement. Any displacement would only be temporary and no individual fitness or population-level impacts would be expected.	Onshore construction will continue at current trends. Some behavior responses could range from escape behavior to mild annoyance, but no individual injury or mortality would be expected.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Subsurface noise from vessels could disturb diving birds foraging for prey below the surface. The consequence to birds would be similar to noise from G&G but likely less because noise levels are lower.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Presence of structures: Entanglement, gear loss, gear damage	Each year, 2,551 seabirds die annually from interactions with U.S. commercial fisheries on the Atlantic (Sigourney et al. 2019). Even more die due to abandoned commercial fishing gear (nets)). In addition, recreational fishing gear (hooks and lines) is periodically lost on existing buoys, pilings, hard protection, and other structures and has the potential to entangle birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various hard protections atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these objects. These impacts are local and can be short term to permanent. These fish aggregations can provide localized, short term to permanent, beneficial impacts on some bird species because it could increase prey species availability.	New cables, installed incrementally in the geographic analysis area for birds over the next 20 to 30 years, would likely require hard protection atop portions of the cables (see New cable emplacement/maintenance row). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are expected to be local and may be short term to permanent. These fish aggregations can provide localized, short-term to permanent beneficial impacts on some bird species due to increased prey species availability.
Presence of structures: Migration disturbances	A few structures may be scattered about the offshore geographic analysis area for birds, such as navigation and weather buoys and light towers (NOAA 2020a). Migrating birds can easily fly around or over these sparsely distributed structures.	The infrequent installation of future new structures in the marine or onshore environment over the next 30 years would not be expected to result in migration disturbances.
Presence of structures: Turbine strikes, displacement, and attraction	A few structures may be in the offshore geographic analysis area for birds, such as navigation and weather buoys, turbines, and light towers (NOAA 2020a). Given the limited number of structures currently in the geographic analysis area, individual- and population-level impacts due to displacement from current foraging habitat would not be expected. Stationary structures in the offshore environment would not be expected to pose a collision risk to birds. Some birds like cormorants and gulls may be attracted to these structures and opportunistically roost on these structures.	The installation of future new structures in the marine or onshore environment over the next 30 years would not be expected to result in an increase in collision risk or to result in displacement. Some potential for attraction and opportunistic roosting exists, but would be expected to be limited given the anticipated number of structures.
Traffic: Aircraft	General aviation accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Additionally, aircraft are used for scientific and academic surveys in marine environments.	Bird fatalities associated with general aviation would be expected to increase with the current trend in commercial air travel. Aircraft will continue to be used to conduct scientific research studies as well as wildlife monitoring and pre-construction surveys. These flights would be well below the 100,000 flights and no bird strikes would be expected to occur.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore construction	Onshore construction activity will continue at current trends. There is some potential for indirect impacts associated with habitat loss and fragmentation.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss, but would not be expected to result in injury or mortality of individuals.

ADLS = Aircraft Detection Light System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; EIS = environmental impact statement; ESP = electrical service platform;
FAA = Federal Aviation Administration; FCC = Federal Communications Commission; G&G = Geological and Geophysical; GHG = greenhouse gas; IPF = impact-producing factors; m/s = meter per second; NOAA = National Oceanic and Atmospheric Administration; OCS = outer continental shelf; ROW = right-of-way; USCG = U.S. Coast Guard; WTG = wind turbine generator

Table F1-5 Summary of Activities and the Associated Impact-Producing Factors for Terrestrial and Coastal Fauna

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Periodic ground-disturbing activities contribute to elevated levels of erosion and sedimentation, but usually not to a degree that affects terrestrial and coastal fauna, assuming that industry standard BMPs are implemented.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore construction	Periodic clearing of shrubs and tree saplings along existing utility ROWs causes disturbance and temporary displacement of mobile species and may cause direct injury or mortality of less-mobile species, resulting in short-term impacts that are less than noticeable. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, and cell tower projects also causes disturbance, displacement, and potential injury or mortality of fauna, resulting in small temporary impacts.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore, land use changes	Periodically, undeveloped parcels are cleared and developed for human uses, permanently changing the condition of those parcels as habitat for terrestrial fauna. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, transportation infrastructure, sewer infrastructure, and cell tower projects could permanently convert various areas.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by greenhouse gas emissions, is altering the seasonal timing and patterns of species distributions and ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 30 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

BMPs = best management practices; BOEM = Bureau of Ocean Energy Management; IPF = impact-producing factors; ROW = right-of-way; WMA = wildlife management area

Table F1-6 Summary of Activities and the Associated Impact-Producing Factors for Coastal Habitats

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a discussion of ongoing accidental releases. Accidental releases of fuel/fluids/hazmat have the potential to cause habitat contamination and harm to the species that build biogenic coastal habitats (e.g., eelgrass, oysters, mussels, slipper limpets, salt marsh cordgrass) from releases or cleanup activities. Only a portion of the ongoing releases contact coastal habitats in the geographic analysis area. Impacts are small, localized, and temporary.	See Table F1-22 for a discussion of accidental releases.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occur from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. As population and vessel traffic increase, accidental releases of trash and debris may increase. Such materials may be obvious when they come to rest on shorelines; however, there does not appear to be evidence that the volumes and extents would have any detectable impact on coastal habitats.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
Anchoring	Vessel anchoring related to ongoing military, survey, commercial, and recreational activities will continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and potential for direct contact to cause physical damage to coastal habitats. All impacts are localized; turbidity is short term and temporary; physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
EMF	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the analysis area. The extent of impacts is likely less than 50 feet from the cable, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
Light: Vessels	Navigation lights and deck lights on vessels would be a source of ongoing light. The extent of impacts is limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	Light is expected to continue to increase gradually with increasing vessel traffic over the next 30 years. The extent of impacts would likely be limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats would likely be undetectable.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Light: Structures	Ongoing lights from navigational aids and other structures onshore and nearshore. The extent of impacts is likely limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
New cable emplacement/ maintenance	Ongoing cable maintenance activities infrequently disturb bottom sediments; these disturbances are local and limited to the emplacement corridor (see the Sediment deposition and burial IPF).	No future activities were identified within the geographic analysis area other than ongoing activities.
Noise: Onshore/offshore construction	Ongoing noise from construction occurs frequently near shores of populated areas in New England and the mid-Atlantic, but infrequently offshore. Noise from construction near shore is expected to gradually increase over the next 30 years in line with human population growth along the coast of the geographic analysis area. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary.	No future activities were identified within the analysis area other than ongoing activities.
Noise: G&G	Site characterization surveys and scientific surveys are ongoing. The intensity and extent of the resulting impacts are difficult to generalize, but are local and temporary.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can reach coastal habitats. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Cable laying/trenching	Rare but ongoing trenching for pipeline and cable laying activities emits noise; cable burial via jet embedment also causes similar noise impacts. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines may occur in the geographic analysis area infrequently over the next 30 years. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.
Presence of structures: Habitat conversion	Various structures, including pilings, piers, towers, riprap, buoys, and various means of hard protection, are periodically added to the seascape, creating uncommon relief in a mostly flat seascape and converting previously existing habitat (whether hard-bottom or soft-bottom) to a type of hard habitat, although it differs from the typical hard-bottom habitat in the analysis area, namely, coarse substrates in a sand matrix. The new habitat may or may not function similarly to hard-bottom habitat typical in the region (Kerckhof et al. 2019; HDR 2019). Soft bottom is the dominant habitat type on the OCS, and structures do not meaningfully reduce the amount of soft-bottom habitat available (Guida et al. 2017; Greene et al. 2010). Structures can also create an artificial reef effect, attracting a different community of organisms.	Any new cable or pipeline installed in the geographic analysis area would likely require hard protection atop portions of the route (see cells to the left). Such protection is anticipated to increase incrementally over the next 30 years. Where cables would be buried deeply enough that protection would not be used, presence of the cable would have no impact on coastal habitats.
Presence of structures: Transmission cable infrastructure	Various means of hard protection atop existing cables can create uncommon hard-bottom habitat. Where cables are buried deeply enough that protection is not used, presence of the cable has no impact on coastal habitats.	See above.
Land disturbance: Erosion and sedimentation	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term erosion and sedimentation of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore construction	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term to permanent degradation of onshore coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore, land use changes	Ongoing development of onshore properties, especially shoreline parcels, periodically causes the conversion of onshore coastal habitats to developed space.	No future activities were identified within the geographic analysis area other than ongoing activities.
Cable emplacement and maintenance: Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized, short-term impacts on coastal habitats through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little effect on the general character of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Cable emplacement and maintenance: Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition within coastal habitats. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. No dredged material disposal sites were identified within the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = Environmental Impact Statement; EMF = electromagnetic field; G&G = Geological and Geophysical;
IPF = impact-producing factors; OCS = Outer Continental Shelf; OECC = offshore export cable corridor; SSU = special, sensitive, and unique.

Table F1-7 Summary of Activities and the Associated Impact-Producing Factors for Commercial Fisheries and For-Hire Recreational Fishing

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Impacts from anchoring occur due to ongoing military, survey, commercial, and recreational activities. The short-term, localized impact on this resource is the presence of a navigational hazard (anchored vessel) to fishing vessels.	Impacts from anchoring may occur on a semi-regular basis over the next 30 years due to offshore military operations, survey activities, commercial vessel traffic, and recreational vessel traffic. Anchoring could pose a temporary (hours to days), localized (within a few hundred meters of anchored vessel) navigational hazard to fishing vessels.
New cable emplacement/ maintenance	New cable emplacement and infrequent cable maintenance activities disturb the seafloor, increase suspended sediment, and cause temporary displacement of fishing vessels. These disturbances would be local and limited to the emplacement corridor.	Future new cables and cable maintenance would occasionally disturb the seafloor and cause temporary displacement in fishing vessels and increases in suspended sediment resulting in local, short-term impacts. The FCC has two pending submarine telecommunication cable applications in the North Atlantic. If the cable routes enter the geographic analysis area for this resource, short-term disruption of fishing activities would be expected.
Noise: Construction, trenching, operations and maintenance	Noise from construction occurs frequently in coastal habitats in populated areas in New England and the mid-Atlantic, but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. Infrequent offshore trenching could occur in connection with cable installation. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Low levels of elevated noise from operational WTGs likely have low to no impacts on fish and no impacts at a fishery level. Noise is also created by operations and maintenance of marine minerals extraction, which has small, local impacts on fish, but likely no impacts at a fishery level.	Noise from construction near shore is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource. Noise from dredging and sand and gravel mining could occur. New or expanded marine minerals extraction may increase noise during their operations and maintenance over the next 30 years. Impacts from construction, operations, and maintenance would likely be small and local on fish, and not seen at a fishery level. Periodic trenching would be needed for repair or new installation of underground infrastructure. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on commercial fish species are typically less prominent than the impacts of the physical disturbance and sediment suspension. Therefore, fishery-level impacts are unlikely.
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb fish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when ports or marinas, piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can cause injury or mortality to finfish and invertebrates in a small area around each pile, and can cause short-term stress and behavioral changes to individuals over a greater area, leading to temporary local impacts on commercial fisheries and for-hire recreational fishing. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Vessels	Vessel noise is anticipated to continue at levels similar to current levels. While vessel noise may have some impact on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 30 years.	Ports would need to perform maintenance and upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Port utilization is expected to increase over the next 30 years, with increased activity during construction. The ability of ports to receive the increase in vessel traffic may require port modifications, such as channel deepening, leading to local impacts on fish populations. Port expansions could also increase vessel traffic and competition for dockside services, which could affect fishing vessels.
Presence of structures: Navigation hazard and allisions	Structures within and near the cumulative lease areas that pose potential navigation hazards include the Block Island Wind Farm WTGs, buoys, and shoreline developments such as docks and ports. An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. Two types of allisions occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements, or is distracted.	No known reasonably foreseeable structures are proposed to be located in the geographic analysis area that could affect commercial fisheries. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts on fish, but likely no impacts at a fishery level.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion and fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard or complex habitat. Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat. Structure-oriented fishes are attracted to these locations. These impacts are local and can be short term to permanent. Fish aggregation may be considered adverse, beneficial, or neither. Commercial and for-hire recreational fishing can occur near these structures. For-hire recreational fishing is more popular, as commercial mobile fishing gear risk snagging on the structures.	New cables, installed incrementally in the analysis area over the next 20 to 30 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance IPF above). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented species could be attracted to these locations. Structure-oriented species would benefit (Claisse et al. 2014, Smith et al. 2016). This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on the communities, as well as increased private and for-hire recreational fishing opportunities. Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). These impacts are expected to be local and may be long-term.
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, buoys, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow species migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure (Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 30 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded. Therefore, fishery-level impacts are not anticipated.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	No known reasonably foreseeable structures are proposed for location in the geographic analysis area that could affect commercial fisheries and for-hire recreational fishing.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Seven subsea cable corridors cross cumulative lease areas. Shoreline developments are ongoing and include docks, ports, and other commercial, industrial, and residential structures.	No known proposed structures (other than those associated with offshore wind development) are reasonably foreseeable and proposed to be located in the geographic analysis area for this resource.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessels and vessel collisions	No substantial changes are anticipated to the vessel traffic volumes. The geographic analysis area would continue to have numerous ports and the extensive marine traffic related to shipping, fishing, and recreation would continue to be important to the region's economy. The region's substantial marine traffic may result in occasional collisions. Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is more complex, as the vessels need to avoid both the structure and each other. The risk for collisions is ongoing but infrequent.	New vessel traffic in the geographic analysis area would consistently be generated by proposed barge routes and dredging demolition sites. Marine commerce and related industries would continue to be important to the regional economy.

BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = Environmental Impact Statement; FMPs = fishery management plans; G&G = Geological and Geophysical; GHG = greenhouse gas; IPF = impact-producing factors; met = meteorological; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; RI and MA Lease Area = Rhode Island and Massachusetts Lease Areas; SAR = search and rescue; VMS = vessel monitoring system; WTG = wind turbine generator

Table F1-8 Summary of Activities and the Associated Impact-Producing Factors for Cultural Resources

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for water quality for a quantitative analysis of these risks. Accidental releases of fuel/fluids/hazmat occur during vessel use for recreational, fisheries, marine transportation, or military purposes, and other ongoing activities. Both released fluids and cleanup activities that require the removal of contaminated soils and seafloor sediments can cause impacts on cultural resources because resources are impacted during by the released chemicals as well as the ensuing cleanup activities.	Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases within the geographic analysis area for cultural resources, increasing the frequency of small releases. Although the majority of anticipated accidental releases would be small, resulting in small-scale impacts on cultural resources, a single, large-scale accidental release such as an oil spill, could have significant impacts on marine and coastal cultural resources. A large-scale release would require extensive cleanup activities to remove contaminated materials resulting in damage to or the complete removal of terrestrial and marine cultural resources. In addition, the accidentally released materials in deep-water settings could settle on seafloor cultural resources such as wreck sites, accelerating their decomposition or covering them and making them inaccessible/unrecognizable to researchers, resulting in a significant loss of historic information. As a result, although considered unlikely, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale impacts on cultural resources.
Accidental releases: Trash and debris	Accidental releases of trash and debris occur during vessel use for recreational, fisheries, marine transportation, or military purposes and other ongoing activities. While the released trash and debris can directly affect cultural resources, the majority of impacts associated with accidental releases occur during cleanup activities, especially if soil or sediment removed during cleanup affect known and undiscovered archaeological resources. In addition, the presence of large amounts of trash on shorelines or the ocean surface can impact the cultural value of TCPs for stakeholders. State and federal laws prohibiting large releases of trash would limit the size of any individual release and ongoing local, state, and federal efforts to clean up trash on beaches and waterways would continue to mitigate the effects of small-scale accidental releases of trash.	Future activities with the potential to result in accidental releases include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications). Accidental releases would continue at current rates along the northeast Atlantic coast.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	The use of vessel anchoring and gear (i.e., wire ropes, cables, chain, sweep on the seafloor) that disturbs the seafloor, such as bottom trawls and anchors, by military, recreational, industrial, and commercial vessels can impact cultural resources by physically damaging maritime archaeological resources such as shipwrecks and debris fields.	Future activities with the potential to result in anchoring/gear utilization include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); military use; marine transportation; fisheries use and management; and oil and gas activities. These activities are likely to continue to occur at current rates along the entire coast of the eastern United States.
Gear utilization: Dredging	Activities associated with dredge operations and activities could damage marine archaeological resources. Ongoing activities identified by BOEM with the potential to result in dredging impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities.	Dredging activities would gradually increase through time as new offshore infrastructure is built, such as gas pipelines and electrical lines, and as ports and harbors are expanded or maintained.
Light: Vessels	Light associated with military, commercial, or construction vessel traffic can temporarily affect coastal historic structures and TCP resources when the addition of intrusive, modern lighting changes the physical environment ("setting") of cultural resources. The impacts of construction and operations lighting would be limited to cultural resources on the shoreline for which a nighttime sky is a contributing element to historic integrity. This excludes resources that are closed at night, such as historic buildings, lighthouses, and battlefields, and resources that generate their own nighttime light, such as historic districts. Offshore construction activities that require increased vessel traffic, construction vessels stationed offshore, and construction area lighting for prolonged periods can cause more sustained and significant visual impacts on coastal historic structure and TCP resources.	Future activities with the potential to result in vessel lighting impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Light pollution from vessel traffic would continue at the current intensity along the northeast coast, with a slight increase due to population increase and development over time.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Light: Structures	The construction of new structures that introduce new light sources into the setting of historic architectural properties or TCPs can result in impacts, particularly if the historic or cultural significance of the resource is associated with uninterrupted nighttime skies or periods of darkness. Any tall structure (commercial building, radio antenna, large satellite dishes, etc.) requiring nighttime hazard lighting to prevent aircraft collision can cause these types of impacts.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Port utilization: Expansion	Major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT was upgraded by the Port of New Bedford specifically to support the construction of offshore wind facilities. Expansion of port facilities can introduce large, modern port infrastructure into the viewsheds of nearby historic properties, impacting their setting and historic significance.	Future activities with the potential to result in port expansion impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Port expansion would continue at current levels, which reflect efforts to capture business associated with the offshore wind industry (irrespective of specific projects).
Presence of structures	The only existing offshore structures within the viewshed of the geographic analysis area are minor features such as buoys.	Non-offshore wind structures that could be viewed would be limited to meteorological towers. Marine activity would also occur within the marine viewshed of the geographic analysis area.
New cable emplacement/ maintenance	Current offshore construction activity is limited to subsea fiber optic and electrical transmission cables, including six existing power cables in the geographic analysis area.	Future activities with the potential to result in seafloor disturbances similar to offshore impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; and oil and gas activities. Such activities could cause impacts on submerged archaeological resources including shipwrecks and formerly subaerially exposed pre-contact Native American archaeological sites.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore construction	Onshore construction activities can impact archaeological resources by damaging or removing resources.	Future activities that could result in terrestrial land disturbance impacts include onshore residential, commercial, industrial, and military development activities in central Cape Cod, particularly those proximate to OECRs and interconnection facilities. Onshore construction would continue at current rates.

ADLS = Aircraft Detection Light System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; hazmat = hazardous materials; ESP = electrical service platform; IFP = impact-producing factors; MCT = New Bedford Marine Commerce Terminal; MHC = Massachusetts Historical Commission; NEPA = National Environmental Policy Act; NHL = National Historic Landmark; NHPA = National Historic Preservation Act; NRHP = National Register of Historic Places; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; OECR = Onshore Export Cable Route; RI and MA Lease Areas = Rhode Island and Massachusetts Lease Areas; SHPO = state historic preservation office; TCP = Traditional Cultural Property; WTG = wind turbine generator.

Table F1-9 Summary of Activities and the Associated Impact-Producing Factors for Demographics, Employment, and Economics

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Energy generation/ security	In 2017, Massachusetts energy production totaled 125.2 trillion Btu, of which 72.4 trillion Btu was from renewable sources, including geothermal, hydroelectric, wind, solar, and biomass (U.S. Energy Information Administration 2018).	Ongoing development of onshore solar and wind energy would provide diversified, small-scale energy generation. State and regional energy markets would require additional peaker plants and energy storage to meet the electricity needs when utility scale renewables are not producing.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors. In the geographic analysis area for demographics, employment, and economics there are six existing power cables.	The FCC has two pending submarine telecommunication cable applications in the North Atlantic. Future new cables would disturb the seafloor and cause temporary increases in suspended sediment resulting in infrequent, localized, short-term impacts over the next 30 years.
Noise: O&M	Limited to South Fork Wind Project.	Not applicable.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the geographic analysis area for demographics, employment, and economics other than ongoing activities.
Noise: Cable laying/trenching	Infrequent trenching for pipeline and cable laying activities emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 30 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The Marine Commerce Terminal at the Port of New Bedford was upgraded by the port specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. As ports expand, maintenance dredging of shipping channels is expected to increase.	Ports would need to perform maintenance and upgrades over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners, and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations, which may be known as fish aggregating devices (FADs). Recreational and commercial fishing can occur near the FADs, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on FADs.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	No existing offshore structures are within the viewshed of the Wind Farm Area except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Additional communication cables run between the U.S. East Coast and European countries along the eastern Atlantic.	: No known proposed structures not associated with offshore wind development are reasonably foreseeable.
Traffic: Vessels	Geographic analysis area ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	No substantial changes anticipated.
Land disturbance: Onshore construction	Onshore development activities support local population growth, employment, and economies. Disturbances can cause temporary, localized traffic delays and restricted access to adjacent properties. The rate of onshore land disturbance is expected to continue at or near current rates.	Onshore development projects would be ongoing in accordance with local government land use plans and regulations.

ADLS = Aircraft Detection Light System; BOEM = Bureau of Ocean Energy Management; Btu = British thermal unit; EIS = Environmental Impact Statement; ESP = electrical service platform; FADs = fish aggregating devices; FCC = Federal Communications Commission; FMPs = fishery management plans; G&G = Geological and Geophysical; GW = gigawatts; IPF = impact-producing factors; MA = Massachusetts; NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; O&M = operations and maintenance; OECC = Offshore Export Cable Corridor(s); RI = Rhode Island; SAR = search and rescue; SEIS = Supplemental Environmental Impact Statement; USCG = United States Coast Guard; WTG = wind turbine generator.

Table F1-10 Summary of Activities and the Associated Impact-Producing Factors for Environmental Justice

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Air emissions: Construction/ decommissioning	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses, and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.
Air emissions: Operations and maintenance	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses, and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	The FCC has two pending submarine telecommunication cable applications in the North Atlantic. Future new cables would disturb the seafloor and cause temporary increases in suspended sediment, resulting in infrequent, localized, short-term impacts over the next 30 years.
Noise: Operations and maintenance	Offshore operations and maintenance of existing wind energy projects generates negligible amounts of noise.	There are no reasonably foreseeable offshore facilities that would generate noise from operations/maintenance.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Trenching	Infrequent trenching for pipeline and cable laying activities emits noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 30 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT at the Port of New Bedford is a completed facility developed by the port specifically to support the construction of offshore wind facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Entanglement, gear loss/ damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners, and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure, and each other.	Vessel traffic is generally not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	There are no existing offshore structures within the viewshed of the Wind Farm Area except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Transmission cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Existing cable operation and maintenance activities would continue within the analysis area.
Traffic: Vessels	Geographic analysis area ports and marine traffic related to shipping, fishing and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the geographic analysis area employment.
Land disturbance: Erosion and sedimentation	Potential erosion and sedimentation from development and construction is controlled by local and state development regulations.	New development activities would be subject to erosion and sedimentation regulations.
Land disturbance: Onshore construction	Onshore development supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	Onshore development would result in changes in land use in accordance with local government land use plans and regulations.	Development of onshore solar and wind energy would provide diversified, small-scale energy generation.

ADLS = Aircraft Detection Light System; ESP = electrical service platform; FCC = Federal Communications Commission; FMPs = fishery management plans; G&G = Geological and Geophysical; HMS = Highly Migratory Species; IPF = impact-producing factors; MA/RI = Massachusetts/Rhode Island; MCT = New Bedford Marine Commerce Terminal; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); OECR = Onshore Export Cable Route; RI and MA Lease Areas = Rhode Island and Massachusetts Lease Areas; USEPA = U.S. Environmental Protection Agency; WTG = wind turbine generator

Table F1-11 Summary of Activities and the Associated Impact-Producing Factors for Finfish, Invertebrates, and Essential Fish Habitat

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Impacts, including mortality, decreased fitness, and contamination of habitat, are localized and temporary, and rarely affect populations.	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Impacts are unlikely to affect populations.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on finfish, invertebrates, and EFH depend on many factors, but can be widespread and permanent.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Anchoring	Vessel anchoring related to ongoing military use, and survey, commercial, and recreational activities continues to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, and sedentary shellfish).	Impacts from anchoring may occur on a semi-regular basis over the next 30 years due to offshore military operations, survey activities, commercial vessel traffic, or recreational vessel traffic. These impacts would include increased turbidity levels and potential for direct contact causing mortality of benthic species and, possibly, degradation of sensitive habitats. All impacts would be localized; turbidity would be temporary; impacts from direct contact would be recovered in the short term. Degradation of sensitive habitats such as certain types of hard bottom (e.g., boulder piles), if it occurs, could be long-term.
EMF	EMF emanates continuously from installed telecommunication and electrical power transmission cables. Biologically significant impacts on finfish, invertebrates, and EFH have not been documented for AC cables (CSA Ocean Sciences, Inc. and Exponent 2019 and see Thomsen et al. 2015), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts are localized and affect the animals only while they are within the EMF. There is no evidence to indicate that EMF from undersea AC power cables negatively affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences, Inc. and Exponent 2019).	During operation, future new cables would produce EMF. (See cell to the left.) Submarine power cables in the geographic analysis area for this resource are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any two sources would not overlap (even for multiple cables within a single OECC). Although the EMF would exist as long as a cable was in operation, impacts, on finfish, invertebrates, and EFH would likely be difficult to detect.
Light: Vessels	Marine vessels have an array of lights including navigational lights and deck lights. There is little downward-focused lighting,	See cell to the left.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	and therefore only a small fraction of the emitted light enters the water. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts.	
Light: Structures	Offshore buoys and towers emit light, and onshore structures, including buildings and ports, emit a great deal more on an ongoing basis. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts. Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances are local, limited to the cable corridor. New cables are infrequently added near shore. Cable emplacement/ maintenance activities disturb, displace, and injure finfish and invertebrates and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPF of Sediment deposition and burial.)	Future new cables would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in local short-term impacts. The FCC has two pending submarine telecommunication cable applications in the North Atlantic. If the cable routes enter the geographic analysis area for this resource, short-term disturbance would be expected. The intensity of impacts would depend on the time (season) and place (habitat type) where the activities would occur.
Noise: Aircraft	Noise from aircraft reaches the sea surface on a regular basis. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH, as very little of the aircraft noise propagates through the water.	Aircraft noise is likely to continue to increase as commercial air traffic increases. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH.
Noise: Onshore/offshore construction	Noise from construction occurs frequently in near shores of populated areas in New England and the mid-Atlantic but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. See also sub-IPF for Noise: Pile driving.	Noise from construction near shores is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource.
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb finfish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 30 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	The extent depends on equipment used, noise levels, and local acoustic conditions.	resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize, but are likely local and temporary.
Noise: O&M	Some finfish and invertebrates may be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Farm, this low frequency noise barley exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015), sound pressure levels would be expected to be at or below ambient levels at relatively short distances (approximately 164 feet [50 meters]) from WTG foundations. These low levels of elevated noise likely have little to no impact. Noise is also created by operations and maintenance of marine minerals extraction and commercial fisheries, each of which has small local impacts.	New or expanded marine minerals extraction and commercial fisheries may intermittently increase noise during their operations and maintenance over the next 30 years. Impacts would likely be small and local.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can cause injury or mortality to finfish and invertebrates in a small area around each pile, and can cause short-term stress and behavioral changes to individuals over a greater area. Eggs, embryos, and larvae of finfish and invertebrates could also experience developmental abnormalities or mortality resulting from this noise, although thresholds of exposure are not known (Weilgart 2018, Hawkins and Popper 2017). Potentially injurious noise could also be considered as rendering EFH temporarily unavailable or unsuitable for the duration of the noise. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area for this

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	resource. These disturbances would be infrequent over the next 30 years, temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Noise: Vessels	While ongoing vessel noise may have some effect on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	See cell to the left.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 30 years.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. In addition, the general trend along the coast from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase may require port modifications, leading to local impacts. Future channel deepening activities will likely be undertaken. Existing ports have already affected finfish, invertebrates, and EFH, and future port projects would implement BMPs to minimize impacts. Although the degree of impacts on EFH would likely be undetectable outside the immediate vicinity of the ports, adverse impacts on EFH for certain species or life stages may lead to impacts on finfish and invertebrates beyond the vicinity of the port.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures:	Manmade structures, especially tall vertical structures such as foundations for towers of various purposes, continuously alter local water flow at a fine scale. Water flow typically returns to	Tall vertical structures can increase seabed scour and sediment suspension. Impacts would likely be highly localized and difficult to detect. Indirect impacts of

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Hydrodynamic disturbance	background levels within a relatively short distance from the structure. Therefore, impacts on finfish, invertebrates, and EFH are typically undetectable. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood. New structures are periodically added.	structures influencing primary productivity and higher trophic levels are possible but are not well understood.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. These impacts are local and often permanent. Fish aggregation may be considered adverse, beneficial, or neutral.	New cables, installed incrementally in the geographic analysis area for this resource over the next 20 to 30 years, would likely require hard protection atop portions of the route (see the New cable emplacement/ maintenance IPF). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are local and may be permanent.
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard or complex habitat. Structure-oriented species thus benefit on a constant basis; however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	New cable, installed incrementally in the analysis area over the next 20 to 30 years, would likely require hard protection atop portions of the route (see New cable emplacement/ maintenance). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented species would benefit (Claisse et al. 2014, Smith et al. 2016); however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Soft bottom is the dominant habitat type from Cape Hatteras to the Gulf of Maine (over 60 million acres), and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure is (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). There is no	The infrequent installation of future new structures in the marine environment over the next 30 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018).

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	evidence to suggest that structures pose a barrier to migratory animals.	Migratory animals would likely be able to proceed from structures unimpeded.
Presence of structures: Cable infrastructure	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.
Cable emplacement and maintenance: Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, change in complexity) on finfish, invertebrates, and EFH through this IPF. Dredging is most likely in sand wave areas where typical jet plowing is insufficient to meet target cable burial depth. Sand waves that are dredged would likely be redeposited in like-sediment areas. Any particular sand wave may not recover to the same height and width as pre-disturbance; however, the habitat function would largely recover post-disturbance. Therefore, seabed profile alterations, while locally intense, have little impact on finfish, invertebrates, and EFH on a regional (Cape Hatteras to Gulf of Maine) scale.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Cable emplacement and maintenance: Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have negative impacts on eggs and larvae, particularly demersal eggs such as longfin squid, which are known to have high rates of egg mortality if egg masses are exposed to abrasion or burial. Impacts may vary based on season/time of year.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

°C = degrees Celsius; AC = alternating current; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; DC = direct current; EFH = essential fish habitat; EMF = electromagnetic field; EIS = Environmental Impact Statement; ESP = electrical service platform; FCC = Federal Communications Commission; G&G = Geological and Geophysical; GW = gigawatts; IPF = impact-producing factors; met = meteorological; NA = not applicable; NOAA = National Oceanic and Atmospheric Administration; O&M = operations and maintenance; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); USACE = United States Army Corps of Engineers; WTG = wind turbine generator.

Table F1-12 Summary of Activities and the Associated Impact-Producing Factors for Land Use and Coastal Infrastructure

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	Various ongoing onshore and coastal construction projects include the use of vehicles and equipment that contain fuel, fluids, and hazardous materials that could be released.	Ongoing onshore construction projects involve vehicles and equipment that use fuel, fluids, or hazardous materials could result in an accidental release. Intensity and extent would vary, depending on the size, location, and materials involved in the release.
Light: Structures	Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would use nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary, depending on the location, type, direction, and duration of nighttime lighting.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The MCT at the Port of New Bedford is a completed facility developed by the port specifically to support the construction of offshore wind facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Viewshed	The only existing offshore structures within the offshore viewshed of the Project are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components would be limited to met towers. Marine activity would also occur within the marine viewshed.
Presence of structures: Transmission cable infrastructure	Onshore buried transmission cables are present in the area near the Project onshore and offshore improvements. Onshore activities would only occur where permitted by local land use authorities, which would avoid long-term land use conflicts.	No known proposed structures are reasonably foreseeable and proposed to be located in the geographic analysis area for land use and coastal infrastructure.
Land disturbance: Onshore construction	Onshore construction supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	New development or redevelopment would result in changes in land use in accordance with local government land use plans and regulations.	Ongoing and future development and redevelopment is anticipated to reinforce existing land use patterns, based on local government planning documents.

ADLS = Aircraft Detection Light System; IPF = impact-producing factors; MCT = New Bedford Marine Commerce Terminal; met = meteorological; NOAA = National Oceanic and Atmospheric Administration; ROW = right-of-way; USACE = U.S. Army Corps of Engineers; WTG = wind turbine generator.

Table F1-13 Summary of Activities and the Associated Impact-Producing Factors for Marine Mammals

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008, Smith et al. 2017; Sullivan et al. 2019; Takeshida et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-13).	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008, Smith et al. 2017; Sullivan et al. 2019; Takeshida et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-13).
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Worldwide 62 of 123 (50.4%) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Stranding data indicate potential debris induced mortality rates of 0 to 22%. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects on individuals to population-level impacts (Browne et al. 2015).	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. Trash and debris may continue to be accidentally released through fisheries use and other offshore and onshore activities. There may also be a long-term risk from exposure to plastics and other debris in the ocean. Worldwide 62 of 123 (50.4%) of marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Mortality has been documented in cases of debris interacts, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014).
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Marine mammals appear to have a detection threshold for magnetic intensity gradients (i.e., changes in magnetic field levels with distance) of 0.1% of the earth's magnetic field or about 0.05 μT (Kirschvink 1990) and are thus likely to be very sensitive to **minor** changes in magnetic fields (Walker et al. 2003). There is a potential for animals to react to local variations	During operation, future new cables would produce EMF. Submarine power cables in the marine mammal geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	of the geomagnetic field caused by power cable EMFs. Depending on the magnitude and persistence of the confounding magnetic field, such an effect could cause a trivial temporary change in swim direction or a longer detour during the animal's migration (Gill et al. 2005). Such an effect on marine mammals is more likely to occur with direct current cables than with AC cables (Normandeau et al. 2011). However, there are numerous transmission cables installed across the seafloor and no impacts on marine mammals have been demonstrated from this source of EMF.	two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Marine mammals have the potential to react to submarine cable EMF, however, no effects from the numerous submarine cables have been observed. Further, this IPF would be limited to extremely small portions of the areas used by migrating marine mammals. As such, exposure to this IPF would be low, and as a result impacts on marine mammals would not be expected.
New cable emplacement/ maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that since some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. Similarly, McConnell et al. (1999) documented movements and foraging of grey seals in the North Sea. One tracked individual was blind in both eyes, but otherwise healthy. Despite being blind, observed movements were typical of the other study individuals, indicating that visual cues are not essential for grey seal foraging and movement (McConnell et al. 1999). If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (Table F1-13).	The FCC has two pending submarine telecommunication cable application in the North Atlantic. The impact on water quality from accidental sediment suspension during cable emplacement is temporary and short term. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on some marine mammal prey species (Table F1-13).
Noise: Aircraft	Aircraft routinely travel in the marine mammal geographic analysis area. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from marine mammals. If flights are at a sufficiently low altitude, marine mammals may respond with behavioral changes, including short surface durations, abrupt dives, and percussive behaviors (i.e.	Future low altitude aircraft activities such as survey activities and navy training operations could result short-term responses of marine mammals to aircraft noise. If flights are at a sufficiently low altitude, marine mammals may respond with a behavior changes, including short surface durations, abrupt

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area. Similarly, aircraft have the potential to disturb hauled out seals if aircraft overflights occur within 2,000 feet (610 meters) of a haul out area (Efroymson et al. 2000). However, this disturbance would be temporary and short term, and would result in minimal energy expenditure. These brief responses would be expected to dissipate once the aircraft has left the area.	dives, and percussive behaviors (i.e. breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area.
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in high-intensity, high-consequence impacts, including auditory injuries, stress, disturbance, and behavioral responses, if present within the ensonified area (NOAA 2018). Survey protocols and underwater noise mitigation procedures are typically implemented to decrease the potential for any marine mammal to be within the area where sound levels are above relevant harassment thresholds associated with an operating sound source to reduce the potential for behavioral responses and injury (PTS/TTS) close to the sound source. The magnitude of effects, if any, is intrinsically related to many factors, including: acoustic signal characteristics, behavioral state (e.g., migrating), biological condition, distance from the source, duration and level of the sound exposure, as well as environmental and physical conditions that affect acoustic propagation (NOAA 2018).	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.
Noise: Turbines	Marine mammals would be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Facility, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015) and Kraus et al. (2016), sound pressure levels would be expected to be at or below ambient levels at relatively short distances from the WTG foundations.	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can result in high-intensity, low-exposure level, long-term, but localized intermittent risk to marine mammals. Impacts would be localized in nearshore waters. Pile driving activities may negatively affect marine mammals during	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	foraging, orientation, migration, predator detection, social interactions, or other activities (Southall et al. 2007). Noise exposure associated with pile-driving activities can interfere with these functions, and have the potential to cause a range of responses, including insignificant behavioral changes, avoidance of the ensonified area, PTS, harassment, and ear injury, depending on the intensity and duration of the exposure. BOEM assumes that all ongoing and potential future activities will be conducted in accordance with a project-specific IHA to minimize impacts on marine mammals.	
Noise: Cable laying/ trenching	N/A	Cable laying impacts resulting from future non-offshore wind activities would be identical to those described for future offshore wind projects.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, scientific and academic research vessels, as well as other construction vessels. The frequency range for vessel noise falls within marine mammals' known range of hearing and would be audible. Noise from vessels presents a long-term and widespread impact on marine mammals across in most oceanic regions. While vessel noise may have some effect on marine mammal behavior, it would be expected to be limited to brief startle and temporary stress response. Results from studies on acoustic impacts from vessel noise on odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 feet (50 meters) of the vessel by 26% (Jensen et al. 2009). Pilot whales in a quieter, deep-water habitat could experience a 50% reduction in communication range from a similar size boat and speed (Jensen et al. 2009). Since lower frequencies propagate farther away from the sound source compared to higher frequencies, low frequency cetaceans are at a greater risk of experiencing Level B Harassment produced by vessel traffic.	Any offshore projects that require the use of ocean vessels could potentially result in long-term but infrequent impacts on marine mammals, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes. However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of marine mammals and no stock or population-level effects would be expected.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	noise may affect marine mammals, but response would be expected to be temporary and short term (see Vessels: Noise sub-IPF above). The impacts on water quality from sediment suspension during port expansion activities is temporary and short term, and would be similar to those described under the New cable emplacement/maintenance IPF above.	from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strike could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	There are more than 130 artificial reefs in the Mid-Atlantic region. This sub-IPF may result in long-term, high-intensity impacts, but with low exposure due to localized and geographic spacing of artificial reefs, long-term. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Moore and van der Hoop 2012), if present nearshore where these structures are located. There are very few, if any, areas within the OCS geographic analysis area for marine mammals that would serve to concentrate recreational fishing and increase the likelihood that marine mammals would encounter lost fishing gear.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Presence of structures: Habitat conversion and prey aggregation	There are more than 130 artificial reefs in the Mid-Atlantic region. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the ‘reef’ effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher	The presence of structures associated with non-offshore wind development in nearshore coastal waters have the potential to provide habitat for seals and small odontocetes as well as preferred prey species. This "reef effect" has the potential to result in long-term, low-intensity benefits. Bridge

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft-bottoms.	foundations will continue to provide foraging opportunities for seals and small odontocetes with measurable benefits to some individuals. Hard-bottom (scour control and rock mattresses used to bury the offshore export cables) and vertical structures (i.e., WTG and ESP foundations) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef effect” (Taormina et al. 2018; Causon and Gill 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for marine mammals compared to the surrounding soft-bottoms.
Presence of structures: Avoidance/ displacement	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Traffic: Vessel collisions	Current activities that are contributing to this sub-IPF include port traffic levels, fairways, traffic separation schemes, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Vessel strike is relatively common with cetaceans (Kraus et al. 2005) and one of the primary causes of death to	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	NARWs with as many as 75% of known anthropogenic mortalities of NARWs likely resulting from collisions with large ships along the US and Canadian eastern seaboard (Kite-Powell et al. 2007). Marine mammals are more vulnerable to vessel strike when they are within the draft of the vessel and when they are beneath the surface and not detectable by visual observers. Some conditions that make marine mammals less detectable include weather conditions with poor visibility (e.g., fog, rain, and wave height) or nighttime operations. Vessels operating at speeds exceeding 10 knots have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart 2007). Reported vessel collisions with whales show that serious injury rarely occurs at speeds below 10 knots (Laist et al. 2001). Data show that the probability of a vessel strike increases with the velocity of a vessel (Pace and Silber 2005; Vanderlaan and Taggart 2007).	marine mammals makes stock or population-level effects unlikely (Navy 2018).

μPa = micropascal; μT = microtesla; AC = alternating current; BA = Biological Assessment; BOEM = Bureau of Ocean Energy Management; BMP = best management practice; BSW = Bay State Wind; CFR = Code of Federal Regulations; COP = Construction and Operations Plan; dB = decibel; dB RMS = decibel root mean square; DP = dynamic positioning; EIS = Environmental Impact Statement; EMF = electromagnetic field; FCC = Federal Communications Commission; G&G = Geological and Geophysical; hazmat = hazardous material; HRG = High Resolution Geophysical; Hz = hertz; IHA = Incidental Harassment Authorization; IPF = impact-producing factors; met = meteorological; MW = megawatt; NARW = North Atlantic right whale; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; PAM = passive acoustic monitoring; PSO = protected species observer; PTS = permanent threshold shift; SOV = service operations vessel; TTS = temporary threshold shift; USCG = U.S. Coast Guard; WTG = wind turbine generator.

Table F1-14 Summary of Activities and the Associated Impact-Producing Factors for Navigation and Vessel Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Larger commercial vessels (specifically tankers) sometimes anchor outside of major ports to transfer their cargo to smaller vessels for transport into port, an operation known as lightering. These anchors have deeper ground penetration and are under higher stresses. Smaller vessels (commercial fishing or recreational vessels) would anchor for fishing and other recreational activities. These activities cause temporary to short-term impacts on navigation in the immediate anchorage area. All vessels may anchor in an emergency scenario (such as power loss) if they lose power to prevent them from drifting and creating navigational hazards for other vessels or drifting into structures.	Lightering and anchoring operations are expected to continue at or near current levels, with the expectation of moderate increase commensurate with any increase in tankers visiting ports. Deep-draft visits to major port visits are expected to increase as well, increasing the potential for an emergency need to anchor, creating navigational hazards for other vessels. Recreational activity and commercial fishing activity would likely stay largely the same related to this IPF.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Impacts from these activities would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.	Ports would need to perform maintenance and perform upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Impacts would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. There are two types of allisions that occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements, or is distracted.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 30 years. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Fish aggregation	Items in the water, such as ghost fishing gear, buoys, and energy platform foundations can create an artificial reef effect, aggregating fish. Recreational and commercial fishing can occur near the artificial reefs. Recreational fishing is more popular than commercial near artificial reefs as commercial mobile fishing gear can risk snagging on the artificial reef structure.	Fishing near artificial reefs is not expected to change meaningfully over the next 30 years.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Equipment in the ocean can create a substrate for mollusks to attach to, and fish eggs to settle near. This can create a reef-like habitat and benefit structure-oriented species on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Migration disturbances	Noise-producing activities, such as pile driving and vessel traffic, may interfere and adversely affect marine mammals during foraging, orientation, migration, response to predators, social interactions, or other activities. Marine mammals may also be sensitive to changes in magnetic field levels. The presence of structures and operation noise could cause mammals to avoid areas.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is made more complex, as the vessels need to avoid both the structure and each other.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 30 years. Even with increased port visits by deep-draft vessels, this is still a relatively small adjustment when considering the whole of New England vessel traffic. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Currently, the offshore area is occupied by marine trade, stationary and mobile fishing, and survey activities.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: cable infrastructure	See IPF for Anchoring.	See IPF for Anchoring.
New cable emplacement/ maintenance	Within the geographic analysis area for navigation and vessel traffic, existing cables may require access for maintenance activities. Infrequent cable maintenance activities may cause temporary increases in vessel traffic and navigational complexity.	The FCC has two pending submarine telecommunication cable applications in the North Atlantic. Future new cables would cause temporary increases in vessel traffic during installation or maintenance, resulting in infrequent, localized, short-term impacts over the next 30 years. Care would need to be taken by vessels that are crossing the cable routes during these activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Traffic: Aircraft	USCG search and rescue (SAR) helicopters are the main aircraft that may be flying at low enough heights to risk interaction with WTGs. USCG SAR aircraft need to fly low enough that they can spot objects in the water.	SAR operations could be expected to increase with any increase in vessel traffic. However, as vessel traffic volume is not expected to increase appreciably, neither should SAR operations. Draft EIS Section 3.16.6 provides a discussion of navigation impacts on fishing vessel traffic.
Traffic: Vessels	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.
Traffic: Vessels, collisions	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.

AIS = Automatic Identification System; BOEM = Bureau of Ocean Energy Management; COP = Construction and Operations Plan; EIS = environmental impact statement; ESP = electrical service platform; FCC = Federal Communications Commission; IPF = impact-producing factors; MA = Massachusetts; MARIPARS = Massachusetts and Rhode Island Port Access Route Study; MCT = Marine Commerce Terminal; NOAA = National Oceanic and Atmospheric Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor(s); RI = Rhode Island; SAR = search and rescue; TSS = traffic separation scheme; USCG = U.S. Coast Guard; WTG = wind turbine generator.

Table F1-15 Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Military and National Security Uses

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions	Existing stationary facilities that present allision risks include the five offshore wind turbines associated with Block Island Wind Farm, dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No additional non-offshore wind stationary structures were identified within the geographic analysis area. Stationary structures such as private or commercial docks may be added close to the shoreline.
Presence of structures: Fish aggregation	Existing stationary facilities that act as FADs include offshore wind turbines associated with Block Island Wind Farm.	No future non-offshore wind additional stationary structures that would act as FADs were identified within the geographic analysis area.
Presence of structures: Navigation hazard	Existing stationary facilities within the geographic analysis area that present navigational hazards include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: Space use conflicts	Existing stationary facilities within the geographic analysis area that present a navigational hazard include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Submarine cables would remain in current locations with infrequent maintenance continuing along those cable routes for the foreseeable future.
Traffic: Vessels	Current vessel traffic in the region is described in draft EIS Section 3.16.6. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region, as described in draft EIS Section 3.16.6.
Traffic: Vessels, collisions	Current vessel traffic in the region is described in draft EIS Section 3.16.6. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region is described in draft EIS Section 3.16.6.

Table F1-16 Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Aviation and Air Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazard	Existing aboveground stationary facilities within the geographic analysis area that present navigational hazards include the five WTGs in the Block Island Wind Farm, onshore wind turbines, communication towers, dock facilities, and other onshore and offshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore development activities are anticipated to continue with additional proposed communications towers.
Presence of structures: Space use conflicts	Existing aboveground stationary facilities within the geographic analysis area that could cause space use conflicts for aircraft include the five WTGs associated with Block Island Wind Farm, onshore wind turbines, communication towers, and other onshore and offshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers.

Table F1-17 Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Cables and Pipelines

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions and navigation hazards	Structures within and near the geographic analysis area that pose potential allision hazards include the five Block Island Wind Farm WTGs, meteorological buoys associated with offshore wind lease areas, and shoreline developments such as docks, ports, and other commercial, industrial, and residential structures.	Reasonably foreseeable non-offshore wind structures that could affect submarine cables have not been identified in the geographic analysis area.
Presence of structures: Space use conflicts	Two submarine cables cross the far western portion of OCS-A 0487. These cables are associated with a larger network of submarine cables that make landfall near Charlestown, Massachusetts.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.
Presence of structures: Transmission cable infrastructure	Seven subsea cable corridors cross cumulative lease areas.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.

Table F1-18 Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Radar Systems

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazards	Wind developments in the direct line-of-sight with, or extremely close to, radar systems can cause clutter and interference. Existing wind developments in the area include scattered onshore wind turbines, and five WTGs in the Block Island Wind Farm.	Reasonably foreseeable non-offshore wind structures proposed for construction in the lease areas that could affect radar systems have not been identified.

Table F1-19 Summary of Activities and the Associated Impact-Producing Factors for Other Uses: Scientific Research and Surveys

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazards	Stationary structures are limited in the open ocean environment of the geographic analysis area, and include met buoys associated with site assessment activities, the five Block Island Wind Farm WTGs, and the two CVOW WTGs. Other lease areas within the geographic analysis area are not yet developed, and are in various stages of permitting.	Reasonably foreseeable non-offshore wind activities would not implement stationary structures within the open ocean environment that would pose navigational hazards and raise the risk of allisions for survey vessels and collisions for survey aircraft.

AMSL = above mean sea level; BOEM = Bureau of Ocean Energy Management; CVOW = Coastal Virginia Offshore Wind; ESP = electrical service platform; FAA = Federal Aviation Administration; FAD = Fish Attracting Device; IPF = impact-producing factor; MA = Massachusetts; met = meteorological; NEXRAD = Next Generation Weather Radar; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; OECC = Offshore Export Cable Corridor(s); OCS = outer continental shelf; RI = Rhode Island; SAR = search and rescue; USACE = United States Army Corps of Engineer; USCG = United States Coast Guard; WTG = wind turbine generator.

Table F1-20 Summary of Activities and the Associated Impact-Producing Factors for Recreation and Tourism

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Anchoring	Anchoring occurs due to ongoing military, survey, commercial, and recreational activities.	Impacts from anchoring would continue, and may increase due to offshore military operations, survey activities, commercial vessel traffic, and recreational vessel traffic. Modest growth in vessel traffic could increase the temporary, localized impacts of navigational hazards, increased turbidity levels, and potential for direct contact causing mortality of benthic resources.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
Light: Structures	Offshore buoys and towers emit low-intensity light. Onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Cable maintenance or replacement of existing cables in the geographic analysis area would occur infrequently, and would generate short-term disturbances.
Noise: O&M	Limited to Block Island Wind Farm	Not applicable
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Noise: Cable laying/trenching	Offshore trenching occurs periodically in connection with cable installation or sand and gravel mining.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge routes and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The Marine Commerce Terminal at the Port of New Bedford was upgraded by the port specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 30 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	No major ports are within the geographic analysis area. Periodic maintenance is necessary for harbors within the analysis area.	Ongoing maintenance and dredging of harbors within the geographic analysis area will continue as needed. No specific projects are known.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations. Recreational and commercial fishing can occur near these aggregation locations, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on structures.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 30 years. The presence of navigation hazards is expected to continue at or near current levels.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	The only existing offshore structures within the viewshed of the Project are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components of the Project would be limited to meteorological towers. Marine activity would also occur within the marine viewshed.
Traffic: Vessels	Geographic analysis area ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 30 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	An increased risk of collisions is not anticipated from future activities.

ADLS = Aircraft Detection Light System; EFH = essential fish habitat; ESP = electrical service platform; FAA = Federal Aviation Administration; IPF = impact-producing factors; MW = megawatts; OECC = Offshore Export Cable Corridor; RI and MA = Rhode Island and Massachusetts; SEIS = Supplemental EIS; USCG = U.S. Coast Guard; WTG = wind turbine generator

Table F1-21 Summary of Activities and the Associated Impact-Producing Factors for Sea Turtles

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent and chronic. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 30 years would increase the risk of accidental releases. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka 2010; Wallace et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, cables, lines, and pipeline laying, as well as debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct ingestion of plastic fragments is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuylar et al. 2014). In addition to plastic debris, ingestion of tar, paper, Styrofoam™, wood, reed, feathers, hooks, lines, and net fragments have also been documented (Thomás et al. 2002). Ingestion can also occur when individuals mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Potential ingestion of marine debris varies among species and life history stages due to differing feeding strategies (Nelms et al. 2016). Ingestion of plastics and other marine debris can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct and indirect ingestion of plastic fragments and other marine debris is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Gregory 2009; Hoarau et al. 2014; Nelms et al. 2016; Schuylar et al. 2014; Thomás et al. 2002). Ingestion can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
	2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Long-term sublethal effects may include dietary dilution, chemical contamination, depressed immune system function, poor body condition, as well as reduced growth rates, fecundity, and reproductive success. However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).	(Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 µT for loggerhead turtles, and 29.3 to 200 µT for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). Juvenile or adult sea turtles foraging on benthic organisms may be able to detect magnetic fields while they are foraging on the bottom near the cables and up to potentially 82 feet (25 meters) in the water column above the cable. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). However, any potential impacts from AC cables on turtle navigation or orientation would likely be undetectable under natural conditions, and thus would be insignificant (Normandeau et al. 2011).	During operations, future new cables would produce EMF. Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. (Section 5.2.7 of BOEM's 2007 Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.) EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Further, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to this IPF would be low, and as a result, impacts on sea turtles would not be expected.
Light: Vessels	Ocean vessels such as ongoing commercial vessel traffic, recreational and fishing activity, scientific and academic research traffic have an array of lights including navigational, deck lights, and interior lights. Such lights have some limited potential to attract sea turtles, although the impacts, if any, are expected to be localized and temporary.	Construction, operations, and decommissioning vessels associated with non-offshore wind activities produce temporary and localized light sources that could result in the attraction or avoidance behavior of sea turtles. These short-term impacts are expected to be of low intensity and occur infrequently.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Light: Structures	Artificial lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles. Artificial lighting on the OCS does not appear to have the same potential for effects. Decades of oil and gas platform operation in the Gulf of Mexico, that can have considerably more lighting than offshore WTGs, has not resulted in any known impacts on sea turtles (BOEM 2019).	Non-offshore wind activities would not be expected to appreciably contribute to this sub-IPF. As such, no impact on sea turtles would be expected.
New cable emplacement/ maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be too small to be detected (NOAA 2020b). Sea turtles would be expected to swim away from the sediment plume. Elevated turbidity is most likely to affect sea turtles if a plume causes a barrier to normal behaviors, but no impacts would be expected due to swimming through the plume (NOAA 2020b). Turbidity associated with increased sedimentation may result in short-term, temporary impacts on sea turtle prey species (Table F1-11).	The FCC has two pending submarine telecommunication cable application in the North Atlantic. The impact on water quality from accidental sediment suspension during cable emplacement is short term and temporary. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be short term and temporary. Turbidity associated with increased sedimentation may result in short-term, temporary impacts on some sea turtle prey species (Table F1-11).
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for sea turtles. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from sea turtles. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.	Future low altitude aircraft activities such as survey activities and navy training operations could result in short-term responses of sea turtles to aircraft noise. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in some impacts including potential auditory injuries, short-term disturbance, behavioral responses, and short-term displacement of feeding or migrating sea turtles, if present within the ensonified area (NSF and USGS 2011). The potential for PTS and TTS is considered possible in proximity to G&G surveys utilizing air guns, but impacts are unlikely as turtles would be expected to avoid such exposure and survey vessels would pass quickly (NSF and USGS 2011). No significant impacts would be expected at the population level.	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.
Noise: Turbines	Available evidence suggests that typical underwater noise levels from operating WTGs would be below current cumulative injury and behavioral effect thresholds for sea turtles. Operating turbines were determined to produce underwater noise on the order of 110 to 125 dB_{RMS}, occasionally reaching as high as 128 dB_{RMS}, in the 10-Hz to 8-kHz range (Tougaard et al. 2020). As measured at the Block Island Wind Facility, low frequency operational noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base (Miller and Potty 2017). Operational noise impacts would be expected to be negligible.	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can result in high-intensity, low-exposure levels, and long-term, but localized intermittent risk to sea turtles. Impacts, potentially including behavioral responses, masking, TTS, and PTS, would be localized in nearshore waters. Data regarding threshold levels for impacts on sea turtles from sound exposure during pile driving are very limited, and no regulatory threshold criteria have been established for sea turtles. Based on current literature, the following thresholds are used to assess impacts on turtles: • Potential mortal injury: 210 dB cumulative SPL or greater than 207 dB peak SPL (Popper et al. 2014) • Potential mortal injury: 204 dB_{SEL}, 232 dB_{PEAK} (PTS) • 189 dB_{SEL}, 226 dB_{PEAK} (TTS) (Navy 2017) • Behavioral harassment: 175 dB referenced to 1 μPa RMS (Navy 2017)	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Noise: Cable laying/ trenching	N/A	Cable laying impacts resulting from future non-offshore wind activities would be identical to those described for future offshore wind projects.
Noise: Vessels	The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with sea turtles' known hearing range (less than 1000 Hz with maximum sensitivity between 200 to 700 Hz; Bartol 1994) and would therefore be audible. However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach or noise with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (2005) indicated that vessel noise could have an effect on sea turtle behavior, especially their submergence patterns.	See Section 3.19.6. Any offshore projects that require the use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of sea turtles and no stock or population-level effects would be expected.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in short-term, temporary impacts, if any, on sea turtles. Vessel noise may affect sea turtles, but response would be expected to be short term and temporary (see the Vessels: Noise sub-IPF above). The impact on water quality from sediment suspension during port expansion activities is short-term, temporary, and would be similar to those described under the New cable emplacement/maintenance IPF above.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
		use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strikes could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	The Mid-Atlantic region has more than 130 artificial reefs. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of sea turtles encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014) if present where these structures are located. At the scale of the OCS geographic analysis area for sea turtles, there are very few areas that would serve to concentrate recreational fishing and increase the likelihood that sea turtles would encounter lost fishing gear.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Presence of structures: Habitat conversion and prey aggregation	The Mid-Atlantic region has more than 130 artificial reefs. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the reef effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for sea turtles compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in nearshore coastal waters has the potential to provide habitat for sea turtles as well as preferred prey species. This reef effect has the potential to result in long-term, low-intensity beneficial impacts. Bridge foundations will continue to provide foraging opportunities for sea turtles with measurable benefits to some individuals.
Presence of structures: Avoidance/ displacement	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.

Associated IPF: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Traffic: Vessel collisions	Current activities contributing to this sub-IPF include port traffic levels, fairways, traffic separation schemes, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike is an increasing concern for sea turtles, especially in the southeastern United States, where development along the coasts is likely to result in increased recreational boat traffic. In the United States, the percentage of strandings of loggerhead sea turtles that were attributed to vessel strikes increased from approximately 10% in the 1980s to a record high of 20.5% in 2004 (NMFS and USFWS 2007). Sea turtles are most susceptible to vessel collisions in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and evidence suggests that they cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of sea turtles makes stock or population-level effects unlikely (Navy 2018).

μPa = micropascal; μT = microtesla; AC = alternating current; ADLS = Aircraft Detection Light System; AIS = Automatic Identification System; BMP = best management practice; BOEM = Bureau of Ocean Energy Management; BSW = Bay State Wind; CFR = Code of Federal Regulations; COP = Construction and Operations Plan; dB = decibel; dB re 1 μPa = decibels relative to one micropascal; dB RMS = decibel root mean square; DC = direct current; DP = dynamic positioning; DPS = distinct population segment; EMF = electromagnetic field; ESP = electrical service platform; FAA = Federal Aviation Administration; FCC = Federal Communications Commission; G&G = Geological and Geophysical; HRG = high resolution geophysical; Hz = hertz; IHA = Incidental Harassment Authorization; IPF = impact-producing factors; MCT = Marine Commerce Terminal; met = meteorological; NARW = North Atlantic right whale; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NRA = Navigational Risk Assessment; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; PAM = passive acoustic monitoring; PSO = protected species observer; PTS = permanent threshold shift; RMS = root mean square; SEIS = Supplemental EIS; SOV = service operations vessel; SPL = sound pressure level; TTS = temporary threshold shift; USACE = U.S. Army Corps of Engineers; USCG = US Coast Guard; WTG = wind turbine generator

Table F1-22 Summary of Activities and the Associated Impact-Producing Factors for Water Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/ hazmat	Accidental releases of fuels and fluids occur during vessel usage for dredge material ocean disposal, fisheries use, marine transportation, military use, survey activities, and submarine cable lines, and pipeline-laying activities. According to the DOE, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and into the offshore was < 70,000 barrels. Impacts on water quality would be expected to brief and localized from accidental releases.	Future accidental releases from offshore vessel usage, spills, and consumption will likely continue on a similar trend. Impacts are unlikely to affect water quality.
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, and cables, lines, and pipeline laying. Accidental releases of trash and debris are expected to be low probability events. BOEM assumes operator compliance with federal and international requirements for management of shipboard trash; such events also have a relatively limited spatial impact.	As population and vessel traffic increase gradually over the next 30 years, accidental release of trash and debris may increase. However, there does not appear to be evidence that the volumes and extents anticipated would have any effect on water quality.
Anchoring	Impacts from anchoring occur due to ongoing military use and survey, commercial, and recreational activities.	Impacts from anchoring may occur semi-regularly over the next 30 years due to offshore military operations or survey activities. These impacts would include increased seabed disturbance resulting in increased turbidity levels. All impacts would be localized, short term, and temporary.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
New cable emplacement/ maintenance	Elevated suspended sediment concentrations can occur under natural tidal conditions and increase during storms, trawling, and vessel propulsion. Survey activities, and new cable and pipeline-laying activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be short term and either be limited to the emplacement corridor or localized.	Suspension of sediments may continue to occur infrequently over the next 30 years due to survey activities, and submarine cable, lines, and pipeline-laying activities. Future new cables would occasionally disturb the seafloor and cause short-term increases in turbidity and minor alterations in localized currents resulting in local short-term impacts. The FCC has two pending submarine telecommunication cable applications in the North Atlantic. If the cable routes enter the water quality geographic analysis area, short-term disturbance in the form of increased suspended sediment and turbidity would be expected.
Port utilization: Expansion	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications, which, along with additional vessel traffic, could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.	The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly over the next 30 years. Port modifications and channel deepening activities are being undertaken to accommodate the increase in vessel traffic and deeper draft vessels that transit the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.
Presence of structures	The installation of onshore and offshore structures leads to alteration of local water currents. These disturbances would be local but, depending on the hydrologic conditions, have the potential to impact water quality through the formation of sediment plumes.	Impacts associated with the presence of structures includes temporary sediment disturbance during maintenance. This sediment suspension would lead to interim and localized impacts.

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Discharges	Discharges impact water quality by introducing nutrients, chemicals, and sediments to the water. There are regulatory requirements related to prevention and control of discharges, the prevention and control of accidental spills, and the prevention and control of nonindigenous species.	Increased coastal development is causing increased nutrient pollution in communities. In addition, ocean disposal activity in the North and Mid-Atlantic is expected to gradually decrease or remain stable. Impacts of ocean disposal on water quality are minimized because USEPA has established dredge spoil criteria and regulate the disposal permits issued by USACE. The impact on water quality from sediment suspension during these future activities would be short term and localized.
Land disturbance: erosion and sedimentation	Ground disturbance activities may lead to unvegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to unvegetated or unstable soils. Precipitation events could mobilize these soils leading to erosion and sedimentation effects and turbidity. The impacts for future offshore wind through this IPF would be staggered in time and localized. The impacts would be short term and localized with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to unvegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo-handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

BOEM = Bureau of Ocean Energy Management; DO = dissolved oxygen; DOE = U.S. Department of Energy; EIS = Environmental Impact Statement; ESP = electrical service platform; FCC = Federal Communications Commission; gal = gallon; IPF = impact-producing factors; NASA = National Aeronautics and Space Administration; OCS = Outer Continental Shelf; OECC = Offshore Export Cable Corridor; USACE = U.S. Army Corps of Engineers; USCG = U.S. Coast Guard; USEPA = Environmental Protection Agency; WTG = wind turbine generator

Table F1-23 Summary of Activities and the Associated Impact-Producing Factors for Wetlands

Associated IPFs: Sub-IPFs	Ongoing Activities	Future Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Ground disturbance activities may lead to unvegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to unvegetated or unstable soils. Precipitation events could mobilize these soils, leading to erosion and sedimentation effects and turbidity. Impacts from future offshore wind activities through this IPF would be staggered in time and localized. The impacts would be short term and localized, with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to unvegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity and land development will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo-handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

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ATTACHMENT F2
MAXIMUM-CASE SCENARIO ESTIMATES FOR OFFSHORE WIND PROJECTS

Tables

The following tables provide maximum-case scenario estimates of potential offshore wind project impacts assuming maximum build-out, using CVOW-C EIS geographic analysis areas. BOEM developed these estimates based on offshore wind demand, as discussed in their 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019). Estimates disclosed in this EIS's Chapter 3, No Action analyses were developed by summing acreage or number calculations across all lease areas noted as occurring within, or overlapping, a given geographic analysis area. This likely overestimates some impacts in cases where lease areas only partially overlap analysis areas. However, this approach was used to provide the most conservative estimate of future offshore wind development.

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Table F2-1 Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 1, Turbine and Cable Design Parameters)

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation and Tourism									
NE	Aquaventis (state waters)	State Project					X		2023	2	11					450	520
NE	Block Island (state waters)	Built					X		Built	5	30	28	5	2	328	541	659
	Total State Waters									**7**	41	**28**	**5**	**2**			
MA/RI	Vineyard Wind 1 part of OCS-A 0501	COP Approved (ROD issued 2021), PPA, SAP					X		2023	62	800	98	6.5	171	451	721	812
MA/RI	South Fork, OCS-A 0517	COP Approved (ROD issued 2021), PPA, SAP					X		2023	12	130	139	6.5	24	472	735	840
MA/RI	Sunrise, OCS-A 0487	COP, PPA, SAP					X		2024	94	1,034	105	6.5	180	459	656	787
MA/RI	Revolution, part of OCS-A 0486	COP, PPA, SAP					X		2023-2024	100	880	100	131	155	512	722	873
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e. Park City Wind])	COP, PPA, SAP					X		2024–2026	62	804	125	10	139	630	837	1,047
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e. Commonwealth Wind])	COP, PPA, SAP					X		2024–2026	79	1,500	225	10	201	702	935	1,171
MA/RI	Mayflower OCS-A 0521	COP, PPA, SAP					X		2025	147	2,400	1,179	6.5	497	605	919	1,066
MA/RI	Beacon Wind 1, part of OCS-A 0520	COP (unpublished), PPA, SAP							2024–2029	78	1,230	232	33	186	591	984	1,083
MA/RI	Beacon Wind 2, part of OCS-A 0520	COP (unpublished), SAP					X		2025–2029	77	1,200	232	33	186	591	984	1,083
MA/RI	Bay State Wind, part of OCS-A 0500	SAP, COP (unpublished), the MW is included in the description below in the 5,148 MW.					X		By 2030, spread over 2025–2030	110	4,200	120	6.5	172	492	722	853
MA/RI	Liberty Wind (OCS-A 0522)	This group is exposed to 4,200 MW of demand--for MA (2,400 MW remaining), CT (900 MW remaining), and RI (900 MW expected). Collectively the remaining technical capacity is 5,148 MW.					X		By 2030, spread over 2025–2030	227		120	6.5	368	492	722	853
MA/RI	OCS-A 0500 remainder						X					120			492	722	853
MA/RI	OCS-A 0487 remainder						X					120			492	722	853
MA/RI	Remaining MA/RI Lease Area Total[2]	73%								337	4,200	480	6.5	540	492	722	853

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation and Tourism									
	Total MA/RI Leases[2]									**1,048**	**14,178**	**2,915**		**2,279**			
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP					X		2023–2025	98	1,100	194[11]	98	190	512	788	906
NY/NJ	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP					X		2025-2027	200	1,510	342	58	547	576	919	1,049
NY/NJ	Ocean Wind 2, part of OCS- A 0532	PPA					X		By 2030, spread over 2026-2030	111	1,554	120	5	173	512	788	906
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP					X		2024	57	816	46	5	133	525	853	951
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP					X		2025	90	1,260	30	5	166	525	853	951
NY/NJ	Atlantic Shores North, OCS-A 0499 remainder	SAP					X		By 2030, spread over 2026–2030	157	2,198	99	58	249	576	919	1,049
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537						X	X	By 2030, spread over 2026–2030	100	960	120	5	157	492	722	853
NY/NJ	Attentive Energy LLC, OCS-A 0538						X	X	By 2030, spread over 2026–2030	102	1,224	120	5	160	492	722	853
NY/NJ	Bight Wind Holdings, LLC, OCS-A 0539						X	X	By 2030, spread over 2026–2030	145	1,740	120	5	231	492	722	853
NY/NJ	Atlantic Shores Offshore Wind Bight, LLC, OCS-A 0541						X		By 2030, spread over 2026–2030	93	1,116	120	5	147	492	722	853
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542						X		By 2030, spread over 2026–2030	97	1,164	120	5	153	492	722	853
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544						X	X	By 2030, spread over 2026–2030	102	1,224	120	5	160	492	722	853
	Total NY/NJ Leases									**1,352**	**16,106**	**1,650**		**2,466**			
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA, SAP					X		2024	16	120	40	10	30	492	722	853
DE/MD	US Wind, part of OCS-A 0490	COP, PPA, SAP					X		2024-2027	121	2,000	146	7	152	528	820	938
DE/MD	GSOE I, OCS-A 0482	Collectively the technical capacity of this is group is 1,080 MW (90 turbines). The remaining capacity may be utilized by demand from NJ or MD.					X		By 2030, spread over 2023–2030	90	1,080				492	722	853
DE/MD	OCS-A 0519 remainder						X										
	Remaining DE/MD Lease Area Total									90	1,080	240	5	139			
	Total DE/MD Leases									**227**	**3,200**	**426**		**321**			
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X	Built	2	12	27	3	9	364	506	620
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	2025–2027	205	3,000	417	5	301	489	761	869

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation and Tourism									
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X	2024–2030	69	1,242	100	30	149	574	935	1,042
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X	2026-2027	121	1,242	353	30	200	574	935	1,042
	Total VA/NC Leases									**397**	**5,496**	**897**		**659**			
	OCS Total[9,10]									**3,031**	**39,021**	**5,916**		**5,728**			

[1] The spacing/layout for projects are as follows: NE State water projects include a single strand of wind turbine generators (WTGs) and no offshore substation (OSS). For projects in the RI, MA, NY, NJ, DE, MD lease areas, a 1×1–nm grid spacing is assumed. For the CVOW Project, the spacing is 0.7 nm; and the Dominion commercial lease area off the coast of Virginia would utilize 0.5-nm average spacing, which is less than the 1×1–nm spacing due to the need to attain the state's goals.
[2] Because development could occur anywhere within the RI and MA lease areas and assumes a continuous 1x1–nm grid, the actual development for these projects is expected to be approximately 73% of the collective technical capacity. Under the scenario described in this appendix, the total area in the RI and MA lease areas is greater than the area needed to meet state demand. Therefore, if a project is not constructed, BOEM assumes that another future project would be constructed to fulfill the unmet demand.
[3] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.
[4] The estimated construction schedule is based on information known at the time of this analysis and could be different when an applicant submits a COP.
[5] The number of turbines for those lease areas without an announced number of turbines has been calculated based on lease size, a 1×1-nm (2×2-km) grid spacing, or the generating capacity.
[6] BOEM assumes that each offshore wind development would have its own cable (both onshore and offshore) and that future projects would not utilize a regional transmission line. The length of offshore export cable for those lease areas without a known project size is assumed to include two offshore cables totaling 120 miles (193 kilometers). The offshore export cable would be buried a minimum of 4 feet (1.2 meters) but not more than 10 feet (3.1 meters).
[7] If information for a future project could not be obtained from a COP, the length of inter-array cabling is assumed to be the average amount per foundation based on the COPs submitted to date, which is 1.48 miles (2.4 kilometers). In addition, for those lease areas that require more than one OSS, it is assumed that an additional 6.2 miles (9.9 kilometers) of inter-link cable would be required to link the two OSSs. Inter-array cable is assumed to be buried between 4 and 6 feet (1.2 and 1.8 feet).
[8] The hub height, rotor diameter, and turbine height for lease areas is based on worst-case scenario for the resource area. Presentation of heights vary by COP and may be presented relative to mean lower low water (MLLW), mean sea level, or height above highest astronomical tide.
[9] BOEM recognizes that the estimates presented within this analysis are likely high, conservative estimates; however, BOEM believes that this analysis is appropriately capturing the potential cumulative impacts and errs on the side of maximum impacts. Totals by lease area and by OCS may not fully sum due to rounding errors.
[10] New York's demand is not double-counted, this total comes from looking at New York's state demand, not adding up the potential of the areas because that would double-count New York.
CT = Connecticut; CVOW = Coastal Virginia Offshore Wind; DE = Delaware; FDR = Facility Design Report; FIR = Fabrication and Installation Report; MA = Massachusetts; MD = Maryland; NC = North Carolina; NE = New England; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement; RAP = research activities plan; RI = Rhode Island; SAP = Site Assessment Plan, VA = Virginia
[11] Includes cable length from offshore export cables and substation interconnector cables.

Table F2-2 Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 2, Seabed/Anchoring Disturbance and Scour Protection)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Estimated Foundation Number[2]	Foundation Footprint[3] (acres)	WTG Seabed Disturbance (Foundation + Scour Protection) (acres)[4]	Offshore Export Cable Seabed Disturbance (acres)[5]	Offshore Export Cable Operating Seabed Footprint (acres)[6]	Offshore Export Cable Hard Protection (acres)[7]	Anchoring Disturbance (acres)[8]	Inter-Array Construction Footprint/Seabed Disturbance (acres)[9]	Inter-Array Operating Footprint/ Seabed Disturbance (acres)[10]	Inter-Array Cable Hard Protection (acres)[11]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism										
	Total NY, NJ, MA, RI, DE, MD Leases								**2,691**	**254**	**4,406**	**19,696**	**2,991**	**1,333**	**2,141**	**19,483**	**4,234**	**919**
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X	2	0	2	33	11	10	3	5	3	0
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	208	4	196	2,635	253	149	42	2,394	297	0
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X	70	1	66	16,012	71	32	2	5,931	14	0
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X	123	1	100	114,133[12]	49	49	9	7,957	19	0
	Total NC and VA Leases								**403**	**5**	**364**	**132,813**[12]	**384**	**240**	**63**	**16,287**	**333**	**0**
	OCS Total								**3,094**	**259**	**4,771**	**152,509**	**3,375**	**1,573**	**2,197**	**35,770**	**4,567**	**919**

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.
[2] The estimated number of foundations is the total number of turbines plus OSS. If information for a future project could not be obtained from a publicly available COP, it is assumed that for every 50 turbines there would be one OSS installed.
[3] If information for a future project could not be obtained from a publicly available COP, the foundation footprint is assumed to be 0.04 acre (0.16 hectares), which is based on the largest monopile reported (12 MW) for all lease areas.
[4] The seabed disturbance with the addition of scour protection was calculated based on scour protection expected in submitted COPs. If information for a future project could not be obtained from a publicly available COP, it is assumed that for all lease areas that a 12-MW foundation with addition of scour protection would be 0.85 acre (0.34 hectare) per foundation.
[5] Offshore export cable seabed bottom disturbance is assumed to be due to installation of the export cable, the use of jack-up vessels, and the need to perform dredging. If information for a future project could not be obtained from a publicly available COP, export cable seabed disturbance assumed to be 1.25 acres per mile.
[6] If information for a future project could not be obtained from a publicly available COP, the offshore export cable operating seabed footprint assumed to be 0.4 acre per mile.
[7] If information for a future project could not be obtained from a publicly available COP, the offshore export cable hard protection is assumed to be similar to Vineyard Wind 1 Project, which is 0.357 acre per mile of offshore export cable.
[8] If information for a future project could not be obtained from a publicly available COP, anchoring disturbance for other lease areas is assumed to be a rate equal to 0.10 acre per mile of offshore export cable.
[9] If information for a future project could not be obtained from a publicly available COP, inter-array construction seabed disturbance is assumed to be a rate equal to the average area per foundation, 2.4 acres (1 hectare) per foundation.
[10] If information for a future project could not be obtained from a publicly available COP, the inter-array operating footprint is assumed to be a rate equal to the average amount per foundation of 1.43 acres (0.58 hectare) per foundation.
[11] If information for a future project could not be obtained from a publicly available COP, the inter-array cable hard protection is assumed to be zero.
[12] Kitty Hawk South has 3 export cables (92 km to Virginia, 322 km to North Carolina, and an additional 154 km of inshore export cable to North Caroline) for a total of 568 km (352.9 miles), and corridor widths between 1,520-m-wide corridor to Virginia and 1,000-m-wide corridors to North Carolina to allow for optimal routing of the cables.

Table F2-3 Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 3, Gallons of Coolant, Oils, Lubricants, and Diesel Fuel)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						Total Coolant Fluids in WTGs (gallons)	Total Coolant Fluids in OSS or ESP (gallons)	Total Oils and Lubricants in WTGs (gallons)	Total Oils and Lubricants in OSS or ESP (gallons)	Total Diesel Fuel in WTGs (gallons)	Total Diesel Fuel in OSS or ESP (gallons)
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism						
	Total NY, NJ, MA, RI, DE, MD Leases								**3,978,858**	**64,299**	**7,955,051**	**7,424,295**	**2,052,462**	**2,322,751**
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X	846		7,660			
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	86,715	0	437,060	258,300		20,409
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X	29,165	46	229,800	61,780	47,580	2,848
VA/NC	Kitty Hawk Wind South, OCS-A 0508 remainder	COP	X	X	X	X	X	X	51,144	93	447,507	247,117	95,894	11,391
	Total NC and VA Leases								**167,870**	**139**	**1,122,027**	**567,197**	**143,474**	**34,648**
	OCS Total								**4,146,728**	**64,438**	**9,077,078**	**7,991,492**	**2,195,936**	**2,357,399**

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.

Table F2-4 Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 4, Construction and Operation Emissions)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						2023	2024	2025	2026	2027	2028	2029	2030	Beyond 2030
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
Nitrogen oxides (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	794.67	4,204.76	6,931.30	2,714.30	1,139.42	480.31			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		20.91	2,334.97	3,118.56	286.87				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				378.31	4,487.59	4,393.83	851.4	582.24	
	Total Air Quality Analysis Area								794.67	4,225.67	9,266.27	6,211.17	5,913.88	4,874.14	851.4	582.24	0.00
Volatile organic compounds (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	31.61	172.67	288.00	109.31	43.60	17.65			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		1.31	99.27	135.37	16.77				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				16.63	191.22	188.37	37.82	26.34	
	Total Air Quality Analysis Area								31.61	173.98	387.27	261.31	251.59	206.025	37.82	26.34	0.00
Carbon monoxide (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	261.71	1,247.63	2,026.12	942.39	391.22	371.72			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		6.02	603.00	884.50	146.60				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				121.88	1,185.88	1,191.42	269.99	196.07	
	Total Air Quality Analysis Area								261.71	1,253.65	2,629.12	1,948.77	1,723.70	1,563.14	269.99	196.07	0.00
Particulate matter, 10 microns or less (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	26.13	139.22	233.46	96.16	36.45	19.40			

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						2023	2024	2025	2026	2027	2028	2029	2030	Beyond 2030
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		0.82	76.77	112.06	14.60				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				13.36	149.75	151.14	33.60	24.36	
	Total Air Quality Analysis Area								26.13	140.04	310.23	221.58	200.80	170.54	33.60	24.36	0.00
Particulate matter, 2.5 microns or less (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	25.35	135.04	226.46	93.28	35.36	18.82			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		0.79	74.46	108.70	14.17				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				12.96	145.25	146.61	32.59	21.38	
	Total Air Quality Analysis Area								25.35	135.83	300.92	214.94	194.78	165.43	32.59	21.38	0.00
Sulfur dioxide (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	9.91	63.40	107.64	32.14	13.83	0.33			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		0.06	41.93	50.83	4.23				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				5.16	79.00	75.29	11.96	7.42	
	Total Air Quality Analysis Area								9.91	63.46	149.57	88.13	97.06	75.62	11.96	7.42	0.00
Carbon dioxide (tons)																	
VA/NC	CVOW, OCS-A 0497	RAP, FDR/FIR	X	X	X	X	X	X									
VA/NC	CVOW-C, OCS-A 0483	COP, SAP	X	X	X	X	X	X	59,590.80	275,647.20	435,327.30	174,190.90	72,908.40	41,623.50			
VA/NC	Kitty Hawk Wind North, OCS-A 0508	COP, SAP	X	X	X	X	X	X		8,518.00	140,229.00	186,464.00	27,825.00				
VA/NC	Kitty Hawk Wind South, OCS-A 0508	COP	X	X	X	X	X	X				41,580.00	274,535.00	259,916.00	52,360.00	36,391.00	
	Total Air Quality Analysis Area								59,590.80	284,165.20	575,556.30	402,234.90	375,268.40	301,539.50	52,360.00	36,391.00	0.00

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.

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LITERATURE CITED

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf. Accessed: December 2020.

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Appendix G. Assessment of Resources with Minor (or Lower) Adverse Impacts

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G.1. Introduction

To focus on the impacts of most concern in the main body of this DEIS, BOEM has included the analysis of resources with no greater than **minor** adverse impacts below. These include Demographics, Employment, and Economics; Land Use and Coastal Infrastructure; and Recreation and Tourism. Those resources with potential impact ratings greater than **minor** are included in DEIS Chapter 3, *Affected Environment and Environmental Consequences*.

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Appendix H. Mitigation and Monitoring

The Draft Environmental Impact Statement (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction, operations and maintenance (O&M), and conceptual decommissioning of the Coastal Virginia Offshore Wind Commercial Project (CVOW-C or Project) proposed by Coastal Virginia Offshore Wind (CVOW) in its Construction and Operations Plan (COP) (Dominion Energy 2022). The Project described in the COP and this Draft EIS would be approximately 2,500–3,000 megawatts (MW) in scale and sited 27 miles (23.75 nautical miles) off the Virginia Beach, Virginia Coastline within Lease Area OCS-A 0483. The Project is designed to serve demand for renewable energy in Virginia and North Carolina.

As part of the Project, CVOW has committed to implementing lessee-proposed measures (LPMs) to avoid, reduce, mitigate, or monitor impacts on the resources discussed in Chapter 3, *Affected Environment and Environmental Consequences*, of the Draft EIS. These APMs are described in Table H-1 of this appendix. The U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM) considers as part of the Proposed Action only those measures that CVOW has committed to in Section 4 of the COP (Dominion Energy 2022). Attachment H-1 to this appendix also includes mitigation CVOW has proposed as part of its *Unanticipated Discoveries Plan,* as described in COP Appendices F, G, and DD.

BOEM may select alternatives and require additional mitigation or monitoring measures to further protect and monitor these resources. Additional mitigation and monitoring measures may result from reviews under several environmental statutes (Clean Air Act, Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, and National Historic Preservation Act) that are described in Appendix A of the Draft EIS. Additional mitigation measures identified by BOEM, as well as those that may result from reviews under these statutes, are shown in Table H-2. Please note that not all of these mitigation measures are within BOEM's statutory and regulatory authority but could be adopted and imposed by other governmental entities. Table H-2 provides descriptions of these mitigation or monitoring measures, as well as those that BOEM has identified for analysis in the Draft EIS.

If BOEM decides to approve the COP, the Record of Decision (ROD) would state which of the mitigation and monitoring measures identified by BOEM in Table H-1 have been adopted, and if not, why they were not. As such, the ROD would inform terms and conditions of COP approval and would compel compliance with or execution of identified mitigation and monitoring measures (40 Code of Federal Regulations [CFR] 1505.3). CVOW would be required to certify compliance with certain terms and conditions, as required under 30 CFR 585.633(b). Furthermore, BOEM would periodically review the activities conducted under the approved COP. The frequency and extent of the review would be based on the significance of any changes in available information and on onshore or offshore conditions affecting, or affected by, the activities conducted under the COP.

Monitoring measures may be required to evaluate the effectiveness of a mitigation measure or to identify if resources are responding as predicted to impacts from the Proposed Action. Monitoring programs would be developed in coordination among BOEM and agencies with jurisdiction over the resource to be monitored. The information generated by monitoring may be used to (1) adapt how a mitigation measure identified in the COP or ROD is being implemented, (2) revise or develop new mitigation or monitoring measures required under the COP in accordance with 30 CFR 585.634(b) or develop measures for future projects, or (3) contribute to regional efforts for better understanding of the impacts and benefits resulting from offshore wind energy projects in the Atlantic (e.g., potential cumulative impact assessment tool). Unless specified, the proposed mitigation measures described below would not change the impact ratings on the affected resource, as described in Chapter 3, *Affected Environment and Environmental Consequences*, of the Draft EIS, but would further reduce expected impacts or inform the development of additional mitigation measures if required.

Table H-1 Lessee-proposed measures

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
Construction; Decommissioning	Offshore Project Area	Disturbance to seabed. Disturbance to objects along the seabed. Disturbance to onshore geology.	• Dominion Energy would identify the most appropriate locations, based on geologic conditions, for installation that would require the least disturbance to the seabed. By opting for locations that avoid the most challenging geology, Dominion Energy would be able to utilize the least-invasive tools for Project installation to the extent practicable. • Dominion Energy would implement appropriate avoidance buffers to avoid contact with any objects on the seabed, to the extent practicable. Objects that cannot be avoided would be further investigated and an appropriate mitigation would be implemented. For cable crossings, this would include optimization of the crossing geometry as well as engineering of the crossing and associated protection. For potential unexploded ordnance, this would include investigation of contacts and mitigation through micrositing if possible and further action and mitigation if necessary. • Dominion Energy would minimize disturbance to onshore geology during the installation of Onshore Project Components by optimizing routes along previously disturbed onshore locations to the extent practicable. • Dominion Energy would consider weather forecasts at all times during the construction stage, and would halt operations in the event that extreme weather events are likely to occur.	Physical and Oceanographic Conditions

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy would avoid and/or relocate boulders that are too close to the installation of the Offshore Export Cable. • The Project would site Offshore Project Components to avoid areas of steep and/or unstable seabed where determined to prove a challenge to specific Project features or installation methods during detailed design. • Dominion Energy would incorporate information on the location of mobile sediments and potential for scour into the design and installation of the Offshore Project Components. • The risk related to soft soils would be thoroughly considered when the jack-up vessel is deployed. • Dominion Energy has moved or eliminated some wind turbine generators (WTGs) locations near potential shallow gas from consideration for the Project. • The Project would implement an avoidance buffer around all wrecks, to the extent possible. Shipwrecks of cultural significance would be avoided in accordance to recommendations from the Project's QMA and are discussed in detail in COP Appendix F, Marine Archaeological Resources Assessment. • The Project would avoid identified debris during Project installation, to the extent possible. In the event that avoidance is not feasible, individual targets may be inspected by a remotely operated vehicle (ROV) to determine if the object poses a risk to operations and if it may be removed from the seabed.	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy will engage with asset owners in order to complete crossing agreements which will detail the conditions and methodology for each cable crossing. • Dominion Energy would microsite and re-route Offshore Project Components to avoid an unexploded ordnance (UXO) when feasible. If potential UXO cannot be avoided through micrositing, ROV investigations will be implemented in order to fully assess the UXO potential. If ROV investigations determine UXO is present, UXO mitigation will be considered by the Project, subject to agency approval. • The Offshore Export Cable Route Corridor has been reduced in width while crossing the Dam Neck Ocean Disposal Site (DNODS) in order to minimize the portion of the DNODS impacted by the Project. While seabed processes are likely to disperse dumped sediment through time, the accumulation of deposited dredge material overlying the buried cables could result in thermal and ampacity changes. This would be considered during the detailed design of the Offshore Project Components and installation works.	
O&M	Offshore Project Area	Disturbance to seabed. Disturbance to objects on the seabed.	• Operations would occur at locations of previously disturbed seabed to minimize the potential for disturbing new seabed whenever possible. • Whenever possible, operations and maintenance would occur at locations of previously disturbed seabed to minimize the potential for disturbing new objects along the seabed whenever possible. In addition, the Project would conduct routine geophysical	Physical and Oceanographic Conditions

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			surveys to monitor the status of the installed cable on the seabed as discussed in Section 3, *Description of Proposed Activity*.	
Construction; Decommissioning	Onshore Project Area	Short-term elevated in-air noise levels associated with vibratory pile driving at the cofferdam for Trenchless Installation exit at the Offshore Trenchless Installation Punch-Out location. Short-term elevated in-air noise levels associated with Trenchless Installation at the Cable Landing Location and the onshore cable crossing locations. Short-term elevated in-air noise levels associated with construction of the Onshore Export Cable Route, Switching Station, Interconnection Cable Route, and Onshore Substation.	• Trenchless Installation activities would occur during the daytime period unless a situation arises that would require operation to continue into the night or as deemed acceptable from the appropriate regulatory authority. • Dominion Energy would consult with the appropriate regulatory agency regarding nighttime work in the case of an emergency. In the case of nighttime operations, only the drill rig, power unit, and light banks would be used unless otherwise deemed acceptable from the appropriate regulatory authority. • If necessary, subject to regulatory requirements and stakeholder engagement, Dominion Energy would install moveable temporary noise barriers as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 A-weighted decibels (dBA). • Dominion Energy would limit construction to the daytime period unless deemed acceptable from the appropriate regulatory authority. • Dominion Energy would ensure construction equipment is well maintained and vehicles using internal combustion engines equipped with mufflers would be routinely checked to ensure they are in good working order. • Dominion Energy would ensure construction equipment is located as far as possible from noise-sensitive areas.	In-Air Acoustic Environment

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• If noise issues are identified, Dominion Energy would install moveable temporary noise barriers as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 dBA. • Dominion Energy would make a Project Communications Plan available to help actively address all noise-related issues in a timely manner.	
Construction; Decommissioning	Offshore Project Area	Short-term elevated in-air noise levels associated with impact pile driving of Wind Turbine Generator Foundation and Offshore Substation Jacket Foundations. Short-term elevated in-air noise levels associated with offshore support vessels.	• If the final design engineering requires sound mitigation measures, Dominion Energy would implement such measures within the Project footprint, as necessary.	In-Air Acoustic Environment
O&M	Onshore Project Area	Long-term elevated in-air sound levels associated with Switching Station and Onshore Substation. Short-term elevated in-air sound levels associated with operations and maintenance activities.	• If the final design engineering requires sound mitigation measures, Dominion Energy would implement such measures within the Project footprint, as necessary.	In-Air Acoustic Environment
O&M	Offshore Project Area	Long-term elevated in-air sound levels associated with the Wind Turbine Generators, Offshore Substation, and, as necessary, operation of sound signals.	No mitigation measures are expected for the Offshore Project area.	In-Air Acoustic Environment
Construction; Decommissioning	Offshore Project Area	Short-term increase in underwater noise levels associated with WTG Foundations and/or pin pile impact pile driving activities required for the installation of WTG and Offshore Substation Jacket Foundations.	• Noise mitigation requirements and methods have not been finalized at this stage of permitting; therefore, two levels (6 decibels [dB] and 10 dB) of reduction were applied to potentially mimic the use of noise mitigation options such as bubble curtains.	Underwater Acoustic Environment

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		Short-term increase in underwater noise levels associated with pile driving for cofferdam installation. Short-term increases in underwater noise levels associated with impact pile driving for goal post installation. Short-term increase in underwater noise levels associated with Offshore Export Cables and Inter-Array Cable laying activities. Short-term increase in underwater noise levels associated with Project-related vessels.	• The results of the analysis would be used to inform development of evaluation and mitigation measures that would be applied during construction and operations and maintenance (O&M) of the Project, in consultation with BOEM and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries). • The Project would obtain necessary permits to address potential impacts on marine mammals, sea turtles and fisheries resources from underwater noise and would establish appropriate and practicable mitigation and monitoring measures through discussions with regulatory agencies.	
O&M	Offshore Project Area	Increase in underwater noise levels associated with WTG operations. Increase in intermittent underwater noise levels associated with Project O&M and Project-related vessels.	• No mitigation measures are expected to be needed during Project O&M to minimize underwater noise levels.	Underwater Acoustic Environment
Construction; Decommissioning	Onshore Project Area	Short-term increase in Project-related emissions.	• Most of the vessels and the onboard construction equipment would utilize diesel engines burning ultra-low sulfur fuel, while some larger construction vessels may use bunker fuel. • Onshore Project area construction activities would primarily utilize diesel-powered equipment, including horizontal directional drilling operations, trenching/duct bank construction, and cable pulling and termination. • Any fugitive dust generated during construction of the Onshore Project Components would be managed in	Air Quality

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			accordance with the Project's Fugitive Dust Control Plan.	
Construction; Decommissioning	Offshore Project Area	Short-term increase in Project-related emissions.	• Vessels constructed on or after January 1, 2016, would meet Tier III nitrogen oxides requirements when operating within the North American Emission Control Area (200 nautical miles [370.4 kilometers]) established by the International Maritime Organization. • Project-related vessels would use low sulfur diesel fuel where possible and be at or below the maximum fuel sulfur content requirement of 1,000 parts per million established per the requirements of 40 CFR 80.510(k); the COP (Dominion Energy 2022: Page 4-59 *Project Stage Location Impact Avoidance, Minimization and Mitigation*). • Project-related vessels would comply with applicable U.S. Environmental Protection Agency (USEPA) or equivalent emission standards. • The Project would provide BOEM with data on horsepower rating of all propulsion and auxiliary engines, duration of time operating in state waters, load factor, and fuel consumption for Project-related vessels to determine actual emissions from Project-related vessels, which would confirm that sufficient emissions offsets have been acquired. • The Project would provide vessel engines and emissions control equipment information to BOEM and the USEPA in accordance with the requirements set forth in the ROD and/or the issued Outer Continental Shelf air permit.	Air Quality

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
O&M	Offshore Project Area	Long-term increase in Project-related emissions.	• As detailed in COP Appendix N, *Air Emissions Calculations and Methodology*, operations and maintenance activities are assumed to include one service operations vessel and two crew transfer vessels over the operational life of the Project. • Operations and maintenance support vessels are assumed to operate out of a port located in the Hampton Roads area of Virginia (Portsmouth has been used for the purpose of estimating emissions). • Vessels constructed on or after January 1, 2016, would meet Tier III nitrogen oxides requirements when operating within the North American Emission Control Area (200 nautical miles [370.4 kilometers]) established by International Maritime Organization. • Project-related vessels would use ultra-low sulfur diesel fuel where possible and be at or below the maximum fuel sulfur content requirement of 1,000 parts per million established per the requirements of 40 CFR 80.510(k). • Project-related vessels would comply with applicable USEPA, or equivalent, emission standards. • The Project would provide BOEM with data on horsepower rating of all propulsion and auxiliary engines, duration of time operating in state waters, load factor, and fuel consumption for Project-related vessels to determine actual emissions from Project-related vessels, which would confirm that sufficient emissions offsets have been acquired.	Air Quality

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• The Project would provide vessel engines and emissions control equipment information to BOEM and the USEPA in accordance with the requirements set forth in the ROD and/or the issued Outer Continental Shelf air permit.	
O&M	Onshore Project Area	Long-term increase in Project-related emissions.	• Onshore emergency generators would comply with applicable emission standards in 40 CFR Part 60 Subpart JJJJ and 40 CFR Part 63 Subpart ZZZZ.	Air Quality
Construction; Decommissioning	Offshore Project Area	Short-term disturbance of seabed sediment due to installation of the WTG Monopile Foundations and Offshore Substation Jacket Foundations, Inter-Array Cables, Offshore Export Cables, and site preparation for installation of scour protection. Short-term potential for inadvertent return of drilling fluids during horizontal directional drilling. Short-term potential for inadvertent return of drilling fluids during horizontal directional drilling. Short-term impacts due to accidental spills and/or releases offshore.	• Dominion Energy would develop and implement a horizontal directional drilling inadvertent release plan. Local pollution prevention and spill response procedures would be included in the Stormwater Pollution Prevention Plan (SWPPP) submitted to State agencies for the portions of the land-disturbing activity covered by the Virginia Pollutant Discharge Elimination System Construction General Permit. • Dominion Energy would manage accidental spills or releases of oils or other hazardous wastes through the Oil Spill Response Plan (Appendix Q). Project-related vessels would be subject to U.S. Coast Guard (USCG) wastewater and discharge regulations and	Water Quality

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
	Onshore Project Area	Short- term increase in erosion and runoff due to land disturbance. Short-term impacts due to dewatering trenches and excavations. Short-term potential for accidental releases from onshore construction vehicles or equipment.	would operate in compliance with oil spill prevention and response plans that meet USCG requirements. Specifically, all Project vessels would comply with USCG standards in U.S. territorial waters to legally discharge uncontaminated ballast and bilge water as well as standards regarding ballast water management. While outside the 3.0-nautical mile (5.6 kilometer) state-border/no-discharge zone (NDZ), vessels would deploy a USCG-certified marine sanitation device (MSD) with certifications displayed. While inside the 3.0 nautical mile (5.6 kilometer) state-border/NDZ, vessels would take normal vessel procedures to close off MSD-effluence discharge piping and redirect it to onboard “Zero-Discharge Tanks” for appropriate disposal either at dock or outside of an NDZ. Additionally, all vessels less than 79 feet (24 meters) would comply with the Small Vessel General Permit issued by USEPA on September 10, 2014, for compliance with National Pollutant Discharge Elimination System permitting. Prevention and response measures for accidental spills and releases are further described in Appendix Q, *Oil Spill Response Plan.* • Dominion Energy would avoid or minimize excavation dewatering in the location of the Battlefield Golf Club. • Dominion Energy would develop a SWPPP for construction activities that would conform with the Virginia Department of Environmental Quality Construction General Permit, Dominion Energy’s approved Annual Standards and Specifications for Erosion and Sediment Control (ESC) and Stormwater	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Management (SWM) for Electric Transmission Line Development, and local pollution prevention and spill response procedures. The SWPPP would include steps that Dominion Energy must take to comply with the permit, including water quality requirements, and discuss the potential to encounter contaminated groundwater during excavation near the Battlefield Golf Club. The SWPPP would discuss how to protect surface water and groundwater quality if contaminated groundwater is encountered. • Dominion Energy would restrict access to only existing paved roads and approved access roads at wetland and stream crossings where possible. • Dominion Energy would restrict access through wetlands and waterbodies to identified construction sites, access roads, and work zones. • Dominion Energy would conduct onshore refueling and/or maintenance of construction equipment and vehicles outside resource areas to the extent practicable. • Dominion Energy would implement an inadvertent return plan with use of non-toxic drilling fluids for review and approval by the appropriate regulatory agencies.	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
O&M	Offshore Project Area	Long-term effects due to WTG Monopile Foundations and Offshore Substation Jacket Foundations and associated scour protection. Short-term change in water quality due to oil spills or accidental release of fluids from vessels required during operations.	• Dominion Energy would use scour protection as necessary around the WTG Monopile Foundations and Offshore Substation Jacket Foundations and cable protection mats to minimize effects of local sediment transport. • Dominion Energy would subject Project-related vessels to USCG wastewater and discharge regulations and ensure they operate in compliance with oil spill prevention and response plans that meet USCG requirements. Specifically, all Project vessels would comply with USCG standards in U.S. territorial waters to legally discharge uncontaminated ballast and bilge water as well as standards regarding ballast water management. While outside the 3.0 nautical mile (5.6 kilometer) state-border/NDZ, vessels would deploy a USCG-certified MSD with certifications displayed. While inside the 3.0-nautical mile (5.6-kilometer) state-border/NDZ, vessels would take normal vessel procedures to close off MSD-effluence discharge piping and redirect it to onboard “Zero -Discharge Tanks” for the appropriate disposal either at dock or outside of an NDZ. Additionally, all vessels less than 79 feet (24 meters) would comply with the Small Vessel General Permit issued by USEPA on September 10, 2014, for compliance with National Pollutant Discharge Elimination System permitting. Prevention and response measures for accidental spills and releases are further described in Appendix Q, *Oil Spill Response Plan*. • Dominion Energy would develop an SWM Plan and ESC Plan ESC in accordance with Dominion Energy’s approved Annual	Water Quality
	Onshore Project Area	Long-term effects due to stormwater runoff.		

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Standards and Specifications for SWM and ESC for Electric Transmission Line Development, and local ordinances as applicable. Routinely inspect and clean on-site stormwater control features to remove debris or excess vegetation that may impede the designed functionality. The SWM plan would describe how the stormwater control facilities would be operated and maintained after construction is complete.	
Construction; Decommissioning	Onshore Project Area	Installation of permanent structures within wetlands, wetland transition areas, riparian areas, and protected watersheds. The permanent conversion of existing wetland cover types. The temporary removal of vegetation within wetlands, wetland transition areas, riparian buffers, and protected watershed features. Erosion of sediment from construction activities into adjacent wetlands and waterbodies. The potential for an inadvertent release of non-toxic drilling fluids to the surface during horizontal directional drilling (HDD) activities The potential for accidental releases from construction vehicles or equipment.	• Dominion Energy would collocate Onshore Project Components in existing rights-of-way (ROWs), existing roads, previously disturbed areas, and otherwise urbanized locations to the maximum extent practicable. • Dominion Energy would site permanent structures outside of protected watershed features and flood-prone areas to the maximum extent practicable. • Dominion Energy would use a combination of HDD and overhead routing to the best extent practicable to avoid and minimize impacts on natural resources. • Dominion Energy would purchase stream and wetland mitigation credits in the applicable service area of a mitigation bank or contribute to an approved in-lieu-of-fee program, such as the Virginia Aquatic Resources Trust Fund Program, prior to construction to mitigate unavoidable impacts on wetlands and waterbodies. • Dominion Energy would restrict access during construction to existing paved roads or access roads constructed for stream or waterbody crossings. Where necessary, access would also be restricted to avoid	Wetlands

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			alteration of soil properties (compaction) that may result in unintended impacts. • Dominion Energy would use temporary avoidance/minimization efforts for wetland access where avoidance is not possible. These efforts would include use of temporary timber mats, using 8- to 12-inch (20- to 30-centimeter)-thick timber, for heavy machinery movement and to avoid unintended impacts on wetlands such as soil compaction, damage to root systems, and development of ruts. • Dominion Energy would develop an invasive species control plan to prevent the spread of invasive species throughout the maintained ROWs and recently disturbed locations. Only agency-approved native species would be replanted, and all plans would be guided by desktop and on-the-ground evaluation of invasive species present in the area. • Dominion Energy would develop a compensatory mitigation plan, where permanent conversion of wetlands is unavoidable, to include on-site mitigation where practicable, off-site mitigation, or purchase of mitigation credits. This mitigation plan would be further refined as a component of the U.S. Army Corps of Engineers (USACE) permitting package. • Dominion Energy would restrict access through wetlands except where approved by regional and local regulatory entities. • Dominion Energy would develop and implement erosion and sediment control plans in compliance with Dominion Energy's Virginia Department of Environmental	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Quality-approved Standards and Specifications for Erosion and Sediment Control and Stormwater Management for Electric Transmission Line Development and appurtenant facilities such as substations and switching stations, as well as any additional requirements specific to the U.S. Department of Defense (DoD) lands (if applicable). • Dominion Energy would install temporary timber matting for access routes through wetlands to protect vegetation to reduce compaction, minimize ruts, and reduce soil discharge. • Dominion Energy would develop and implement an inadvertent release plan with use of non-toxic drilling fluids to be reviewed and approved by the appropriate regulatory agencies. • Dominion Energy would manage accidental spills or releases of oils through a spill prevention, control, and countermeasures plan for approval by the appropriate regulatory agency.	
O&M	Onshore Project Area	It is not anticipated that Project-related activities in association with O&M would result in new impacts on wetlands and waterbodies.	• Dominion Energy would take protective measures to prevent access to any active operation area including, but not limited to, security and safety fencing. • Dominion Energy would monitor revegetation throughout the life of the Project and leading up to decommissioning. Monitoring would comply with a restoration plan and invasive species control plan. Monitoring would serve as the primary measure for ensuring return of wetland, waterbody, and special area	Wetlands

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			functionality following completion of construction and during necessary O&M. • Dominion Energy would monitor mitigation efforts where appropriate and define via the approved permitting package. • Dominion Energy would assess and maintain stormwater control and treatment features on a regular interval, as specified in the SWPPP. This would include removal of debris and a determination of functionality.	
Construction; Decommissioning	Onshore Project Area	Vegetation removal associated with installation of all Onshore Project Components. The inadvertent release of drilling fluids to the surface during HDD activities within environmentally sensitive areas. Noise and light activities associated with construction equipment and other noise-generating activities associated with construction Impedance to local migration of terrestrial biota (such as reptiles and amphibians) from installation and placement of erosion- and sediment-control measures such as staggered silt fencing or stabilization matting. Accidental releases of petroleum products from construction vehicles or equipment. Potential for erosion into adjacent vegetation and wildlife habitat. Conversion of existing vegetation cover types (e.g., forested to herbaceous) where the onshore	• Dominion Energy would collocate Onshore Project Components in or adjacent to existing ROWs, existing roads, previously disturbed areas, and other urbanized locations to the maximum extent practicable. • Dominion Energy would seed and stabilize construction areas involving temporary vegetation clearing with an appropriate grass seed mix (in urban areas) or native seed mix (in natural areas) and in accordance with Virginia Erosion and Sediment Control Law and Regulations (Virginia Department of Environmental Quality [VDEQ] 2014) and the Virginia Erosion and Sediment Control Handbook (VDEQ 1992). • Dominion Energy would prepare and submit a mitigation planting plan to the City of Virginia Beach for approval to address unavoidable temporary impacts that would occur within sensitive ecological areas (such as within the Southern Rivers Watershed). The City of Virginia Beach may require native plantings. • Dominion Energy would plant or seed larval host plants and forage plants in the Interconnection Cable Routes after	Terrestrial Vegetation and Wildlife

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		routes are not collocated with existing road corridors or utility ROWs. Permanent fragmentation of habitat as a result of clearing, particularly of large contiguous forested wetland habitats. Colonization and establishment of invasive vegetation in formerly undisturbed areas due to clearing. Impacts to locally rare or sensitive species and natural communities.	construction efforts have been completed in order to avoid and minimize impacts on pollinator species. A list of regionally appropriate species as well as regional suppliers of native seed mixes are available from the U.S. Department of Agriculture Natural Resources Conservation Service (2020). • Dominion Energy would develop and implement an inadvertent release plan with use of non-toxic drilling fluids to be reviewed and approved by the appropriate regulatory entities. • Dominion Energy would coordinate with the U.S. Fish and Wildlife Service (USFWS), Virginia Department of Wildlife Resources (VDWR), and Virginia Natural Heritage Program to ensure potential impacts on threatened and endangered (T&E) species are avoided and minimized to the maximum extent practicable. • Dominion Energy would evaluate time-of-year restrictions for applicable T&E species via coordination with the USFWS, VD WR, and Virginia Natural Heritage Program. • Dominion Energy would limit lighting associated with construction vehicles and work zones when possible to reduce interaction with or disturbance of wildlife species such as bats and insectivorous birds. • Dominion Energy would initiate coordination with the VDWR and Virginia Natural Heritage Program to evaluate potential impacts on T&E reptile and amphibian species, including the canebrake rattlesnake.	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy would install staggered silt fencing in areas surrounding wetlands, waterbodies, and areas with the potential to contain T&E species, rare natural communities, and habitat for reptiles and amphibians. Staggered gaps would ensure reptiles and amphibians could continue to move relatively unrestricted through the Onshore Project area. This strategy would be employed on a site-specific basis following coordination with VDWR and the Virginia Natural Heritage Program. • Dominion Energy would, when applicable, employ snake-friendly erosion-control blankets containing natural or biodegradable fibers or loose-weave netting in areas surrounding wetlands, waterbodies, and areas with the potential to contain habitat for reptiles and amphibians. • Additional mitigation strategies would be adhered to in accordance with VDWR consultation regarding impacts on canebrake rattlesnake habitat if determined to be necessary. • Dominion Energy would restrict vehicular access to paved roads, approved road crossings, and designated construction areas. • Dominion Energy would manage accidental spills or releases of oils through a spill prevention, control, and countermeasures plan approved by the appropriate regulatory entity. • Dominion Energy would develop and implement erosion and sediment control plans in compliance with Dominion Energy's	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			VDEQ-approved Standards and Specifications for ESC and Stormwater Management (SWM) for Electric Transmission Line Development and appurtenant facilities such as substations and switching stations. • Dominion Energy would prepare and maintain a SWPPP in compliance with Virginia Pollution Discharge Elimination System VAR10 Construction General Permit. A permit would be required because the land-disturbing activity would exceed 1.0 acre (0.4 hectare). As a component of the permit, the SWPPP would be prepared and maintained throughout Project construction and retained for 3 years following construction completion as required by Virginia Law. • Dominion Energy would restrict construction access to existing paved roads or access roads constructed for stream or waterbody crossings. Where possible, restrict access to avoid alteration of soil properties (compaction) that may result in unintended impacts. • Dominion Energy would use temporary timber mats in wetlands, using 8- to 12-inch (20- to 30-centimeter)-thick timber, for heavy machinery movement and to avoid unintended impacts on wetland soils. • Dominion Energy would develop an invasive species control plan to prevent the spread of invasive vegetation into natural communities via maintained ROWs and recently disturbed locations. Replanting would be an approved use of native species only, and all plans	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			would be guided by desktop and on-site evaluation of invasive species present in the area. • Dominion Energy would develop and implement a landscape restoration plan in compliance with applicable local and regional ordinances, paying specific attention to re-seeding and replanting with native plant stock. • Dominion Energy would revegetate temporary access areas with native plants and/or an appropriate native seed mix. • Dominion Energy would develop standard best management practices (BMPs) to reduce the spread of invasive species to previously uncolonized areas that would be incorporated into the invasive species control plan and implemented during construction. Resources detailing BMPs to prevent the introduction and spread of invasive species are recommended by the U.S. Department of Agriculture National Invasive Species Information Center (NISIC), and a comprehensive guide was published by the University of Georgia in 2011 (USDA NISIC 2020; Moorhead et al. 2011). • Dominion Energy would coordinate with the USFWS, VDWR, and the Virginia Natural Heritage Program to avoid impacts on rare and T&E species or natural communities to the greatest extent practicable, and to identify additional minimization and mitigation measures if necessary. • Dominion Energy would develop and implement invasive species control and landscape restoration plans to prevent the	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			introduction and spread of invasive species and to facilitate restoration of disturbed habitats. • Dominion Energy would develop a compensatory mitigation plan, where permanent conversion of wetlands is unavoidable, to include on-site mitigation where practical, off-site mitigation, or purchase of mitigation credits or payment of an in-lieu fee mitigation as appropriate. This mitigation plan would be further refined as a component of the USACE permitting package.	
O&M	Onshore Project Area	Conversion of existing vegetation cover types as a result of permanent access roads, structures, and facilities in previously vegetated areas. Vegetation disturbance as a result of routine or periodic facility maintenance (e.g., invasive species control, herbicide applications, and mowing) throughout the lifetime of the facility. Noise or light disturbance associated with routine facility maintenance and activities (at permanent facilities such as substations) throughout the lifetime of the facility.	• Dominion Energy would implement an invasive species control plan to avoid the spread of invasive species for the lifetime of the Project, and provide the plan for agency review and approval, as applicable. • Dominion Energy would limit unauthorized access of Onshore Project personnel and vehicles beyond existing disturbed areas and approved access roads to the extent practicable. • Dominion Energy would plant and seed desirable noninvasive native species within the ROWs to reduce establishment of invasive woody vegetation requiring control. • Dominion Energy would adhere to all federal, state, and local laws and regulations pertaining to herbicide application. If herbicides are to be used in wetland habitats, use wetland-safe herbicide to avoid unintended impacts on sensitive wetland wildlife and vegetation. • During operations, the Project will be in compliance with relevant City of Virginia	Terrestrial Vegetation and Wildlife

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Beach and City of Chesapeake noise requirements. If the final design engineering requires sound mitigation measures, they will be implemented within the Project footprint, as necessary. • Dominion Energy would implement lighting-reduction measures, such as downward projecting lights, lights triggered by motion sensors, and limiting artificial light to the extent practicable, to avoid disruption to nocturnal avian and bat species. • Dominion Energy would take protective measures to prevent access to any active operation area including, but not limited to, security and safety fencing. • Dominion Energy would monitor revegetation throughout the life of the Onshore Project and leading up to decommissioning. Monitoring would comply with the approved landscape restoration plan and invasive species control plan, as required by the City of Virginia Beach and the City of Chesapeake, as well as an invasive species control plan. Monitoring would serve as the primary measure for ensuring return of natural habitat functionality following completion of construction and necessary operation. • Dominion Energy would employ vegetation control methods, including application of herbicides for maintenance of ROWs that would comply with all applicable federal, state, and local laws and regulations.	
Construction; Decommissioning	Offshore Project Area	Short-term attraction to, and potential collision with, Project-related vessels	• To mitigate impacts from lighting, Dominion Energy would use BMPs identified by BOEM COP guidelines (BOEM 2020) and would	Avian and Bat Species

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		and partially installed Offshore Project Components. Short-term disturbance of, and displacement from, offshore habitat.	comply with Federal Aviation Administration (FAA) and USCG requirements for lighting while, to the extent practicable, using lighting technology (e.g., low-intensity strobe lights) that minimize impacts on avian and bat species. • Dominion Energy would document any dead or injured birds or bats found on Project vessels or structures during the construction stage of the Project and would submit an annual report to BOEM and USFWS (any birds found with federal bands will be reported to the U.S. Geological Survey [USGS] Bird Band Laboratory).	
Construction; Decommissioning	Onshore Project Area	Disturbance of, and displacement from, onshore habitat.	• Dominion Energy would avoid potential effects to birds and bats by using trenchless installation techniques in coastal areas at the Cable Landing Location; collocating the Onshore Export Cable Route with existing roads as much as possible; and timing construction activities to avoid critical periods when endangered and threatened species may be affected to the extent practicable. • If either or both of the Harpers or Chicory Switching Stations are constructed, then they would be constructed within either previously developed areas associated with an existing golf course or small areas of mixed forest and woody wetland. Some tree and vegetation clearing will be required, but will be minimized to the extent practicable. • To the extent practicable, Dominion Energy would collocate the Interconnection Cable Route within or adjacent to existing transmission line corridors and ROWs as much as possible, timing construction	Avian and Bat Species

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			activities to avoid critical periods when endangered and threatened species may be affected. • Tree/vegetation clearing would avoid trees favorable for bat maternity roosting locations and would be conducted outside of the breeding/roosting season to avoid nesting birds and bat maternity roosting locations to the extent practicable. • Dominion Energy will conduct presence/absence surveys for bats (acoustic and/or mist-net) along the Onshore Project area, pursuant to discussions with VDWR, USFWS, and appropriate regulatory agencies beginning May 2022 and approval of a bat survey plan. • Dominion Energy conducted an eagle/osprey/raptor nest survey along the Interconnection Cable Route in March 2022 of the Onshore Project area, pursuant to discussions with VDWR, USFWS, and appropriate regulatory agencies. • Where surveys indicate the presence of species of conservation concern, Dominion Energy would work with the VDWR and USFWS to minimize potential impacts prior to construction. • Dominion Energy would maintain a minimum no-tree-clearing buffer of 150 feet (45 meters) around any known northern long-eared bat (*Myotis septentrionalis*) maternity roosts following the final 4(d) rule for the species (USFWS 2016). • Dominion Energy would develop avoidance and minimization measures in coordination with the VDWR, USFWS, and appropriate	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			regulatory agencies to ensure protection of threatened and endangered species or to address the potential for incidental take, that may occur within the Project Area. • Dominion Energy would ensure avoidance, minimization, and mitigation measures protective of wetlands, vegetation, and other wildlife species discussed in Section 4.2.1, *Wetlands and Waterbodies*, and Section 4.2.2, T*errestrial Vegetation and Wildlife*, also would be protective of bird and bat species and their habitats.	
O&M	Offshore Project Area	Long-term risk of collision with WTGs and Offshore Substations. Long-term displacement from the Lease Area due to presence of WTGs and Offshore Substations. Long-term attraction to and displacement from Project-related maintenance vessels.	• To mitigate the potential for collision with WTGs and Offshore Substations during O&M stage of the Project, Dominion Energy would use BMPs identified by BOEM COP guidelines (BOEM 2020) and comply with FAA and USCG requirements for lighting and, to the extent practicable, use lighting technology (e.g., low-intensity strobe lights, flashing red aviation lights) that minimize impacts on bat species. • To continue the advancement of the understanding of avian and bat activity in the offshore environment, Dominion Energy will continue operation of one Acoustic Thermographic Offshore Monitoring System two additional years to inform the development of the CVOW Commercial Project as the CVOW Pilot WTGs are installed adjacent to the west side of the CVOW Commercial lease. • Dominion Energy will provide Motus Wildlife Tracking tags to the USFWS, which is currently studying the movements of piping plovers in the region. The specific	Avian and Bat Species

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			deployment location will be determined in consultation with the USFWS. • Dominion Energy will purchase satellite tags to be attached to Rufa red knots (*Calidris canutus*; rufa subspecies). These tags will provide accurate data on Rufa red knot movements onshore, offshore, and flight heights that can be related to weather data. The deployment location will be determined in consultation with USFWS. • Dominion Energy will fund a research project to study the Whimbrel (*Numenius phaeopus*). This study will be implemented by The Nature Conservancy and Center for Conservation Biology, and will include purchasing satellite tags, The Nature Conservancy and Center for Conservation Biology staff time associated with project implementation including data analysis, seasonal staff capacity to implement field work, seasonal housing and travel costs, field supplies, and tagging technology. • Dominion Energy plans to upgrade the current Motus network/antennas on both CVOW Pilot WTG platforms to a “dual-mode” (166 and 434 megahertz [MHz]) system with one station prioritized for 434 MHz and the other prioritized for 166 MHz in accordance with the updated USFWS guidance document. This antenna upgrade will increase the monitoring range from approximately 2 kilometers to approximately 15 kilometers and will remain in place for two years, expected to begin in late spring 2022. • Dominion Energy would reduce perching opportunities on offshore structures to the	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			extent practicable and, where possible, in compliance with health and safety requirements for the WTGs and Offshore Substations. • Dominion Energy would develop a robust post-construction monitoring plan with clear goals, monitoring questions, and methods, including monitoring that focuses on areas of uncertainty such as bird and bat presence offshored, and would install automated radio telemetry receiver stations (i.e., Motus towers) on select offshore structures. • Dominion Energy would document any dead or injured birds or bats found on Project vessels or infrastructure (offshore and onshore) during construction, O&M, or decommissioning, in an annual report submitted to BOEM and USFWS (any birds found with federal bands would be reported to the USGS Bird Band Laboratory). • Dominion Energy would limit risks of long-term displacement of offshore bird species, to the extent practicable. • Potential impacts would be further minimized by reducing lighting on O&M vessels to the extent practicable.	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
O&M	Onshore Project Area	Long-term risk of collision with overhead Interconnection Cables. Long-term displacement from onshore habitat at Onshore Project Components.	Dominion Energy would reduce potential impacts of the overhead lines by complying with Avian Power Line Interaction Committee (https://www.aplic.org/) best practices to reduce collision and electrocution.	Avian and Bat Species
Construction; Decommissioning	Offshore Project Area	Disturbance of softbottom habitat. Disturbance, injury, or mortality of benthic and pelagic species. Change in water quality, including turbidity, sediment deposition, and chemical contamination. Entrainment of plankton and ichthyoplankton. Increase in underwater noise and vibration.	• Dominion Energy would further microsite within the Offshore Export Cable Route Corridor to avoid such habitats where feasible to minimize the probability of adverse interactions with sensitive benthic resources. • The release of non-toxic drilling muds during Trenchless Installation activities is possible but unlikely. Dominion Energy would develop and implement an Inadvertent Release Plan that would include pollution prevention measures and spill response procedures covered by the SWPPP. • Dominion Energy would commit to using a soft-start procedure and noise mitigation systems such as bubble curtain technologies to avoid or minimize impacts on marine mammals, sea turtles, fishes, and mobile invertebrates. During pile-driving activities, Dominion Energy will implement near-field and/or far-field noise mitigation systems to minimize underwater sound propagation. Examples of near-field noise mitigation systems include the Hydro Sound Damper, the Noise Mitigation Sleeve or the AdBm Noise Mitigation System. Dominion Energy is	Benthic Resources

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			committed to the use of a double big-bubble curtain for far-field noise mitigation.	
O&M	Offshore Project Area	Long-term conversion of softbottom to artificial hardbottom habitat and introduction of vertical infrastructure to the water column. Habitat creation for nonindigenous species such as invasive tunicate (*Didemnun vexilium*). Increase in shading and artificial lights. Increase in underwater noise and vibration. Change in water quality, including fuel and chemical spills. Introduction of Project-related electromagnetic fields (EMF).	• Dominion Energy does not expect the installation of hard structure to introduce nonindigenous species to the Project Area; however, existing species in the area may colonize or become associated with the structures once they are installed (e.g., lionfish). • As required by USCG for navigational safety, artificial lights would be installed on all Project structures. • Dominion Energy would develop and implement an Oil Spill Response Plan describing measures to avoid accidental spills and protocols to be implemented should a spill occur. Dominion Energy also would require all Project-related vessels to operate in accordance with laws regulating at-sea discharges of vessel -generated waste. • Dominion Energy would commit to burying Project-related cables wherever feasible to minimize detectable EMF.	Benthic Resources
Construction; Decommissioning	Offshore Project Area	Short-term disturbance of habitat. Short term loss of local prey species. Short-term introduction of marine debris. Short-term increase in risk of entanglement and entrapment. Short-term increase in underwater noise. Short-term increase in risk of ship strike due to the increase in vessel traffic.	• Dominion Energy has sited Offshore Project Components, including WTG Monopile and Offshore Substation Jacket Foundations and Offshore Export Cable Route Corridors, to avoid sensitive benthic habitats and minimize disturbance of benthic features to the extent practical. • Dominion Energy would implement practices to prevent Project personnel from commencing or continuing certain construction activities should marine mammals be observed within monitoring and	Marine Mammals

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		Short-term change in water quality, including oil spills.	exclusion zones based on required NOAA Fisheries monitoring and mitigation protocols and stipulations of the Lease. • During pile driving of WTG Monopile and Offshore Substation Jacket Foundations, Dominion Energy would apply monitoring and exclusion zones as appropriate to underwater noise assessments and impact thresholds. • Qualified NOAA Fisheries-approved Protected Species Observers, real-time monitoring systems, Passive Acoustic Monitoring systems, and reduced visibility monitoring tools (e.g., night vision, infrared, and/or thermal cameras) will be employed to enforce these zones. • Construction personnel will employ soft starts and shutdown procedures as appropriate to thresholds of noise-emitting survey equipment; soft starts will last 30 minutes at the onset of pile driving. • Dominion Energy would use commercially and technically available noise-reducing technologies as appropriate and will provide marine mammal sighting and reporting training for each specific stage of construction to emphasize individual responsibility for marine mammal awareness and protection. • Dominion Energy would ensure continued engagement with regulatory agencies regarding potential best practices. • All Project-related vessels larger than 65 feet (20 meters) will be required to abide by speed restrictions when transiting within the	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Seasonal Management Area (SMA) from November 1 to April 30. • Dominion Energy would conduct monitoring of NOAA's website for updates to Dynamic Management Area (DMA) locations. • All Project-related vessels will be required to comply with the Ship Strike Reduction Rule speed restrictions within the Mid-Atlantic U.S. SMA and any DMA that intersects the Study Area (10 knots [18.5 kilometers/hour] or less for vessels 65 feet [20 meters] or longer). • Dominion Energy would require Project-related vessels to maintain a distance of 328 feet (100 meters) or greater from all marine mammals and 1,640 feet (500 meters) from North Atlantic right whales. Vessels larger than 300 gross tons (305 metric tons) will receive whale sighting updates and vessel speed reminders when transiting North Atlantic right whale territory by reporting to the North Atlantic right whale Mandatory Ship Reporting System. • Project personnel, particularly marine mammal observers, will check the NOAA Fisheries website for DMA locations. • Dominion Energy would provide Project personnel with marine mammal sighting, take and harassment, and reporting training to emphasize individual responsibility for marine mammal awareness and protection. • Dominion Energy has also developed an Oil Spill Response Plan (COP Appendix Q; Dominion Energy 2022)), proposing measures to avoid inadvertent releases and spills and a protocol to be implemented	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			should an event occur. Project-related vessels will operate in accordance with laws regulating at-sea discharges of vessel-generated waste.	
O&M	Offshore Project Area	Modification of habitat. Project-related EMF. Project-related marine debris. Project-related underwater noise. Increase in risk for ship strike due to the increase in vessel traffic. Changes in water quality, including oil spills.	• Dominion Energy proposes to use heating, ventilation, and air conditioning (HVAC) cables for the Project; such cables emit EMF below levels documented to have adverse effects on fish or marine mammal behavior. • Dominion Energy would require all Project personnel to implement appropriate practices and protocols to prevent the release of marine debris. • Dominion Energy would implement several measures to avoid, minimize, and mitigate marine mammal physical disturbances, strikes, and collisions. • All Project-related vessels will be required to comply with the Ship Strike Reduction Rule speed restrictions within the Mid-Atlantic United States. SMA and any DMA that intersects the Project Area (10 knots [18.5 kilometers/hour] or less for vessels 65 feet [20 meters] or longer). • Dominion Energy would require Project-related vessels to maintain a distance of 328 feet (100 meters) or greater from all marine mammals and 1,640 feet (500 meters) from North Atlantic right whales. • Vessels larger than 300 gross tons (305 metric tons) will receive whale sighting updates and vessel speed reminders when transiting North Atlantic right whale territory by reporting to the North Atlantic right whale Mandatory Ship Reporting System.	Marine Mammals

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Project personnel, particularly marine mammal observers, will check the NOAA Fisheries website for DMA locations. • Dominion Energy would provide Project personnel with marine mammal sighting and reporting training to emphasize individual responsibility for marine mammal awareness and protection. • Dominion Energy has also developed an Oil Spill Response Plan (Appendix Q) proposing measures to avoid inadvertent releases and spills and a protocol to be implemented, should a potential vessel oil and fuel spill or contaminant release from resuspended sediments occur. • Project-related vessels will operate in accordance with laws regulating at-sea discharges of vessel-generated waste.	
Construction; Decommissioning	Offshore Project Area	Short-term disturbance of habitat. Short-term loss of local prey species. Short-term increase in construction-related lighting. Short-term introduction of marine debris. Short-term increase in risk of entanglement and entrapment. Short-term increase in underwater noise. Short-term increase in risk of ship strike due to the increase in vessel traffic. Short-term change in water quality, including oil spills.	• Dominion Energy has sited Offshore Project Components, including WTG and Offshore Substation Foundations and Offshore Export Cable Route Corridors, to avoid sensitive benthic habitats and minimize disturbance of benthic features to the extent practical. • Dominion Energy would require all offshore personnel and vessel contractors to implement appropriate debris control practices and protocols to prevent the accidental release of marine debris. All Project-related vessels would operate in accordance with regulations pertaining to at-sea discharge of vessel-generated waste. • Dominion Energy would implement the following measures as appropriate to avoid,	Sea turtles

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			minimize, and mitigate potential impacts of construction-related underwater noise: o Implement monitoring and exclusion zones where pile-driven foundations are installed, enforced by qualified NOAA Fisheries-approved Protected Species Observers. o Implement real-time monitoring systems. o Employ soft starts and shutdown procedures where technically feasible. o Employ soft starts for a duration of 30 minutes at the onset of pile-driving activities. o Use reduced visibility monitoring tools/technologies (e.g., night vision, infrared, and/or thermal cameras). o Use commercially and technically available noise-reducing technologies. o Provide sea turtle sighting and reporting procedures for appropriate Project-related personnel specific to construction and its potential impacts on sea turtles. • Dominion Energy would also ensure continued engagement with regulatory agencies regarding potential best practices. • Dominion Energy has developed an Oil Spill Response Plan (Appendix Q), detailing all proposed measures to avoid accidental spills and a protocol to be implemented should such an event occur. Additional information may be found in Section 4.4.12, *Public Health and Safety*. All Project-related vessels would operate in accordance with regulations pertaining to at-sea discharge of vessel-generated waste. • Dominion Energy would provide a full decommissioning plan to the appropriate	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			regulatory agencies for approval prior to decommissioning activities, and potential impacts will be re-evaluated at that time.	
Operations and Maintenance	Offshore Project Area	Modification of habitat. Project-related EMF. Project-related lighting. Project-related marine debris. Project-related underwater noise. Increase in risk for ship strike due to the increase in vessel traffic. Changes in water quality, including oil spills.	• Dominion Energy has identified areas where sufficient cable burial is achievable, further buffering the pelagic environment from cable EMF, and cable protection would serve as an alternative barrier where sufficient cable burial is not feasible. • Dominion Energy would consult appropriate regulatory agencies regarding operational lighting requirements. • Dominion Energy would require all offshore personnel to implement appropriate practices and protocols to avoid and minimize the release of marine debris. • Dominion Energy would implement the following measures as appropriate to avoid, minimize, and mitigate potential vessel-related impacts: o Vessel speed restrictions while transiting to and from the review area. o Vessel collision avoidance measures for vessels working in or transiting to and from the Project area, including a 164 feet (50 meters) separation distance from all sea turtle species. • Dominion Energy has developed an Oil Spill Response Plan (Appendix Q) that details all measures proposed to avoid an inadvertent spill of vessel oil or fuel and a protocol to be implemented should such an event occur. • Dominion Energy would implement the following measures as appropriate to avoid, minimize, and mitigate potential impacts on water quality:	Sea Turtles

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			o Vessel operation in accordance with regulations pertaining to at-sea discharges of vessel-generated waste.	
Construction; Decommissioning	Offshore Project Area	Disturbance to submerged marine archaeological and cultural resources.	• Dominion Energy will develop an operations plan prior to construction, to ensure that construction activities adhere to the recommended avoidance buffers. • Design and construction methods, including micrositing opportunities, will continue to be evaluated in order to avoid or minimize the extent of seabed disturbance and adverse effects to historic properties. • Disturbance to known resources that cannot practicably be avoided would only occur with appropriate consultations (i.e., BOEM, State Historic Preservation Offices, Tribal Historic Preservation Officers) and approvals. • Additional archaeological investigation of resources that cannot be avoided may be needed to determine whether they are historic properties and to fully assess Project effects on them. • Dominion Energy would develop and implement an Unanticipated Discoveries Plan to avoid and mitigate impacts on unknown resources.	Cultural Resources
O&M	Offshore Project Area	Disturbance to submerged marine archaeological and cultural resources.	• Repairs and other future activities will only occur within previously disturbed portions of the area of potential effects (APE) which have been previously assessed by the QMA. • Adherence to the QMA recommended avoidance buffers would remain in effect during operations.	Cultural Resources

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
Construction; Decommissioning	Onshore Project Area	Short-term visual impacts during offshore construction activities. Short-term visual impacts during onshore construction activities.	• Dominion Energy would implement a Fugitive Dust Plan to minimize dust and visual pollution. The Onshore Project area would be maintained free of debris, trash, and waste to the extent possible during construction, and areas temporarily disturbed during construction would be restored to the conditions required by state and/or local permits.	Visual Resources
O&M	Onshore Project Area	Long-term visual effects from the presence of Onshore Project Components.	• Dominion Energy would evaluate vegetative screening to help screen views of the Onshore Substation and Switching Station and design the lighting of the Onshore Substation and Switching Station to reduce light pollution where feasible (e.g., downward lighting, motion-detecting sensors). • Dominion Energy would consult with the U.S. Navy, City of Virginia Beach, and the City of Chesapeake to evaluate color treatment and other visual impact mitigations for Switching Station and the Onshore Substation.	Visual Resources
Construction; Decommissioning	Onshore Project Area	Short-term increase in spending on construction materials and services and related economic activity in the region (Hamptons Road area) and state (Virginia). Short-term increase in construction-related employment and income in the region and state. Short-term increase in tax revenues for state and local governments. Short-term increase in the demand for housing. Potential short-term effects to property values.	• Project-related vessels transiting to the Lease Area would be consistent with existing vessel traffic off the coast of Virginia. • Dominion Energy would coordinate with local fire and police departments as needed throughout construction of the Project.	Demographics

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		Short-term increase in the demand for public services.		
O&M	Onshore Project Area	Long-term increase in spending on O&M and related economic activity in the region. Long-term increase in O&M-related employment and income in the region. Long-term increase in tax revenues for state and local governments. Long-term increase in demand for housing. Long-term increase in the demand for public services. Long-term change in property values due to O&M activities.	• Dominion Energy would coordinate with local fire and police departments as needed throughout operation of the Project.	Demographics
Construction; Decommissioning	Onshore Project Area	Short-term increase in construction vehicle traffic and activity. Temporary shortage of affordable temporary housing due to increased demand. Short-term increase in tax revenues for state and local governments. Short-term increase in construction-related employment and income in the region and state. Short-term increase in the demand for public services.	• Dominion Energy would coordinate with local fire and police departments as needed throughout construction of the Project. • The Project would use existing roads, ROWs, and infrastructure where possible. • Communications and outreach to foster the meaningful public participation of potential environmental justice communities is ongoing to better understand how communities may be affected and identify related mitigation measures.	Environmental Justice
O&M	Onshore Project Area	Decrease in availability of long-term housing due to in-migration of operations workers. Long-term presence of Offshore Project Components in the Lease	• Dominion Energy has attempted to site the Offshore Project area where it would have the least impact on commercial fishing. Further, the addition of Offshore Project Components (WTGs and scouring) would facilitate natural reef building which can	Environmental Justice

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		Area (e.g., wind turbine generators [WTGs] and Offshore Substations). Long-term presence of Onshore Project Components. An increase in O&M-related vehicle traffic. Long-term increase in local and regional government tax revenues. Long-term increase in O&M-related employment and income in the region. Long-term increase in the demand for public services.	increase overall species abundance and diversity. This may have positive benefits for the fishing industries in the area. • Dominion Energy is committed to coexistence with commercial and recreational fishing and is conducting extensive outreach and engagement with the fishing community as part of this Project, which will assist in identifying additional environmental justice populations that may rely on the Offshore Project area for fishing and who may require additional engagement. • Dominion Energy would coordinate with local fire and police departments as needed throughout the operations period of the Project.	
Construction; Decommissioning	Onshore Project Area	Short-term disruption to adjacent land uses at the Cable Landing Location and along the Onshore Export Cable Route and Interconnection Cable Route Corridors, including recreational uses associated with the SSMR property within the Onshore Export Cable Route Corridor. Direct disturbance during construction and installation of the Onshore Export Cable Route, Switching Station, Interconnection Cable Route, and Onshore Substation.	• A schedule showing the months when construction would occur is provided in Section 1, Table 1.1-3. • To avoid disruption of recreational uses, installation of the Onshore Export Cable would be coordinated with localities and stakeholders to avoid and minimize potential impacts on recreational and tourism uses to the extent practicable. Once construction is complete, the roads and parking lots would be restored to previous conditions. • To further minimize potential construction effects, adjacent landowners would be provided timely information regarding the planned construction activities and schedule, and work also would be coordinated with appropriate regulatory agencies. Dominion Energy would provide regular updates to the local community through social media, public	Land Use and Coastal Infrastructure

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			notices, and/or other appropriate communications tools. • Temporary safety zones would be implemented around construction activities to ensure the safety of the public. • Dominion Energy would provide regular updates to the local community through social media, public notices, and/or other appropriate communications tools. • Any additional temporary staging areas necessary to support onshore construction activities are anticipated to be located on either previously disturbed lands or within the area of disturbance for construction, to the extent practicable. • During construction, the Project would additionally involve temporary construction laydown area(s). The portion of the parcel not required for long-term operation of the Onshore Substation would be restored to previous conditions once construction is complete.	
O&M	Onshore Project Area	Long-term conversion of land for the access to facilities of Onshore Export Cable, Switching Station, Interconnection Cable Route, and the Onshore Substation.	• If necessary, permitting, regulatory actions, and other actions would be taken in the future for development of the Interconnection Route as part of the Preferred Alternative if direct land use displacement, land acquisitions, or re-zonings are required. • Dominion Energy intends to coordinate with permitting authorities and stakeholders to identify what, if any, land use may continue within land acquired for the Interconnection Route, as well as any additional mitigation measures that may be appropriate related to impacts on local land use and resources	Land Use and Coastal Infrastructure

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			during construction and operations and maintenance.	
Construction; Decommissioning	Onshore Project Area	Short-term increase in Project-related construction vehicle traffic, including workforce commuting trips. Temporary modification of roadway traffic patterns due to lane closures, street closures, and travel restrictions (e.g., one-way traffic, alternating traffic).	• Dominion Energy would develop a Traffic Management Plan (TMP) in coordination with, and approved by, the affected federal, state, and local agencies as applicable to offset any anticipated traffic-related impacts associated with increased vehicle demand during construction. As part of the preparation of the TMP, Dominion Energy would coordinate with local and state transportation and public works departments to identify any planned roadway improvements that may impact traffic operations within the Transportation and Traffic geographic analysis area. The TMP would include, but not be limited to, the development of vehicular travel routes to and from the Project construction site; provision of highly visible markings, signage, and lighting of active construction sites; provision of sufficient on-site parking; and implementation of temporary, localized construction zones to minimize areas or sections of road closure. • Dominion Energy would provide regular updates to the local community through social media, public notices, and other appropriate communications methods and schedule construction activities to minimize impacts on the summer peak tourism season to the extent practicable where appropriate and as deemed necessary by local authorities.	Land Use and Coastal Infrastructure
O&M	Onshore Project Area	An increase in operation and maintenance vehicle traffic, including workforce commuting trips.	• Dominion Energy would develop a TMP that would offset any anticipated traffic-related impacts associated with increased vehicle	Land Use and Coastal Infrastructure

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			demand during construction in the same manner as described above for Project-related construction vehicle traffic.	
Construction; Decommissioning	Offshore and Onshore Project Area	Short-term displacement of marine users due to the establishment of safety zones around Project-related vessels and structures. Short-term displacement of recreational users onshore due to the establishment of safety zones around Project-related equipment and construction areas. Minor and temporary increases to local traffic during construction for the Onshore Project area.	• Dominion Energy would establish a Project-specific website to share information about the Project's construction progress with the community and to give guidance on the construction activities and how they may affect marine traffic in the area. Dominion Energy would also issue specific local notices to mariners (LNTMs) in coordination with USCG throughout the construction period. To ensure the safety of commercial and recreational mariners, temporary vessel restrictions may reduce access within the temporary Wind Turbine Generator work areas, the nearshore HDD area, and along the offshore installation corridor during construction. As appropriate, these areas would be marked and illuminated in accordance with USCG requirements and monitored by a security boat available to assist local mariners. • Dominion Energy would coordinate shoreline construction activities with localities and stakeholders to avoid and minimize conflicts with users to the extent practicable. In addition, Dominion Energy intends on coordinating construction activities with the Virginia SMR to avoid and minimize conflicts with recreational uses to the extent practicable. • To avoid disruption of recreational uses, installation of the Onshore Export Cable would be coordinated with localities and stakeholders to avoid and minimize potential impacts on recreational and tourism uses to	Recreation and Tourism

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			the extent practicable. Once construction is complete, the roads and parking lots would be restored to previous conditions. • Dominion Energy intends to coordinate construction activities to minimize impacts on the extent practicable and to provide regular updates to the local community through social media, public notices, and/or other appropriate communications tools. • Dominion Energy would not block roadways to the SMR vehicular traffic for long periods of time for onshore construction activities.	
O&M	Offshore and Onshore Project Area	Long-term modification of existing marine uses in the Offshore Project area. Long-term displacement of recreational activities in the Onshore Project area.	• Dominion Energy would notify recreational mariners of all non-emergency Project-related maintenance activities on its website and social media sites and work in accordance with the USCG requirements. When possible, Dominion Energy would schedule and plan maintenance activities to minimize impact and interruption to recreation and tourism activities in the Project Area. In order to maintain navigational safety for marine recreational users, Dominion Energy would place a radar beacon (RACON; radar responder) at the WTG site and light, individually mark, and maintain Private Aids to Navigation (PATON) per USCG Aids to Navigation (ATON) requirements. • When possible, Dominion Energy would schedule and plan maintenance activities to minimize impact and interruption to recreation and tourism activities in the Project Area.	Recreation and Tourism

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
Construction; Decommissioning	Offshore Project Area	Potential for temporary displacement of fishing activity. Potential for temporary disturbance to local commercial fish species. Potential for risk of gear entanglements on partially installed structures. Potential for increase in Project-related vessel traffic.	• Closures would be limited to discrete segments of the Offshore Project Components that would have restricted access on a temporary basis while construction is active. • Dominion Energy would work with fishermen and the head of marine construction operations to review operational planning and schedules in order to identity any areas where fishing operations may be temporarily displaced. Dominion Energy would also work with the USCG and make notices of area closures publicly available through LNTMs posted to Dominion Energy's website and social media. • Dominion Energy would work with those affected fishermen to minimize any potential impact. Dominion Energy would remain committed to coexistence with the commercial and recreational fishing industries. • Dominion Energy is planning to utilize underwater noise mitigation (e.g., bubble curtain or equivalent) to mitigate temporary impacts of pile driving on marine species. • The Fisheries Communications Plan (COP Appendix V; Dominion Energy 2022) developed for the Project, combined with the direct outreach activities anticipated during construction, would provide the fishing community with advance notice, prior to formal LNTM, describing the extent and duration of construction activities and locations of all fixed structures within the Offshore Project area, including partially installed structures within the safety zone.	Commercial and Recreational Fishing

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• For the safety of both mariners and Project technicians, Dominion Energy would establish safety zones around construction activities as applicable. Dominion Energy would notify all mariners via LNTM of the presence and location of partially installed structures. • Dominion Energy would ensure that all Project-related vessels follow appropriate navigational routes and communicate to other mariners via LNTM and/or radio communications to mitigate risks to the commercial and recreational fishing industries as well as other mariners.	
O&M	Offshore Project Area	Potential for loss of access to traditional fishing grounds, or temporary displacement of fishing activity during maintenance activities. Potential for modification of habitat and displacement of target commercial species. Potential for increased Project-related vessel traffic. Potential for positive beneficial increases in species diversity and abundance. Potential for impacts on marine radar/navigation instruments due to the presence of WTGs.	• Dominion Energy would continue to coordinate with existing commercial fishermen that utilize the Offshore Project area (largely using fixed gear [pots/traps and gillnets]) and emerging fisheries to ensure they can deploy and recover their gear safely during operations and maintenance. • Dominion will also ensure that the operation WTGs and Offshore Substations comply with USCG safety zones (should they become effective during the operational life of the Project) when offshore service vessels/crew transfer vessels are present and/or WTG technicians are aboard Project components, to ensure safe working conditions and safe vessel operation. • Dominion will also ensure that the operational wind turbine generators and Offshore Substations include adequate marking and lighting in accordance with USCG approved measures to ensure safe vessel operation.	Commercial and Recreational Fishing

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy is in the process of establishing partnerships with local and regional experts from institutions, including the Virginia Institute of Marine Science and the Virginia Aquarium to facilitate preparation of pre- and post-construction monitoring plans, driven by the stakeholders' interests and built upon existing data. • Dominion Energy would continue to ensure that all Project-related vessels follow appropriate navigational routes and other USCG "rules of the road," communicate via USCG LNTM, issue regular mariner updates and/or direct offshore radio communications to help mitigate risks to the commercial and recreational fishing industry as well as other mariners. • Dominion Energy would leverage its experience on this topic with the CVOW Pilot Project and would work with the USCG and the local fishing community to refine site-specific controls or settings that may help to mitigate potential interference of marine radar associated with the presence of Offshore Project Components.	
Construction; Decommissioning	Offshore Project Area	Temporary displacement of existing regional vessel traffic. Vessel allision risk with partially installed structures.	• Project-related vessel traffic would follow existing transit routes to the extent practicable and Dominion Energy would coordinate with USCG and local port authorities during the construction stage of the Project. • Project-related construction and vessel activities would be communicated to the maritime community by use of LNTMs in coordination with the USCG throughout the construction stage. This information would	Navigation

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			also be posted on Dominion Energy's social media pages and website. • The Project will require operational Automated Identification System (AIS) on all vessels associated with the construction, operation, and decommissioning of the Project, pursuant to USCG and AIS carriage requirements. AIS will be required to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. • To reduce the risks of vessel allision, Dominion Energy would mark potential hazards in coordination with USCG. • Dominion Energy would develop LNTMs that would include locations of partially installed structures. In addition, Dominion Energy would advise mariners of safety zones around all Offshore Project Components under construction and construction-related activities for the safety of mariners.	
O&M	Offshore Project Area	Long-term displacement of maritime vessels due to new fixed structures. Temporary diversion of maritime vessel traffic because of occasional O&M activities to the Offshore Project Components. Long-term vessel collision risk. Long-term vessel allision risk with WTGs and Offshore Substations.	• The WTG layout was designed to have a 397-foot (121-meter) buffer to the edges of the Lease Area to ensure that no structures would be outside of the Lease Area including the blades. • Dominion Energy would provide information to the USCG for publication in the LNTM, which provides schedules and locations for all O&M activities, and would continue to coordinate with the USCG. • All Offshore Project Components (i.e., infrastructure associated with the Project) would be charted on the relevant nautical charts (electronic and print) in conjunction with NOAA Fisheries. Dominion Energy	Navigation

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			would seek to have infrastructure charted prior to the start of the construction stage. This includes precise, planned Offshore Export Cable location information provided in spreadsheet and geographic information system formats. • Dominion Energy would follow all BOEM International Association of Marine Aids to Navigation and Lighthouse Authorities, and USCG lighting and marking requirements for each WTG.	
Construction; Decommissioning	Offshore Project Area	Short-term increase in Project-related vessel traffic due to the construction of Offshore Project Components. Short-term adjustments to military vessel traffic during offshore construction activities.	• Dominion Energy would schedule and track Project-related vessels to best manage congestion and traffic flow in coordination with the USCG, DoD, and other national security stakeholders. • Where practical, Project vessels would utilize transit lanes, fairways, and predetermined passage plans consistent with existing waterway uses. • Dominion Energy would continue to communicate and engage with key national security stakeholders, including the USCG, DoD, and others, to coordinate installation activities. • USCG would publish LNTMs and broadcast LNTMs to inform mariners and aviators of Project activities in the area. • Dominion Energy would publish an operations plan on the Project website to inform mariners and other interested parties on what work is being done in the Offshore Project area.	Other Uses

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy would establish and enforce safety zones around active construction areas. • Should USCG safety zone authorities not extend beyond 12 nautical miles (22 kilometers) at the time of construction, Dominion Energy would utilize a combination of safety vessels, LNTMs, and Convention on the International Regulations for Prevention of Collisions at Sea to promote both awareness of these activities and the safety of the construction equipment and personnel. Project vessels will also send and receive AIS signals for awareness and collision avoidance.	
Construction; Decommissioning	Onshore Project Area	Short-term disturbance at the Cable Landing Location and along the Onshore Export Cable Corridor.	• Once construction is complete, the lands, roads, and parking lots would be restored to previous conditions. • To minimize potential construction effects on DoD activities, DoD would be provided timely information.	Other Uses
O&M	Offshore Project Area	Long-term modification of existing waterway use. Long-term presence of new fixed structures (e.g., Offshore Project Components) in the Offshore Project area. Occasional diversion of national security maritime vessel traffic due to short-term inspection, repair, or replacement of Offshore Export Cables or Inter-Array Cables, and other such O&M activities.	• Dominion Energy may need to implement temporary safety zones (e.g., foundation locations and/or cable installation vessels) during O&M activities. • Dominion Energy would maintain regular communications and updates with all key national security stakeholders on timing and locations of maintenance activities in order to avoid, minimize, and mitigate impacts. • Dominion Energy would ensure that Wind Turbine Generators and Offshore Substations are properly marked and lighted in accordance with FAA Advisory Circular 70/7460-1M (FAA 2020), BOEM's Proposed Guidelines for Providing Information on	Other Uses

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Lighting and Marking of Structures Supporting Renewable Energy Development (BOEM 2021), the International Association of Marine Aids' (IALA's) Navigation and Lighthouse Authorities Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA 2013), and referencing COP Appendix T, *Obstruction Evaluation and Additional Analysis*. • Dominion Energy would provide as-built information to NOAA) National Ocean Service to support necessary updates to navigation charts in coordination with other stakeholders as needed. • Dominion Energy would work with USCG to facilitate training exercises within the Offshore Project area as requested. Dominion Energy would also provide regular communications and updates with key national security stakeholders on Project-related activities that may affect national security operations. • Dominion Energy would employ helicopters for O&M activities for the transfer of personnel and materials to the Offshore Project area. Dominion Energy would control Project vessel and helicopter movements through the Control Center to minimize vessel encounters during training operations in and near the Offshore Project area. • Dominion Project vessels will also send and receive AIS signals for awareness and collision avoidance. • Dominion Energy would communicate with key national stakeholders on the timing and location of O&M activities. Dominion Energy	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			would also follow the USCG establishment of safety zones around O&M activities.	
O&M	Offshore Project Area	Long-term conversion of land for the access to facilities (e.g., Cable Landing Location) in the Onshore Project area.	• Dominion Energy intends to coordinate with the SMR to identify what, if any, land use may continue within land acquired or leased for the Cable Landing Location, as well as any additional mitigation measures that may be appropriate related to impacts on DoD activities and resources during O&M.	Other Uses
Construction; Decommissioning	Offshore Project Area	Short-term restricted access to sand resources and dredge disposal sites due to the implementation of safety zones. Short-term disturbance to seafloor, including existing submarine cables during construction. Short-term increase in vessel traffic during construction. Short-term noise impacts during construction.	• Dominion Energy would provide advance notice of construction and maintenance activities through LNTMs and broadcast LNTMs as well as on the Project website. • Dominion Energy would monitor and control Project vessel movements to minimize impacts on sand-borrowing and dredge spoil dumping activities. • Because safety zones would be implemented during construction activities, marine users are expected to be outside of this potential area of effect and are, therefore, not anticipated to be affected by this temporary disturbance in the Offshore Project area, other than temporarily being restricted from accessing these areas during construction activities. • Installation of the Offshore Export Cables in proximity to the four existing submarine cables (BRUSA fiber optic cable, MAREA fiber optic cable, DUNANT fiber optic cable, and Commercial Virginia Offshore Wind Pilot Export Cable) would be coordinated with these asset owners to avoid impacts on any of these critical seabed assets. • Dominion Energy would schedule and track Project-related vessels to best manage	Other Uses

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			congestion and traffic flow in coordination with USCG and other maritime stakeholders. • All Dominion Project vessels will send and receive AIS signals for awareness and collision avoidance. • Where practical, Project vessels would utilize traffic separation schemes, fairways (should they be developed), and predetermined passage plans consistent with existing waterway uses. • The USCG would publish LNTMs and broadcast LNTMs to inform mariners of Project activities in the area. Additionally, a Project website with the operations plan would be updated so that mariners know what work is being done in the various offshore Project locations. • During pile driving of WTG Monopile Foundations, Dominion Energy would apply monitoring and exclusion zones as appropriate to underwater noise assessments and impact thresholds. • Construction personnel would employ soft starts and shutdown procedures as appropriate to thresholds of noise-emitting survey equipment; soft starts would last 30 minutes at the onset of pile driving. • Dominion Energy would use commercially and technically available noise-reducing technologies as appropriate and provide marine mammal sighting and reporting training for each specific stage of construction to emphasize individual responsibility for marine mammal awareness and protection.	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			• Dominion Energy would ensure continued engagement with regulatory agencies regarding potential best practices for noise mitigation.	
O&M	Offshore Project Area	Short-term restricted access in the vicinity of inspection, survey, maintenance, or repair. Long-term restricted access for inspection, maintenance, and repairs to existing cables.	• Should this activity be conducted near the Atlantic Ocean Channel and shipping lanes, Dominion Energy would schedule and control Project-related vessels to best manage congestion and traffic flow in coordination with USCG, as well as DoD exercises and training activities, as appropriate. • Dominion Energy has proactively sited the Offshore Export Cables to avoid active sand borrow sites and disposal sites to the extent practicable in an effort to avoid impacts. • Dominion Energy would work with the appropriate federal and state agencies to safeguard the export cable assets.	Other Uses
Construction; Decommissioning	Onshore and Offshore Project Area	Short-term interference with airspace and aviation radar systems due to the temporary presence of construction equipment onshore and offshore as well as transportation of Project Components to the Project Area.	• Notice Criteria check (14 CFR § 77.9) and/or additional airspace and aviation radar system assessment would be performed to determine whether there are potential airspace impacts and FAA filing is required during the storage or transit of Project materials and Offshore Project Components. FAA coordination for the onshore portion of the Project will occur following further detailed engineering of structures, when structure heights have been determined. It is also possible that the DoD would request to be informed through the Informal Review Process for the transit of large materials. Further coordination with the DoD will occur as a result of the findings of the Informal Review Process and any notifications	Other Uses

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			requested by the DoD will be applied to the Project as needed. • Dominion Energy would be in direct communication with applicable agencies and personnel to alert the appropriate parties to planned construction movements and actions. All WTG Components and construction equipment would be properly lighted and marked in accordance with FAA's Advisory Circular 70/7460-1M within FAA jurisdiction and beyond, or other methods as deemed required during consultation and as applicable.	
Operations	Onshore and Offshore Project Area	Long-term interference with regulated airspace due to the presence of fixed structures (Onshore and Offshore Project Components). Long-term interference with regulated aviation radar systems. Long-term interference with military radar operations. Long-term interference with high-frequency radar operations.	• Dominion Energy would coordinate with the FAA to make this required change to the airspace as necessary. In addition, all WTGs would be properly lighted and marked in accordance with FAA's Advisory Circular number 70/7460-1M within FAA jurisdiction and beyond. • Dominion Energy would continue to engage and coordinate with applicable military contacts to assess and address potential impacts as needed. • Dominion Energy would continue to engage and coordinate with applicable owners and operators of these high-frequency radar systems to assess and address potential impacts as needed.	Other Uses
Construction; Decommissioning	Offshore Project Area	Short-term change in Project-related vessel traffic. Short-term displacement of marine users due to the establishment of safety zones around Project-related vessels and structures.	• Dominion Energy would take measures to minimize impacts associated with construction vessels, including transiting within existing traffic lanes to the extent feasible, regular communication with stakeholders regarding Project activity, completing construction as quickly as is	Other Uses

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
		Short-term interference with access to nearshore and beach area. Short-term increases in turbidity and water quality. Short-term disturbance and displacement of local marine wildlife.	safely practicable, and limiting vessel activity to necessary transits. • Dominion Energy would continue to coordinate with appropriate personnel from the Navy to ensure construction activities do not conflict with training and testing activities within the Virginia Capes Range Complex, including transits to/from such activities. • Dominion Energy would minimize displacement of other marine users by establishing restricted zones in portions of the Offshore Project area only for the time required to complete the work. • Dominion Energy would provide frequent and regular updates of construction activity and implemented safety zones to the local marine community through the Project website, social media, and the LNTMs and by actively engaging other stakeholders. Impacts on other marine and coastal uses will be short term and localized. • Dominion Energy would minimize the size of safety areas and duration of exclusion to reduce impacts on other users of the area. Dominion Energy is committed to keeping the coastal community informed by providing advance notice of area restrictions and regular updates to the public via local news, on-site signage, social media, and other suitable information outlets. • All Dominion Energy vessel crews would be familiar with practices to avoid and minimize accidental spills as detailed in Dominion Energy's Marine Trash and Debris Prevention Training, Emergency Response	

Project Stage	Location	Impact	Avoidance, Minimization and Mitigation	Resource Area Mitigated
			Plan, and Oil Spill Response Plan (see Appendix Q). • Dominion Energy would avoid and minimize disturbance of wildlife, particularly endangered sea turtles and marine mammals. Avoidance, minimization, and mitigation measures include soft-start pile driving, dedicated marine mammal and sea turtle observers on vessels, and other activities.	
O&M	Offshore Project Area	Long-term modification of existing uses. Long-term changes in vessel traffic. Increase in diving, snorkeling, and other tourism in the wind farm in the Offshore Project area. Increase in recreational fishing (including tournaments) near the WTGs as artificial reefs become established on the Foundations.	• Dominion Energy would minimize and mitigate impacts on other users by notifying local marine users when any major repairs are planned and reducing any necessary restriction to the extent that safety precautions allow. The crew transfer and O&M vessels would use established transit lanes and will not substantially restrict other uses. No measurable impact of vessel traffic is expected.	Other Uses

Table H-2 Potential Mitigation and Monitoring Measures Analyzed

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
NHPA Section 106 Mitigation Measures				
1	C	Marine cultural resources avoidance or additional investigation	Dominion Energy must establish and comply with requirements for all protective buffers recommended by the Qualified Marine Archaeologist for each marine cultural resource (i.e., archaeological resource and ancient submerged landform feature) based on the size and dimension of the resource. Protective buffers extend outward from the maximum discernable limit of each resource and are intended to minimize the risk of disturbance during construction.	Cultural Resources – Marine Archaeological Resources
2	C	Ancient submerged landform feature monitoring program and post-review discovery plan	Dominion Energy must establish and implement a monitoring program and post-review discovery plan to review impacts of construction or any seabed-disturbing activities on ancient submerged landform feature locations if such landforms will not be avoided and will be impacted.	Cultural Resources – Marine Archaeological Resources
3	C	Terrestrial archaeological resource avoidance or additional investigation	Dominion Energy must avoid any identified terrestrial archaeological resource. If avoidance of a resource is not feasible, additional investigations must be conducted for the purpose of determining eligibility for listing in the NRHP. If any such resource is determined eligible for listing, Dominion Energy must conduct Phase III data recovery investigations for the purposes of resolving adverse effects in accordance with 36 CFR 800.6.	Cultural Resources – Terrestrial Archaeological Resources
4	C	Terrestrial archaeological resource monitoring program and post-review discovery plan	Dominion Energy must conduct archaeological monitoring during onshore construction in areas identified as having high or moderate archaeological sensitivity and must prepare and implement a terrestrial archaeological post-review discovery plan.	Cultural Resources – Terrestrial Archaeological Resources
5	Prior to C	Historic Property Treatment Plans	BOEM, with the assistance of Dominion Energy, will develop and implement one or multiple Historic Property Treatment Plans (HPTPs) to address impacts on historic properties that cannot be avoided. The HPTP(s) will be developed in consultation with property owners and consulting parties who have demonstrated interest in specific historic properties. The HPTP(s) will provide details and specifications for mitigation measures to resolve adverse visual effects, including cumulative effects,	Cultural Resources

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			on aboveground historic properties.	
BOEM-Proposed Mitigation and Monitoring Measures in the NMFS BA				
1	C, O&M, D	Incorporate LOA requirements	The measures required by the final MMPA LOA would be incorporated into COP approval, and BOEM and/or Bureau of Safety and Environmental Enforcement (BSEE) would monitor compliance with these measures.	Marine Mammals
2	C, O&M	PAM Plan	BOEM and USACE would ensure that Dominion Energy prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the proposed uses of PAM for mitigation and long-term monitoring. This plan would be submitted to NMFS and BOEM for review and concurrence at least 120 days prior to the planned start of activities requiring PAM.	ESA-listed Fish, Marine Mammals, and Sea Turtles
3	C	Pile-Driving Monitoring Plan	BOEM would ensure that Dominion Energy prepare and submit a *Pile Driving Monitoring Plan* to NMFS for review and concurrence at least 90 days before start of pile driving. The plan would detail all plans and procedures for sound attenuation as well as for monitoring ESA-listed whales and sea turtles during all impact and vibratory pile driving. The plan would also describe how BOEM and Dominion Energy would determine the number of whales exposed to noise above the Level B harassment threshold during pile driving with the vibratory hammer to install the cofferdam at the sea to shore transition. Dominion Energy would obtain NMFS' concurrence with this plan prior to starting any pile driving.	ESA-listed whales and sea turtles
4	C	PSO coverage	BOEM and USACE would ensure that PSO coverage is sufficient to reliably detect marine mammals and sea turtles at the surface in the identified clearance and shutdown zones to execute any pile-driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage that is included as part of the Proposed Action is determined not to be sufficient to reliably detect ESA-listed whales and sea turtles within the clearance and shutdown zones, additional PSOs and/or platforms would be deployed. Determinations prior to construction would be based on review of the Pile Driving Monitoring Plan. Determinations during construction would be based on review of the weekly pile-driving reports and other information, as appropriate.	ESA-listed Fish, Marine Mammals, and Sea Turtles
5	C	Sound field verification	BOEM and USACE would ensure that if the clearance and/or shutdown zones are expanded due to the verification of sound fields from Project activities, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers would be deployed on additional platforms for every 1,500 meters that a clearance or shutdown zone is expanded beyond the distances modeled prior to verification.	ESA-listed Fish, Marine Mammals, and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
6	C	Shutdown zones	BOEM and USACE may consider reductions in the shutdown zones for sei, fin, or sperm whales based upon sound field verification of a minimum of three piles; however, BOEM/USACE would ensure that the shutdown zone for sei whales, fin whales, blue whales, and sperm whales is not reduced to less than 3,280 feet (1,000 meters), or 1,640 feet (500 meters) for sea turtles. No reductions in the clearance or shutdown zones for North Atlantic right whales would be considered regardless of the results of sound field verification of a minimum of three piles.	ESA-listed Marine Mammals
7	C	General project development	BOEM will require that Dominion Energy comply with all the Project Design Criteria and Best Management Practices for Protected Species at https://www.boem.gov/sites/default/files/documents//PDCs%20and%20BMPs%20for%20Atlantic%20Data%20Collection%2011222021.pdf that implement the integrated requirements for threatened and endangered species resulting from the June 29, 2021, programmatic consultation under the ESA, revised September 1, 2021. This requirement also applies to non-ESA-listed marine mammals that are found in that document. Consultation conditions occurring in state waters outside of BOEM jurisdiction may apply to co-action agencies issuing permits and authorizations under this consultation	ESA-listed Fish, Marine Mammals, and Sea Turtles
8	C	Monitoring zone for sea turtles	BOEM and USACE would ensure that Dominion Energy monitors the full extent of the area where noise would exceed the root-mean-square SPL 175 dB re 1 μPa behavioral disturbance threshold for turtles for the full duration of all pile-driving activities and for 30 minutes following the cessation of pile-driving activities, and record all observations in order to ensure that all take that occurs is documented.	Sea Turtles
9	C, O&M, D	Lookout for sea turtles and reporting	a. For all vessels operating north of the Virginia/North Carolina border, between June 1 and November 30, Dominion Energy would have a trained lookout posted on all vessel transits during all phases of the Project to observe for sea turtles. The trained lookout would communicate any sightings, in real time, to the captain. b. For all vessels operating south of the Virginia/North Carolina border, year-round, Dominion Energy would have a trained lookout posted on all vessel transits during all phases of the Project to observe for sea turtles. The trained lookout would communicate any sightings, in real time, to the captain. This requirement is in place year-round for any vessels transiting south of Virginia, as sea turtles are present year-round in those waters. c. The trained lookout would monitor https://seaturtlesightings.org/ prior to each trip and report any observations of sea turtles in the vicinity of the planned transit to all vessel operators/captains and lookouts on duty that day. d. The trained lookout would maintain a vigilant watch and monitor a Vessel Strike Avoidance Zone (1,640 feet [500 meters]) at all times to maintain minimum	Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			separation distances from ESA-listed species. Alternative monitoring technology (e.g., night vision, thermal cameras) would be available to ensure effective watch at night and in any other low visibility conditions. If the trained lookout is a vessel crew member, this would be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts would receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. e. If a sea turtle is sighted within 328 feet (100 meters) or less of the operating vessel's forward path, the vessel operator would slow down to 4 knots (7 kph) (unless unsafe to do so) and then proceed away from the turtle at a speed of 4 knots (7 kph) or less until there is a separation distance of at least 328 feet (100 meters) at which time the vessel may resume normal operations. If a sea turtle is sighted within 164 feet (50 meters) of the forward path of the operating vessel, the vessel operator would shift to neutral when safe to do so and then proceed away from the turtle at a speed of 4 knots (7 kph). The vessel may resume normal operations once it has passed the turtle. f. Vessel captains/operators would avoid transiting through areas of visible jellyfish aggregations or floating sargassum lines or mats. In the event that operational safety prevents avoidance of such areas, vessels would slow to 4 knots (7 kph)_while transiting through such areas. g. All vessel crew members would be briefed in the identification of sea turtles and in regulations and best practices for avoiding vessel collisions. Reference materials would be available aboard all Project vessels for identification of sea turtles. The expectation and process for reporting of sea turtles (including live, entangled, and dead individuals) would be clearly communicated and posted in highly visible locations aboard all Project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so. h. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements on an emergency basis. If any such incidents occur, they would be reported to NMFS within 24 hours. i. If a vessel is carrying a PSO or trained lookout for the purposes of maintaining watch for North Atlantic right whales, an additional lookout is not required, and this PSO or trained lookout would maintain watch for whales and sea turtles. j. Vessel transits to and from the Offshore Project area, that require PSOs, will	

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			maintain a speed commensurate with weather conditions and effectively detecting sea turtles prior to reaching the 328-foot (100-meter) avoidance measure.	
10	C, O&M, D	Sampling gear	All sampling gear would be hauled at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	ESA-listed Fish, Marine Mammals, and Sea Turtles
11	C, O&M, D	Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in the surveys would be uniquely marked to distinguish it from other commercial or recreational gear. Using black and yellow striped duct tape, place a 3-foot-long (0.9-meter-long) mark within 2 fathoms of a buoy. In addition, using black and white paint or duct tape, place three additional marks on the top, middle and bottom of the line. These gear marking colors are proposed as they are not gear markings used in other fisheries and are therefore distinct. Any changes in marking would not be made without notification and approval from NMFS.	ESA-listed Fish, Marine Mammals, and Sea Turtles
12	C, O&M, D	Lost survey gear	If any survey gear is lost, all reasonable efforts that do not compromise human safety would be undertaken to recover the gear. All lost gear would be reported to NMFS (mailto:nmfs.gar.incidental-take@noaa.gov) within 24 hours of the documented time of missing or lost gear. This report would include information on any markings on the gear and any efforts undertaken or planned to recover the gear.	ESA-listed Fish, Marine Mammals, and Sea Turtles
13	C, O&M, D	Marine debris awareness training	Dominion Energy would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris or by contacting BSEE. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities would continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are in fact trained. The training process would include the following elements: • Viewing of either a video or slide show by the personnel specified above; • An explanation from management personnel that emphasizes their commitment to the requirements;	ESA-listed Fish, Marine Mammals, and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			• Attendance measures (initial and annual); and • Recordkeeping and the availability of records for inspection by U.S. Department of the Interior (DOI). By January 31 of each year, Dominion Energy would submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. Dominion Energy would send the reports via email to BOEM (at renewable_reporting@boem.gov) and to BSEE (at marinedebris@bsee.gov).	
14	C, O&M, D	Training	At least one of the survey staff onboard the trawl surveys and ventless trap surveys would have completed Northeast Fisheries Observer Program (NEFOP) observer training (within the last 5 years) or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon). Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures would be available on board each survey vessel. BOEM would ensure that Dominion Energy prepares a training plan that addresses how this requirement would be met and that the plan is submitted to NMFS in advance of any trawl or trap surveys. This requirement is in place for any trips where gear is set or hauled.	Atlantic Sturgeon
15	C, O&M, D	Sea turtle disentanglement	Vessels deploying fixed gear (e.g., pots/traps) would have adequate disentanglement equipment (i.e., knife and boathook) onboard. Any disentanglement would occur consistent with the Northeast Atlantic Coast Sea Turtle Disentanglement Network (STDN) Disentanglement Guidelines at https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501 and the procedures described in *Careful Release Protocols for Sea Turtle Release with Minimal Injury* (NOAA Technical Memorandum 580; https://repository.library.noaa.gov/view/noaa/3773).	Sea Turtles
16	C, O&M, D	Sea turtle/ESA-fish identification and data collection	Any sea turtles or ESA-fish caught and/or retrieved in any fisheries survey gear would first be identified to species or species group. Each ESA-listed species caught and/or retrieved would then be properly documented using appropriate equipment and data collection forms. Biological data, samples, and tagging would occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation. a. The Sturgeon and Sea Turtle Take Standard Operating Procedures would be followed (https://media.fisheries.noaa.gov/dammigration/sturgeon_&_sea_turtle_take_sops_external.pdf).	ESA-listed Fish and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			b. Survey vessels would have a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader) and this reader would be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags would be recorded on the take reporting form (see below). c. Genetic samples would be taken from all captured ESA-fish (alive or dead) to allow for identification of the Distinct Population Segment (DPS) of origin of captured individuals and tracking of the amount of incidental take. This would be done in accordance with the Procedures for Obtaining Sturgeon Fin Clips (https://media.fisheries.noaa.gov/dammigration/sturgeon_genetics_sampling_revised_june_2019.pdf). i. Fin clips would be sent to an NMFS-approved laboratory capable of performing genetic analysis and assignment to DPS of origin. To the extent authorized by law, BOEM is responsible for the cost of the genetic analysis. Arrangements would be made for shipping and analysis in advance of submission of any samples; these arrangements would be confirmed in writing to NMFS within 60 days of the receipt of this ITS. Results of genetic analysis, including assigned DPS of origin would be submitted to NMFS within 6 months of the sample collection. ii. Subsamples of all fin clips and accompanying metadata forms would be held and submitted to a tissue repository (e.g., the Atlantic Coast Sturgeon Tissue Research Repository) on a quarterly basis. The Sturgeon Genetic Sample Submission Form is available for download at: https://www.fisheries.noaa.gov/new-england-midatlantic/consultations/section-7-take-reporting-programmaticsgreater-atlantic). d. All captured sea turtles and ESA-fish would be documented with required measurements and photographs. The animal's condition and any marks or injuries would be described. This information would be entered as part of the record for each incidental take. A, NMFS Take Report Form would be filled out for each individual sturgeon and sea turtle (download at: https://media.fisheries.noaa.gov/2021-41507/Take%20Report%20Form%2007162021.pdf?null) and submitted to NMFS as described below.	
17	C, O&M, D	Sea turtle/ESA-fish handling and	Any sea turtles or ESA-fish caught and retrieved in gear used in fisheries surveys would be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and	ESA-listed Fish and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
		resuscitation guidelines	resuscitating the animal(s) to do so. Specifically: a. Priority would be given to the handling and resuscitation of any sea turtles or ESA-fish that are captured in the gear being used, if conditions at sea are safe to do so. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals. b. All survey vessels would have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) prior to the commencement of any on-water activity (download at: https://media.fisheries.noaa.gov/dammigration/sea_turtle_handling_and_resuscitation_measures.pdf). These handling and resuscitation procedures would be carried out any time a sea turtle is incidentally captured and brought onboard the vessel during the Proposed Actions. c. If any sea turtles that appear injured, sick, or distressed, are caught and retrieved in fisheries survey gear, survey staff would immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling the animal, and potential coordination of transfer to a rehabilitation facility. If unable to contact the Hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the USCG should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for up to 24 hours following handling instructions provided by the Hotline, prior to transfer to a rehabilitation facility. d. Attempts would be made to resuscitate any ESA-fish that are unresponsive or comatose by providing a running source of water over the gills as described in the Sturgeon Resuscitation Guidelines (https://media.fisheries.noaa.gov/dammigration-miss/Resuscitation-Cards-120513.pdf). e. Provided that appropriate cold storage facilities are available on the survey vessel, following the report of a dead sea turtle or sturgeon to NMFS, and if NMFS requests, any dead sea turtle or ESA-fish would be retained on board the survey vessel for transfer to an appropriately permitted partner or facility on shore as safe to do so. f. Any live sea turtles or ESA-fish caught and retrieved in gear used in any fisheries survey would ultimately be released according to established protocols and whenever at-sea conditions are safe for those releasing the animal(s) to do so.	
18	C, O&M, D	Take notification	GARFO PRD would be notified as soon as possible of all observed takes of sea turtles and ESA-fish occurring as a result of any fisheries survey. Specifically:	ESA-listed Fish and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			a. GARFO PRD would be notified within 24 hours of any interaction with a sea turtle or ESA-fish (nmfs.gar.incidental-take@noaa.gov). The report would include at a minimum: (1) survey name and applicable information (e.g., vessel name, station number); (2) GPS coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; and (6) identification of the animal to the species level. Additionally, the email would transmit a copy of the NMFS Take Report Form (download at: https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null) and a link to or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes). If reporting within 24 hours is not possible due to distance from shore or lack of ability to communicate via phone, fax, or email, reports would be submitted as soon as possible; late reports would be submitted with an explanation for the delay. b. At the end of each survey season, a report would be sent to NMFS that compiles all information on any observations and interactions with ESA-listed species. This report would also contain information on all survey activities that took place during the season including location of gear set, duration of soak/trawl, and total effort. The report on survey activities would be comprehensive of all activities, regardless of whether ESA-listed species were observed.	
19	C, O&M, D	Monthly/annual reporting requirements	BOEM would ensure that Dominion Energy implements the following reporting requirements necessary to document the amount or extent of take that occurs during all phases of the Proposed Action: a. All reports would be sent to: nmfs.gar.incidental-take@noaa.gov. b. During the construction phase and for the first year of operations, Dominion Energy would compile and submit monthly reports that include a summary of all Project activities carried out in the previous month, including vessel transits (number, type of vessel, and route), and piles installed, and all observations of ESA-listed species. Monthly reports are due on the 15th of the month for the previous month. c. Beginning in year 2 of operations, Dominion Energy would compile and submit annual reports that include a summary of all Project activities carried out in the previous year, including vessel transits (number, type of vessel, and route), repair and maintenance activities, survey activities, and all observations of ESA-listed species. These reports are due by April 1 of each year (i.e., the 2026 report is	ESA-listed Fish, Marine Mammals, and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			due by April 1, 2027). Upon mutual agreement of NMFS and BOEM, the frequency of reports can be changed.	
20	C, O&M, D	BOEM/NMFS meeting requirements for sea turtle take documentation	To facilitate monitoring of the incidental take exemption for sea turtles, through the first year of operations, BOEM and NMFS would meet twice annually to review sea turtle observation records. These meetings/conference calls would be held in September (to review observations through August of that year) and December (to review observations from September to November) and would use the best available information on sea turtle presence, distribution, and abundance, Project vessel activity, and observations to estimate the total number of sea turtle vessel strikes in the action area that are attributable to Project operations. These meetings would continue on an annual basis following year 1 of operations. Upon mutual agreement of NMFS and BOEM, the frequency of these meetings can be changed.	Sea Turtles
21	C, O&M, D	Data Collection BA BMPs	BOEM would ensure that all PDC and BMPs incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) will be applied to activities associated with the construction, maintenance, and operations of the Dominion Energy Project as applicable.	ESA-listed Fish, Marine Mammals, and Sea Turtles
22	C	Alternative Monitoring Plan (AMP) for pile driving	Dominion Energy must not conduct pile-driving operations at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the full extent of the clearance and shutdown zones. Dominion Energy must submit an AMP to BOEM and NMFS for review and approval at least 6 months prior to the planned start of pile driving. This plan may include deploying additional observers; alternative monitoring technologies such as night vision, thermal, and infrared technologies; or use of PAM, and must demonstrate the ability and effectiveness to maintain all clearance and shutdown zones during daytime as outlined below in Part 1 and nighttime as outlined in Part 2 to BOEM's and NMFS's satisfaction. The AMP must include two stand-alone components as described below: • Part 1 – Daytime when lighting or weather (e.g., fog, rain, sea state) conditions prevent visual monitoring of the full extent of the clearance and shutdown zones. Daytime being defined as 1 hour after civil sunrise to 1.5 hours before civil sunset. • Part 2 – Nighttime inclusive of weather conditions (e.g., fog, rain, sea state). Nighttime being defined as 1.5 hours before civil sunset to 1 hour after civil sunrise.	ESA-listed Fish, Marine Mammals, and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			If a protected marine mammal or sea turtle is observed entering or found within the shutdown zones after impact pile driving has commenced, Dominion Energy would follow the shutdown procedures outlined in the Biological Assessment. Dominion Energy would notify BOEM and NMFS of any shutdown occurrence during piling-driving operations with 24 hours of the occurrence unless otherwise authorized by BOEM and NMFS. The AMP should include, but is not limited to, the following information: • Identification of night vision devices (e.g., mounted thermal/IR camera systems, handheld or wearable NVDs, IR spotlights), if proposed for use to detect protected marine mammal and sea turtle species. • The AMP must demonstrate (through empirical evidence) the capability of the proposed monitoring methodology to detect marine mammals and sea turtles within the full extent of the established clearance and shutdown zones (i.e., species can be detected at the same distances and with similar confidence) with the same effectiveness as daytime visual monitoring (i.e., same detection probability). Only devices and methods demonstrated as being capable of detecting marine mammals and sea turtles to the maximum extent of the clearance and shutdown zones will be acceptable. • Evidence and discussion of the efficacy (range and accuracy) of each device proposed for low visibility monitoring must include an assessment of the results of field studies (e.g., Thayer Mahan demonstration), as well as supporting documentation regarding the efficacy of all proposed alternative monitoring methods (e.g., best scientific data available). • Procedures and timeframes for notifying NMFS and BOEM of Dominion Energy's intent to pursue nighttime pile driving. • Reporting procedures, contacts, and timeframes. BOEM may request additional information, when appropriate, to assess the efficacy of the AMP.	
23	O	Periodic underwater surveys, reporting of monofilament and other fishing	Dominion Energy must monitor indirect impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 of the WTGs located closest to shore in the Dominion Energy Lease Area (OCS-A 0483) annually. Survey design and effort may be modified with review and concurrence by DOI. Dominion Energy may conduct surveys by remotely operated vehicles, divers, or other means to determine the	ESA-listed Fish, Marine Mammals, and Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
		gear around WTG foundations	frequency and locations of marine debris. Dominion Energy must report the results of the surveys to BOEM (at renewable_reporting@boem.gov) and BSEE (at marinedebris@bsee.gov) in an annual report, submitted by April 30, for the preceding calendar year. Annual reports must be submitted in Microsoft Word format. Photographic and videographic materials must be provided on a portable drive in a lossless format such as TIFF or Motion JPEG 2000. Annual reports must include survey reports that include: the survey date, contact information of the operator, the location and pile identification number, photographic and/or video documentation of the survey and debris encountered, any animals sighted, and the disposition of any located debris (i.e., removed or left in place). Annual reports must also include claim data attributable to the Project from Dominion Energy corporate gear loss compensation policy and procedures. Required data and reports may be archived, analyzed, published, and disseminated by BOEM.	
24	C, O&M, D	PDC minimize vessel interactions with listed species (from high-resolution geophysical [HRG] programmatic)	All vessels associated with survey activities (transiting or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. • If any ESA-listed marine mammal is sighted within 1,640 feet (500 meters) of the forward path of a vessel, the vessel operator must steer a course away from the whale at <10 knots (18.5 kph) until the minimum separation distance has been established. Vessels may also shift to idle if feasible. If any ESA-listed marine mammal is sighted within 656 feet (200 meters) of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 1,640 feet (500 meters). If stationary, the vessel must not engage engines until the large whale has moved beyond 1,640 feet (500 meters).	Marine Mammals
25	O&M	Operational Sound Field Verification Plan	BOEM would require Dominion Energy to develop an operational sound field verification plan to determine the operational noises emitted from the Offshore Project area. The plan would be reviewed and approved by BOEM and NMFS.	ESA-listed Fish, Marine Mammals, and Sea Turtles
BOEM-Proposed Measures from the Data Collection and Site Survey Activities for Renewable Energy on the Atlantic OCS BA				
1	C, O&M, D	Data Collection BA BMPs	BOEM will ensure that all Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) will be applied to activities associated with the construction, maintenance, and operations of the CVOW Project as applicable.	ESA-listed Fish, Marine Mammals, Sea Turtles

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
NMFS-Proposed Measures to Minimize Impacts on Benthic Habitat				
1	C, O&M, D	Essential Fish Habitat	The measures required by the final Essential Fish Habitat consultation would be incorporated into COP approval, and BOEM and/or NMFS would monitor compliance with these measures.	Benthic Resources
2	C, O&M, D	Lionfish	BOEM would require Dominion Energy to develop a Lionfish Monitoring and Adaptive Management Plan.	Benthic Resources
BOEM- Proposed Bird and Bat Mitigation Measures				
1	C, O&M, D	Reporting	Report bird mortality annually during construction, operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the USGS Bird Band Laboratory. Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.	Birds and Bats
2		Monitoring	Develop an avian and bat monitoring program during construction and operation. At least 45 calendar days before beginning surveys, the Lessee must complete, obtain concurrence from DOI, and adopt an Avian and Bat Monitoring Plan, including coordination with interested stakeholders. DOI will review the Avian and Bat Monitoring Plan and provide any comments on the plan within 30 calendar days of its submittal. The Lessee must resolve all comments on the Avian and Bat Monitoring Plan to DOI's satisfaction before implementing the plan. The Lessee may conclude that DOI has concurred in the Avian and Bat Monitoring Plan if DOI provides no comments on the plan within 30 calendar days of its submittal date. Under this condition the Lessee must allow for: 1. Monitoring. TBD. 2. Annual Monitoring Reports. The Lessee must submit to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) a comprehensive report after each full year of monitoring (pre- and post-	Birds & Bats

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			construction) within 6 months of completion of the last avian survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. DOI will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the Avian and Bat Monitoring Plan. DOI reserves the right to require reasonable revisions to the Avian and Bat Monitoring Plan and may require new technologies as they become available for use in offshore environments. 3. Post-Construction Quarterly Progress Reports. The Lessee must submit quarterly progress reports during the implementation of the Avian and Bat Monitoring Plan to BOEM (at renewable_reporting@boem.gov) and USFWS by the 15th day of the month following the end of each quarter during the first full year that the Project is operational. The progress reports must include a summary of all work performed, an explanation of overall progress, and any technical problems encountered 4. Monitoring Plan Revisions. Within 15 calendar days of submitting the annual monitoring report, the Lessee must meet with BOEM and USFWS to discuss the following: the monitoring results; the potential need for revisions to the Avian and Bat Monitoring Plan, including technical refinements or additional monitoring; and the potential need for any additional efforts to reduce impacts. If DOI determines after this discussion that revisions to the Avian and Bat Monitoring Plan are necessary, DOI may require the Lessee to modify the Avian and Bat Monitoring Plan. If the reported monitoring results deviate substantially from the impact analysis included in the Final EIS, the Lessee must transmit to DOI recommendations for new mitigation measures or monitoring methods. 5. Operational Reporting (Operations). The Lessee must submit to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) an annual report with the following monthly operational data in tabular format: the proportion of time the turbines were operational (spinning) each month, the average monthly revolutions per minute (rpm) of spinning turbines, and the average pitch angle of blades (degrees relative to rotor plane). DOI will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the impact analysis included in the Final EIS. 6. Raw Data. The Lessee must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to DOI and USFWS upon request for the duration of the Lease. The Lessee must work with BOEM to ensure the data are publicly	

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			available.	
3	C, O&M	Offshore structures	Use bird-deterrent devices during construction and operation. To minimize attracting birds to operating turbines, the Lessee must install bird-deterrent devices on turbines and the OSS. The location of bird-deterrent devices must be proposed by the Lessee based on BMPs applicable to the appropriate operation and safe installation of the devices. The Lessee must confirm the locations of bird-deterrent devices as part of the as-built documentation it must submit with the FDR.	Birds
BOEM-Proposed Measure for Reporting Incidental Take of Endangered or Threatened Species				
1	C, O&M, D	Reporting	Dominion Energy will report to BOEM and BSEE within 24-hours of confirmation any incidental take of an endangered or threatened species.	ESA-listed Fish, Marine Mammals, Sea Turtles
BOEM OCS Study 2020-039 – Radar Systems Mitigations to Operations				
1	O&M	Mitigation for ARSR-4 and ASR-8/9 radars	Dominion Energy will enter into a mitigation agreement with DoD for impacts on ARSR-4 and for ASR-8/9 radars. Possible mitigation measures might include the following: • Passive aircraft tracking using ADS-B or signal/transponder • Increasing aircraft altitude near radar • Sensitivity time control (range-dependent attenuation) • Range azimuth gating (ability to isolate/ignore signals from specific range-angle gates) • Track initiation inhibit, velocity editing, plot amplitude thresholding (limiting the amplitude of certain signals) • Modification mitigations for ARSR-4 and for ASR-8/9 systems: o Utilizing the dual beams of the radar simultaneously o In-fill radars	Other Uses - Radar
2	O&M	Mitigation for oceanographic high-frequency radars	Dominion Energy will enter into a mitigation agreement with NOAA, to mitigate operational impacts on oceanographic high-frequency radars. Possible mitigation measures might include the following: • Data sharing from turbine operators to include the following: o Sharing real-time telemetry of surface currents and other oceanographic data measured at locations in the Projects with radar operators into the public domain	Other Uses - Radar

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
			o Sharing time-series of blade rotation rates, nacelle bearing angles, and other information about the operational state of each of the Projects' turbines with radar operators to aid interference mitigation • Wind farm curtailment/curtailment agreement • Signal processing enhancements • Antenna modifications	
3	O&M	Mitigation for NEXRAD weather radar systems	Dominion Energy will enter into a mitigation agreement with NOAA, to mitigate operational impacts on NEXRAD weather radar systems. Possible mitigation measures might include the following: • Wind farm curtailment/curtailment agreement • Employing adaptive clutter filters • Changing the radar scan strategy to pass over areas with wind turbines • Using phased array radars to achieve a null in the antenna radiation pattern in the direction of the wind turbine • Curtailment	Other Uses - Radar
USACE-Proposed Measures				
1	C, O&M, D	Clean Water Act (CWA) 404; Section 10 of the Rivers and Harbors Act	Dominion Energy will comply with all mitigation required by USACE for CWA Section 404 and Section 10 impacts.	Wetlands
NPS- and BOEM-Proposed Measures				
1	C, O&M, D	Lighting	Dominion Energy will comply with BOEM's detailed Lighting and Marking Guidelines and NPS sustainable lighting best practices.	Cultural, Historic, and Archaeological Resources; ESA-listed Species; Recreation and Tourism; Scenic and Visual Resources

#	Proposed Project Phase	Mitigation & Monitoring Measures	Description	Resource Area Mitigated
BOEM-Proposed Measures for Fisheries Income Compensation				
1	C, O&M, D	Fisheries compensation	BOEM would require that Dominion Energy implement a compensation program for lost income for commercial and recreational fishermen and other eligible fishing interests for construction and operations consistent with BOEM's draft guidance for *Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585* or as modified in response to public comment. This measure, if adopted, would reduce impacts from the impact-producing factor (IPF) presence of structures by compensating commercial and recreational fishing interests for lost income during construction and a minimum of 5 years post-construction. If adopted, this measure would reduce the negligible to major impact level from the presence of structures to negligible to moderate. This is because a compensation scheme will mitigate "indefinite" impacts to a level where the fishing community would have to adjust somewhat to account for disruptions due to impacts but income losses would be mitigated.	Commercial Fisheries and For-Hire Recreational Fishing

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ATTACHMENT H-1
UNANTICIPATED DISCOVERIES PLAN

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CVOW-C
Unanticipated Discoveries Plan
Terrestrial Archaeological Resources

1. Introduction

Virginia Electric and Power Company, d/b/a Dominion Energy Virginia (Dominion Energy), is proposing the Dominion Coastal Virginia Offshore Wind (CVOW) Commercial Project (the Project), an offshore wind energy project within the area leased by Dominion Energy in the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf offshore Virginia (Lease No. OCS-A-0483) as well as in federal and state territorial waters of Virginia and onshore in the independent cities of Virginia Beach and Chesapeake, Virginia (Figure 1).

In consultation with the Bureau of Ocean Energy Management (BOEM) and the Virginia Department of Historic Resources (VDHR) Dominion Energy has developed this Unanticipated Discoveries Plan–Terrestrial (UDP-T) to provide a protocol for responding to the unplanned discovery of cultural resources, including archaeological deposits, human remains, and other evidence of past human activities, during the construction and operation of the onshore portion of the Project between the Cable Landing Location on the Atlantic Ocean shoreline of the City of Virginia Beach and Dominion Energy's existing Fentress substation in the City of Chesapeake, including portions located within Naval Air Station (NAS) Oceana and the Virginia National Guard State Military Reservation (SMR [formerly Camp Pendleton]).

1.1 Project Description

The proposed CVOW Project will erect up to 205 wind turbine generators over an area of 112,799 acres (45,658 hectares) situated approximately 27 statute miles (23.75 nautical miles, or 43.99 kilometers) off the Virginia Beach coastline. It will have a nameplate generating capacity of approximately 2.6 gigawatts of electrical energy. Energy generated by the Project will be collected via Inter-Array Cables from the individual wind turbine generators to one of three offshore substations and then transmitted to onshore consumers via nine Offshore Export Cables laid along the Offshore Export Cable Route Corridor within federal and state waters of the Commonwealth of Virginia. To bring the energy onshore at the Cable Landing Location, the Offshore Export Cables will be installed under the beach and dunes using a trenchless installation method (Direct Steerable Pipe Thrusting).

The Onshore Project Components will include, in addition to the Cable Landing Location, an Onshore Export Cable Route, a Switching Station, an Interconnection Cable Route, and an Onshore Substation (Figure 2).[1] Dominion Energy's preferred routing, subject to landowner permission and approval by the Virginia State Corporation Commission, situates the Cable Landing Location within a Proposed Parking Lot West of the Firing Range at the SMR. At the cable landing, the nine Offshore Export Cables will interconnect with 27 single-phase 230-kilovolt transmission lines that comprise the Onshore Export Cable.

[1] Note that while onshore electrical interconnections are commonly referred to a s "circuits," for consistency with terminology commonly associated with offshore wind projects, "cables" is used throughout.

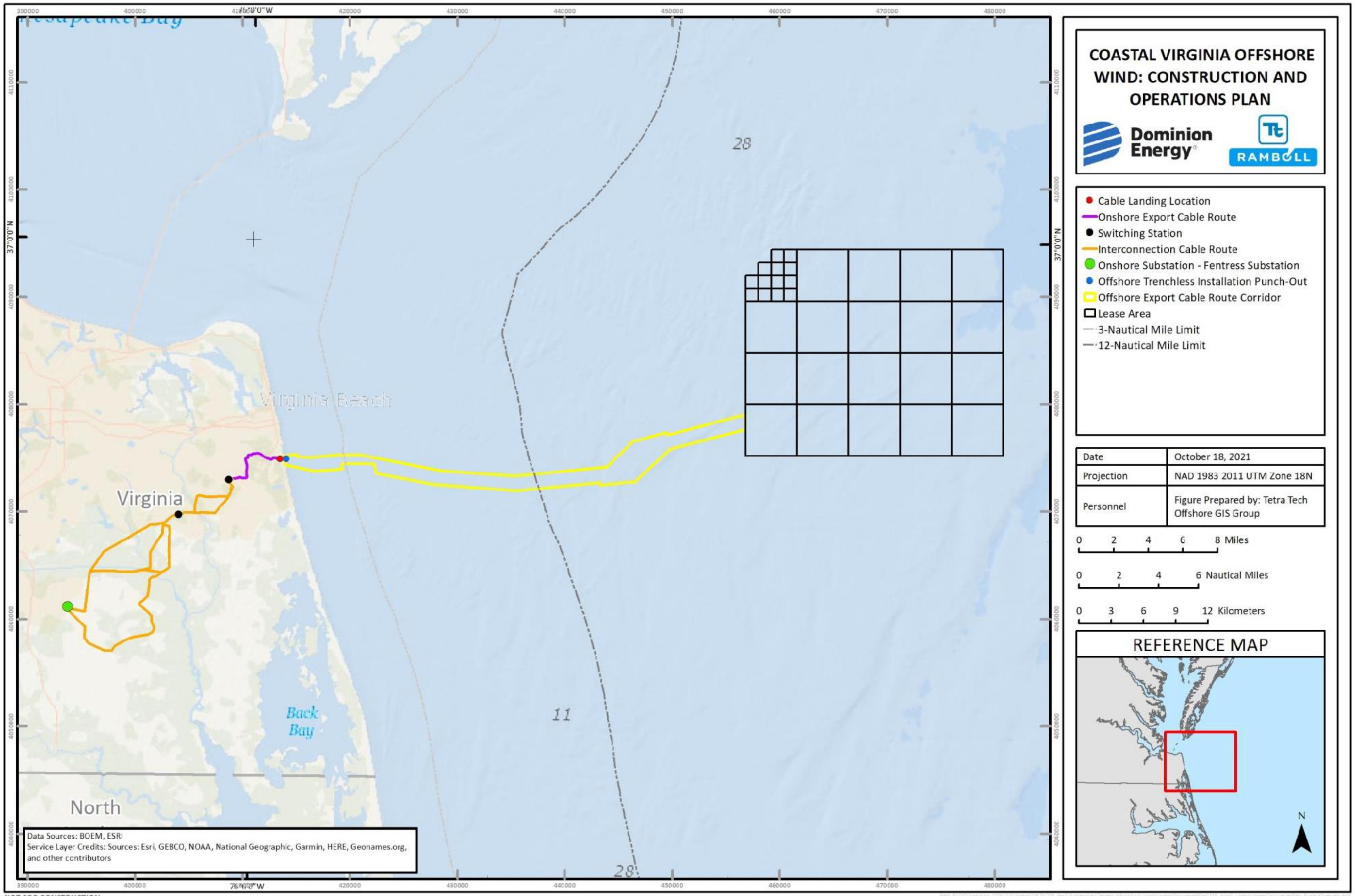

Figure 1 CVOW Commercial Project

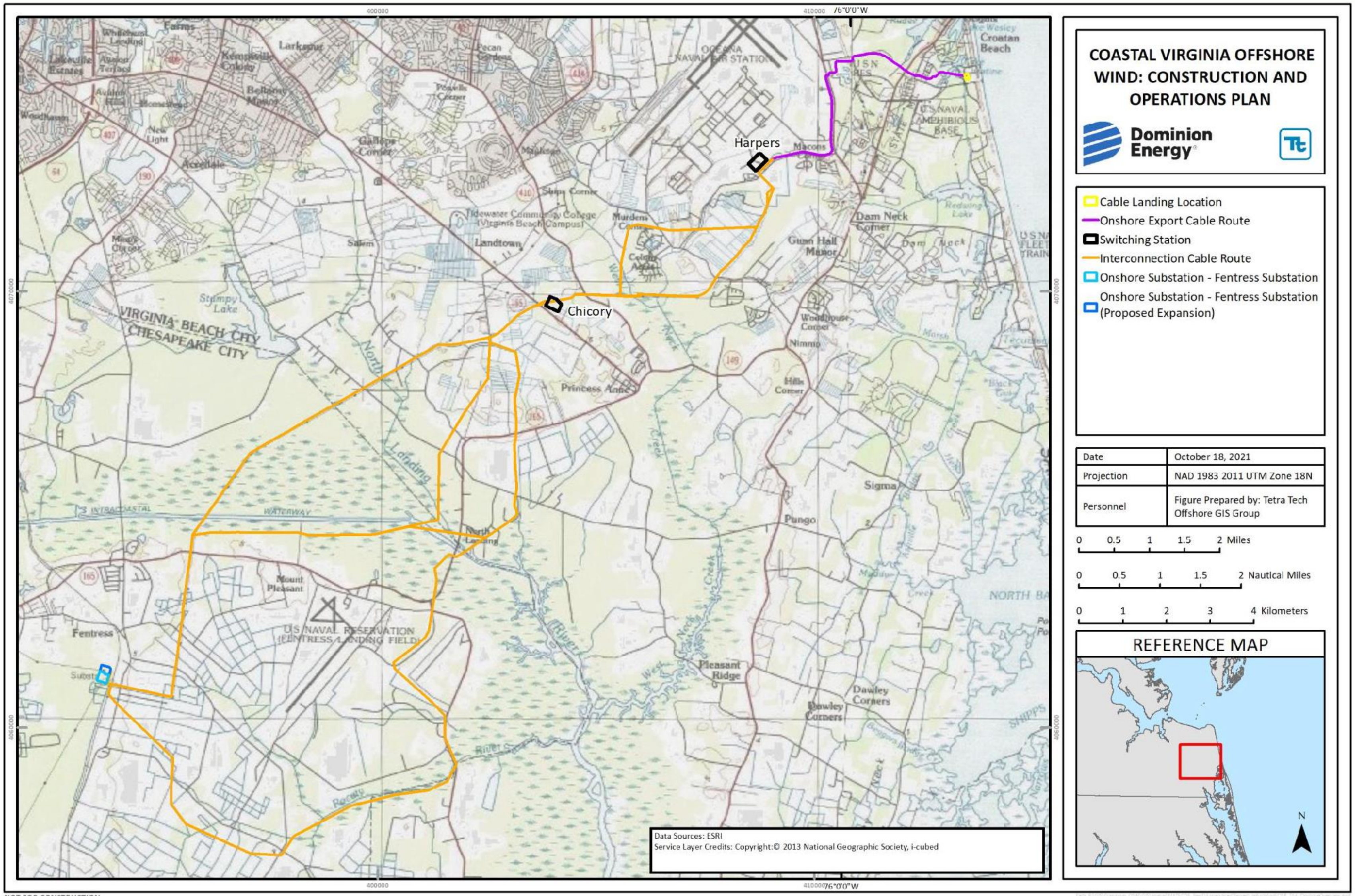

Figure 2 Onshore Project Components

As of April 2022, Dominion Energy is examining the feasibility and appropriateness of one Interconnection Cable Routes alternatives between the Common Location north of Harpers Road and the planned Onshore Substation, an expansion of the existing Fentress Substation in the City of Chesapeake, approximately 15 miles (24 kilometers) to the southwest of the Cable Landing Location. According to current planning, the Onshore Export Cable Route will traverse several miles underground beneath existing roads or through previously disturbed ground to the planned new Switching Station. A Switching Station will either be located north of Harpers Road (preferred) or north of Princess Anne Road. The Onshore Project Components under consideration include portions located within NAS Oceana and SMR properties.

The Switching Station will serve as the transition point where power transmitted by the Onshore Export Cable from the Cable Landing Location will be collected to the Interconnection Cable. The Interconnection Cable will connect the Switching Station with the Onshore Substation at Fentress, where the electricity from the offshore wind energy facility will be connected into the PJM power grid for distribution to consumers. The Interconnection Cable will consist of three 230-kilovolt circuits installed as either all overhead transmission facilities (preferred), or as a combination of overhead and underground (hybrid) transmission facilities. As of April 2022, Dominion Energy is evaluating one Overhead Interconnection Cable Route Alternatives and one Hybrid Interconnection Cable Route, both located within the same footprint.

1.2 Purpose of the Unanticipated Discoveries Plan—Terrestrial

The UDP-T applies to all Project construction and maintenance activities inshore of the mean high tide line. Under federal law, the mean high tide line marks the marine boundary of the lands beneath navigable waters of the United States (Submerged Lands Act of 1953, as amended, 43 United States Code [U.S.C.] § 1301(a)(2)), and from a practical point of view, it approximates the point at which terrestrial methods of archaeological investigation predominate over marine methods. The elevation of Mean High Water Datum is taken to be a convenient approximation of the "mean high tide line." As of September 2021, the National Oceanic and Atmospheric Administration, National Ocean Service, Center for Operational Oceanographic Products and Services lists the elevation of Mean High Water at Rudee Inlet, Virginia Beach, Virginia (Tidal Station 8639208), a location approximately 0.8 mile (1.3 kilometers) north of the Project's proposed Cable Landing Location as +0.92 feet (+0.281 meters) North American Vertical Datum of 1988, based upon the current National Tidal Datum Epoch, 1983-2001, now under revision (NOAA 2021).

2. Guidelines, Regulations, and Legislation for Unanticipated Cultural Resources and Human Remains

The UDP-T will be followed in the event that cultural resources and/or human remains are encountered during construction of the onshore Project components. The stipulations of the Plan as set forth below are in accordance with the current guidelines detailed in the following federal and state guidelines, regulations and legislation, as well as BOEM recommendation:

2.1 Federal

- Sections 106 and 110 of the National Historic Preservation Act, as amended (54 U.S.C. §§ 306108 and 306101 *et seq.*)

- Archaeological Resources Protection Act, as amended (16 U.S.C. §§ 470aa *et seq.*)
- Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (September 29, 1983, 48 Federal Register 44716-42)
- Advisory Council for Historic Preservation: Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects (February 23, 2007)
- Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001 *et seq.*)
- As of October 2021, BOEM has not issued specific regulations or guidance for completing Section 106 compliance archaeological investigations in terrestrial areas; marine archaeological investigations are covered by BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (2020)
- BOEM Project recommendation for an on-site Archaeological Monitor (AM) during construction activities
- U.S. Department of the Navy guidelines and requirements for portions of the Project located on NAS Oceana property

2.2 Commonwealth of Virginia

- Guidelines for Conducting Historic Resources Survey in Virginia, revised (VDHR 2017)
- Section 2305 of the Virginia Antiquities Act (Virginia Code Annotated [VCA] § 10.1-2305) "Permit required for the archaeological excavation of human remains"—provides a permit process for archaeological field investigations involving the removal of human remains and artifacts from graves. These permits are issued through VDHR's Office of Review and Compliance. The following state statutes pertain to human remains, graves, and cemeteries:
    - VCA § 8.01-44.6, action for injury to cemetery property
    - VCA § 15.2-2258, plat of proposed subdivision and site plans to be submitted for approval
    - VCA § 18.2-125, trespass at night upon any cemetery
    - VCA § 18.2-126, violation of sepulture; defilement of dead human body
    - VCA § 18.2-127, injuries to churches, church property, cemeteries, burial grounds, etc.
    - VCA § 33.1-241, roads not to be established through a cemetery or seminary of learning without owners' consent
    - VCA § 45.1-252, designating areas unsuitable for coal surface mining
    - VCA § 57-27.1, access to cemeteries located on private property; cause of action for injunctive relief
    - VCA § 57-36, abandoned cemeteries may be condemned; removal of bodies
    - VCA § 57-38.1, proceedings by landowner for removal of remains from abandoned family graveyard

- VCA § 57-38.2, proceedings by heir at law or descendant for removal of ancestor's remains from abandoned family cemetery
- VCA § 57-39, proceedings for removal of remains and sale of land vacated
- VCA § 57-39.1, improvement of abandoned and neglected graveyards

- Virginia Army National Guard guidelines and requirements for portions of the Project located on SMR property

2.3 Local

Both the City of Virginia Beach and the City of Chesapeake have active historic preservation commissions. Virginia Beach is a Certified Local Government under the National Park Service program; Chesapeake is not. Neither city has a local ordinance specifically addressing archaeological resources. Virginia Beach has a local historic preservation plan, which serves to establish the vision, goals, and actions for the City of Virginia Beach historical preservation program for the next 10 years to identify strategic areas for partnership with internal and external stakeholders. The plan is in the process of being revised. On October 8, 2021, Draft 4 of the plan was released (Commonwealth Preservation Group 2021; City of Virginia Beach 2001). Chesapeake does not have a local historic preservation plan. An archaeological survey for historic preservation planning purposes was completed in Virginia Beach in the northern part of city in 2018 (Blondino et al. 2018). An archaeological survey of Chesapeake was completed in 1999 (Underwood and Blanton 1999).

2.4 Archaeological Permits Checklist

If an unanticipated archaeological find is made or if human remains are found, one or more of the following permits may be required if archaeological excavation is necessary:

- Archaeological Resources Protection Act Permit (federal land, issued by federal agency responsible for land management)
- Permit for Archaeological Field Investigation on State-Controlled Land (Virginia's state and state-controlled land;[2] issued by VDHR)
- Permit for the Archaeological Excavation of Human Remains (removal of human remains from a grave in Virginia requires a court order or a permit issued by VDHR)
- Additional permits may be required, depending on circumstances

3. Training and Orientation

Dominion Energy's on-site Project Manager (PM) will be responsible for advising construction-contractor personnel on the procedures to follow in the event of an unanticipated discovery. Training will occur as part of the pre-construction on-site training program for foremen, company inspectors and

[2] State-controlled land "means any land owned by the Commonwealth or under the primary administrative jurisdiction of any state agency. 'State agency' shall not mean any locality or any board or authority organized under state law to perform local or regional functions. 'State-controlled land' includes state parks, state wildlife areas, state recreation areas, highway rights-of-way, and state-owned easements" (VCA § 10.1-2300).

construction supervisors. The PM will advise all operators of equipment involved in grading, stripping, or drilling activities to:

1. Stop work immediately if they observe indications of the presence of cultural artifacts, animal bones, or human remains.
2. Contact the AM and PM immediately.
3. Comply with unanticipated discovery procedures.
4. Treat human remains with dignity and respect.

3.1 Procedure When Potential Cultural Materials Are Observed

Cultural materials include man-made historic objects (prehistoric pottery or chipped stone tools and waste flakes) and historic period items (items that are approximately 50 years old or greater such as architectural debris, fragments of dishes, bottle glass, old farm equipment, etc.) and features (e.g., alignments, walls, floors, including those that are constructed of cobbles, rough or quarry-dressed masonry, brick, concrete, or other materials), or other remnants of cultural activity.

1. Stop work in the immediate vicinity of the observed potential cultural materials
2. Notify the AM and PM of the discovery.
3. If AM makes a determination that cultural materials are not man-made and historic, features, or other remnants of cultural activity that constitute an anticipated discovery, work will resume.
4. If AM makes a determination that an unanticipated discovery may have been made:
   (i) AM directs all ground-disturbing activities that may affect area of discovery to stop.
   (ii) AM will protect and secure the evidence in place by delineating the find with flagging or fencing.
   (iii) Project activities can continue outside of the delineated unanticipated find area.
   (iv) Make immediate notifications

The PM will notify the designated Dominion Energy contacts as soon as practicable by telephone with written confirmation via email, fax, or overnight mail. If the primary contact cannot be reached, notify the indicated alternate. Written notifications should be accompanied by photographs and maps or geographic coordinates of the find.

The **CONTACTS LIST** is at the end of this document.

Professional archaeologist will assess the find.

As soon as practicable, a professional archaeologist (PA)[3] will examine the location of the discovery.

1. If the PA determines that the discovery is not a cultural resource, the PA will promptly communicate the basis for this professional judgment to the PM. The PM will be allowed to remove the stop work

[3] A professional archaeologist, also called a Secretary of the Interior-qualified archaeologist, is one who meets the Secretary's qualifications to serve as a principal investigator of an archaeological study for purposes of federally sanctioned historic preservation (48 Federal Register 44739, September 29, 1983).

order with concurrence from the PM's management at Dominion Energy. This concurrence may be provided initially by telephone and will be followed by a concurrence email from Dominion Energy. The PA will document the communication with the PM by a letter report including photographs of the discovery to the PM, Dominion Energy, and Tetra Tech contacts within 14 business days.

2. If the PA determines that the discovery is a potentially significant cultural resource, the PA will immediately advise the PM who will make the appropriate notifications to Dominion Energy and Tetra Tech. Together the PA and the PM will then notify VDHR and BOEM by telephone and written confirmation by email, fax or overnight mail. In consultation with Dominion Energy, VDHR, and BOEM, the PA will develop a scope-of-work for evaluating the significance of the resource and evaluating potential Project effects on the resource. The written, draft scope-of-work will be prepared by the PA and submitted to the PM, Dominion Energy, within two business days of notifying the PM of the cultural resource determination. The PM will provide the scope-of-work to VDHR and BOEM following Dominion Energy review. Once approved by VDHR, work may commence immediately on the cultural resource investigations.
3. In accordance with construction or other permits or applicable regulations, additional parties such as federal or state land managers, may need to be notified, provided with copies of evaluative letter reports and/or field investigation plans, or afforded the opportunity to issue archaeological excavation permits.

Initiate consultation with VDHR.

1. Within 10 days of the notification of the cultural resource determination, the PM and PA will consult with Dominion Energy, VDHR, and BOEM by telephone and discuss the PA's results from the evaluation and opinion concerning the potential significance of the resource and possible eligibility of the resource for the National Register of Historic Places or Virginia Landmarks Register. As directed by Dominion Energy, the PM or PA may notify other interested parties about the unanticipated discovery.

   Other Interested Parties may include:

   - Local Historical Commissions
     - Chesapeake City Historic Preservation Commission
     - Virginia Beach Historic Preservation Commission
   - Native American Tribes
     - Absentee-Shawnee Tribe of Oklahoma
     - Cheroenhaka Nottoway Nation
     - Chickahominy Tribe
     - Delaware Nation
     - Delaware Tribe of Indians
     - Eastern Chickahominy Tribe
     - Eastern Shawnee Tribe of Oklahoma
     - Lenape Tribe of Delaware

- Mattaponi Tribe
- Meherrin Tribe
- Monacan Indian Nation
- Nansemond Tribe
- Narragansett Indian Tribe
- Nottoway Indian Tribe of Virginia
- Pamunkey Tribe
- Patawomeck Tribe of Virginia
- Rappahannock Indian Tribe
- Shinnecock Indian Nation
- Upper Mattaponi Tribe

It will be the responsibility of BOEM to identify which interested parties should be involved in any specific consultation and request the assistance of Dominion Energy in notifying them and inviting their participation in the consultation.

2. Once the scope-of-work is approved by VDHR, work may commence immediately on the cultural resource investigations. Dominion Energy assumes the VDHR and other consulting parties will provide an expedited 10-day review of scopes-of-work.
3. As soon as possible following the field investigation, the PA will provide the PM and Dominion Energy contacts with a written report describing the results of the fieldwork.
4. If the resource is believed to be significant and cannot be avoided by construction activities, the PA will prepare a proposal for data recovery for submission to the PM, Dominion Energy, VDHR, BOEM, and potentially other interested parties, such as federally recognized Native American tribes with a historical interest in the municipality or county in which the find is located. The data recovery proposal will be approved by the PM, Dominion Energy, VDHR, and BOEM. Following completion of the data recovery effort, work in the delineated area will be allowed to re-commence.
5. If the resource is believed to be significant and can be avoided by construction activities, the PA will prepare a proposal for avoidance measures (avoidance plan) for submission to PM, Dominion Energy. The avoidance plan may specify ongoing monitoring of construction activity by a PA in an area of sensitivity in the vicinity of the unanticipated find. Following review, the PM will provide the avoidance plan to VDHR and BOEM. Once VDHR and BOEM approve the avoidance plan, the Project work will be allowed to re-commence with implementation of the avoidance plan.
6. Dominion Energy will be responsible for all costs associated with the discovery, investigation, reporting, and curation of any unanticipated finds encountered during Project construction.

3.2 Procedure When Human Remains and/or Potentially Human Skeletal Materials Are Observed

Human remains are physical remains of a human body or bodies including, but not limited to, bones, teeth, hair, and preserved soft tissues (mummified or otherwise preserved) of an individual. Remains may be articulated or disarticulated bones or teeth. Disturbance of human remains, burial places, or burial offerings and other grave furnishings without authorization is a felony.

ESSENTIAL INSTRUCTIONS

Workers shall treat all human remains with dignity and respect.

In Virginia, it is a felony to remove human remains from a grave without a court order or appropriate permit.

Stop immediately and establish a buffer zone.

IMMEDIATELY STOP all ground-disturbing activities in the vicinity of a discovery of human remains or suspected human remains.

An initial buffer of at least 50 feet (15 meters) around the find location shall immediately be established, within which no construction or other ground-disturbing activities shall take place pending evaluation of the find. Be aware that additional discoveries of possible human remains could be made outside the initial buffer, so the boundary of buffer of no construction activities may need to be expanded pending further evaluation of the finds.

Immediately notify the Archaeological Monitor and Project Manager

Immediately notify the AM and PM about the find.

The Archaeological Monitor and Project Manager ensures that the find(s) are secured from disturbance and notifies additional personnel

If the AM believes that potentially human skeletal remains have been found, she or he will:

1. Protect and secure the evidence of the discovery.
2. Delineate the location of the find and the surrounding initial buffer area with flagging or safety fencing.
3. Immediately notify the designated contacts:
    - Dominion Energy
    - Local Law Enforcement
    - VDHR
    - BOEM
    - Navy, as applicable
    - SMR, as applicable

As directed by Dominion Energy, the PM or PA may notify other interested parties about the unanticipated discovery.

Local law enforcement will assess the find.

Local law enforcement will visit the discovery and evaluate whether it represents a crime scene. If determined to be a crime scene, no work will be undertaken in the area until written permission to resume is provided by the investigating agency.

The Professional Archaeologist assesses the find, if not of concern to law enforcement.

If law enforcement determines that the find is not of concern, the PA will examine the discovery as soon as practicable to determine if the remains are likely human and make a determination on its archaeological association as to aboriginal or non-aboriginal.

The Professional Archaeologist determines the find is non-human.

Non-human find with no significant archaeological association.

If skeletal remains are determined to be non-human and there is no archaeological association, the PA making the determination will promptly advise the PM. PM will advise Dominion Energy and of PA's assessment and with their concurrence, PM will give order for construction to resume in the delineated area. The PA will submit a letter report including photographs of the discovery site to the PM and Dominion Energy, contacts within 14 business days of the determination.

Non-human find with an archaeological association.

If the skeletal remains are non-human, but are associated with an archaeological site, follow the steps described in Section G-3.3.1.

The Professional Archaeologist determines the find represents human remains.

If the skeletal remains are human and not of interest to law enforcement, the PA will notify the PM, Dominion Energy, VDHR, and BOEM contacts. The disposition of unmarked burial sites, human skeletal remains, or burial artifacts shall proceed as follows:

1. Reasonable efforts will be made to restore the unmarked burial site, avoid disturbance to the human skeletal remains or burial artifacts, and preserve the remains in place;
2. Dominion Energy shall be responsible for prompt notification of the owner of any leased property on which an unmarked cemetery or grave or human remains are discovered during construction;
3. BOEM in coordination with VDHR and Dominion Energy will notify and consult with appropriate tribal leaders;
4. If the human skeletal remains must be removed, Dominion Energy and the PA shall obtain a court order from the County Circuit Court and a Permit for Archaeological Removal of Human Burials from VDHR;
5. All artifacts found in association with an unmarked burial site shall become the property of the Commonwealth of Virginia and VDHR shall be the custodian thereof. The disposition of the burial artifacts shall be made by VDHR in accordance with its regulations;
6. If disturbance to human remains or a burial place cannot be avoided, Dominion Energy and the PA will prepare a treatment plan, in consultation with VDHR, BOEM, and interested Indian tribes or related descendants, as appropriate, outlining measures for excavation, disinterment, study, and re-

interment. The treatment plan will discuss the curation of any artifacts recovered in the process of excavation and provide for appropriate final disposition of the remains in accordance with applicable laws; and

7. Dominion Energy will be responsible for all costs associated with the discovery, evaluation and agency consultation, excavation, investigation and study, disinterment, re-interment, reporting, and curation of any human remains and associated funerary items encountered during Project construction.

3.3 References

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3.4 Contact List

The Contact List will be updated prior to construction and implementation of the UDP-T. The Contact List will be periodically updated while implemented to ensure contacts are up to date.

Dominion Energy On-Site Project Manager

TBD (Name)

(Title)

(Address)

(Address)

(Phone)

(email)

Contractor On-Site Manager/Foreman

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Appendix I. Environmental and Physical Settings

The environmental and physical settings section is prepared by the Environmental Impact Statement (EIS) third-party contractor, but relies heavily on information presented in the Construction and Operations Plan (COP). This section describes environmental and physical settings in the area(s) in which the actions are proposed to occur, and areas that may have interrelated or interdependent activities with the Proposed Action. These descriptions are utilized by various environmental resource sections in Chapter 3, *Affected Environment and Environmental Consequences,* to assess the reasonable, foreseeable impacts on those resources. Sections of this appendix may include physical oceanography, biological oceanography, meteorological conditions, geology, and acoustic environment. This section is to be used to provide additional information on resources within the Project area that is relevant to the impact discussions, but due to page limitations, could not be incorporated into Chapter 3.

I.1. General Regional Setting

I.2. Climate and Meteorology

Conditions that affect the weather and climate in an area include wind velocity, air temperature, and precipitation. Long-term averages of these conditions produce the regional climate. The state of Virginia straddles the Mid-Atlantic and Southeast regions of the United States. Northern parts of the state have a temperate climate while the southern parts of the state have a subtropical climate. Virginia officially classifies the state as a humid, subtropical climate due to winter frost and humid conditions in the summer influenced by the Chesapeake Bay and the Atlantic Ocean (Virginia Tourism Corporation 2021). Extreme meteorological conditions can be produced in both the Mid-Atlantic and Southeast regions during tropical and extratropical storms. Over the open ocean, meteorological characteristics are fundamentally influenced by oceanographic conditions and are therefore sometimes jointly discussed as “metocean” conditions. Several metocean conditions are highly seasonal and driven by both atmospheric and oceanic circulation patterns. Daily variability in meteorological conditions will drive fluctuations in wind farm power production and associated stresses on the wind turbine generators (WTGs), while long-term performance may be estimated based on the climatic conditions.

I.2.1 Regional Climate Overview

Virginia is classified as a mid-latitude climate zone based on the Köppen Climate Classification System. The mid-latitude climate zone is characterized by mostly moist subtropical conditions, generally warm and humid in the summer with relatively mild winters (BOEM 2021a). More specifically, the Lease Area is located in the Mid-Atlantic Bight. Oceanographic conditions along the Mid-Atlantic Bight are comparable to conditions along the mid-latitude East Coast, with warmer summer months and cooler yet mild winter months (BOEM 2021b).

Virginia has a varied topography with the Appalachian Mountains and Blue Ridge Mountains in the west and the Atlantic coastal region in the east. The eastern tidewater coastal region experiences more precipitation and humidity than the rest of the state, registering up to 50 inches of precipitation per year as compared to less than 40 inches in the central and western parts of the state (NCEI 2021a). The tidewater coastal region is also prone to coastal flooding, extreme winds, and high levels of rainfall from coastal storms. Coastal storms, including tropical storms and hurricanes, primarily affect the region between the months of June and November (BOEM 2021b).

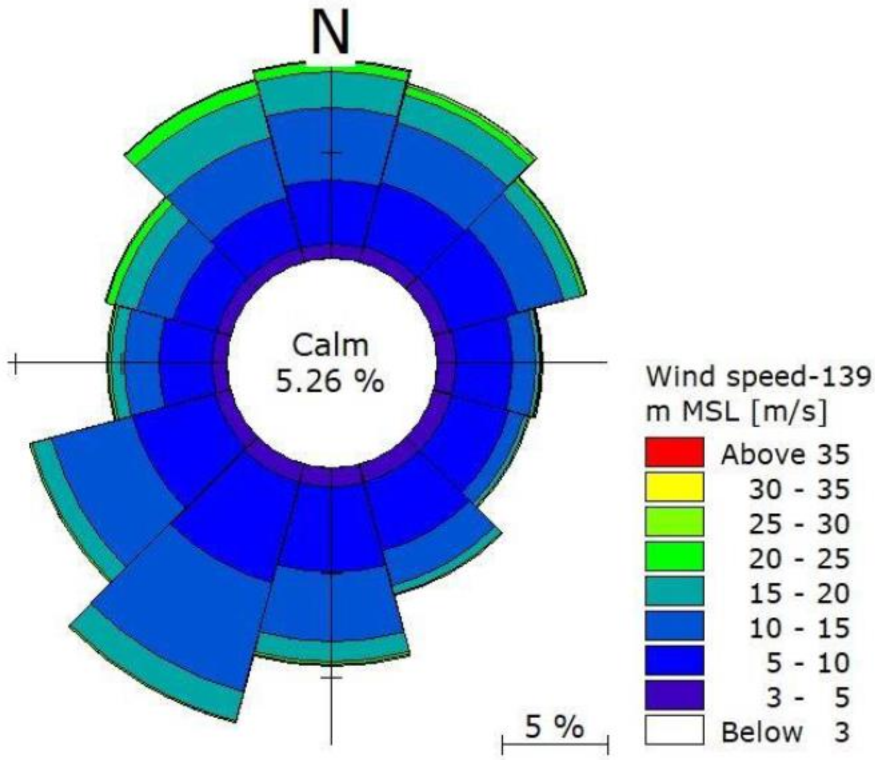
The North Atlantic Oscillation (NAO) also affects climate in the Northwest Atlantic on the scale of decades (Townsend et al. 2004). The NAO is calculated as the wintertime pressure difference between the high-pressure system over the Azores Islands and the low-pressure system over Iceland (Townsend et al. 2004). Shifts in the ratio of these pressures contribute to warmer or cooler average winters. Since the late 1970s, warmer NAO conditions have persisted on average (NJDEP 2010; Townsend et al. 2004). The NAO may be influenced by the El Niño-Southern Oscillation, which is a large-scale multi-year fluctuation in sea surface temperatures in the Pacific Ocean (NJDEP 2010). The NAO may also be correlated with an 11-year solar cycle (IPCC 2021).

IPCC classifies Virginia to be in the Southeast region of the United States for its climate change reports. The U.S. Southeast region is currently subject to climate changes associated with global warming that are primarily attributed to human activities, especially the production of heat-trapping (i.e., “greenhouse”) gases (Carter et al. 2018; Hayhoe et al. 2018; IPCC 2021). The Southeast region has experienced gradual warming since the 1960s, and the number of very cold nights in Virginia (minimum temperature below 0 degrees Fahrenheit [°F]) was below the long-term average for the last two decades recorded (Carter et al. 2018; NCEI 2021a). There is also an upward trend in the number of extreme precipitation events in Virginia, with the number of such events between 1995 and 1999 surpassing the previous record set in the early 1940s (NCEI 2021a). Continued climate change is likely to change the frequency and intensity of storms in the Project area because of its coastal location (EPA 2017 as cited in BOEM 2021b). Nuisance-level tidal floods associated with storms in the region, which can damage infrastructure and cause road closures, are increasing in frequency. Between 1980 and 2012, Virginia was affected by 35 of the 144 unique U.S. billion-dollar disaster events (NCEI 2021a).

I.2.2 Winds

Prevailing winds at the middle latitudes over North America occur mostly west to east (“westerlies”). Westerlies within the Lease Area vary in strength, pattern, and directionality and contribute to seasonal variability in the region. In the Mid-Atlantic Bight, winds during the summer are typically from the southwest, while winds in the winter months are typically from the northwest. Spring and fall are more variable, with wind currents from either the southwest or northeast (Schofield et al. 2008).

According to the Climate Forecast System Reanalysis data set, winds in the Lease Area are strongest from the north, while the highest frequency of winds come from the southwest and the north (NOAA n.d. as cited in BOEM 2021b). Average wind speed and direction are depicted as a wind rose in Figure I-1 below.



Source: NOAA n.d. as cited in BOEM 2021b.
Note: Operational wind parameters analyzed measured at a height of 32.8 feet (10 meters) above mean sea level (MSL); however, the data points were scaled to hub height of 456.0 feet (139 meters) above MSL. Lease Area is modeled at 36.947, -75.217 (latitude, longitude).

Figure I-1 Wind Rose of Mean Wind Speeds and Directions at Hub Height for the Lease Area (1979–2018)

In addition to the wind data presented above, representative data for wind speed and wind direction are publicly available from the NOAA National Data Buoy Center. The Chesapeake Light, Virginia buoy (Station CHLV2) located approximately 12 miles west of the Lease Area at coordinates of 36.905, -75.713 (latitude, longitude) was the closest National Data Buoy Center station to the Lease Area measuring wind speed and wind direction data. The Chesapeake Light, Virginia buoy was decommissioned in August 2016 due to deteriorating structural conditions (NOAA National Data Buoy Center 2021a). Data are also available from the Cape Henry, Virginia station (Station CHYV2) which is located on the coast in the Cape Henry Lighthouse approximately 29 miles west of the Lease Area at coordinates of 36.926, -76.007 (latitude, longitude) (NOAA National Data Buoy Center 2021b).

Before it was decommissioned, the maximum wind speed[1] recorded at the Chesapeake Light, Virginia buoy (Station CHLV2) was 83.0 miles per hour (mph) (37.1 meters per second [m/s]) in September 1985, with annual average wind speeds from 15.1 to 18.0 mph (6.8 to 8.0 m/s) across the 25 year data collection period. Monthly average wind speeds, monthly average peak wind gusts, and hourly peak wind gusts for each individual month are shown in Table I-1. Monthly mean wind speeds range from a low of 13.1 mph

[1] NOAA buoy measurements for wind speed are averaged over an 8-minute period. Higher speeds are recorded for 5- to 8-second gusts.

(5.9 m/s) in July and August to a high of 19.1 mph (8.5 m/s) in January. The monthly wind mean peak gusts reach a maximum during January at 23.8 mph (10.6 m/s), while the 1-hour average wind gusts reach a maximum during August at 98.9 mph (44.2 m/s) (NOAA National Data Buoy Center 2021a). Extreme wind conditions along the mid-latitude East Coast are influenced by tropical storms and higher hourly peak wind gusts registered in summer and fall months are often due to tropical cyclones.

Data from the Cape Henry, Virginia station (Station CHYV2) are available for the more recent period of March 2006 through December 2012. The Cape Henry, Virginia station, located on the coast as opposed to offshore, has measured lower wind speeds than the Chesapeake Light, Virginia buoy. The maximum wind speed at the Cape Henry, Virginia station was 59.5 mph (26.6 m/s) recorded in March 2009, and average annual wind speeds measured from 11.7 to 12.8 mph (5.2 to 5.7 m/s) across the 6 years recorded (NOAA National Data Buoy Center 2021b).

Table I-1 Representative Wind Speed Data

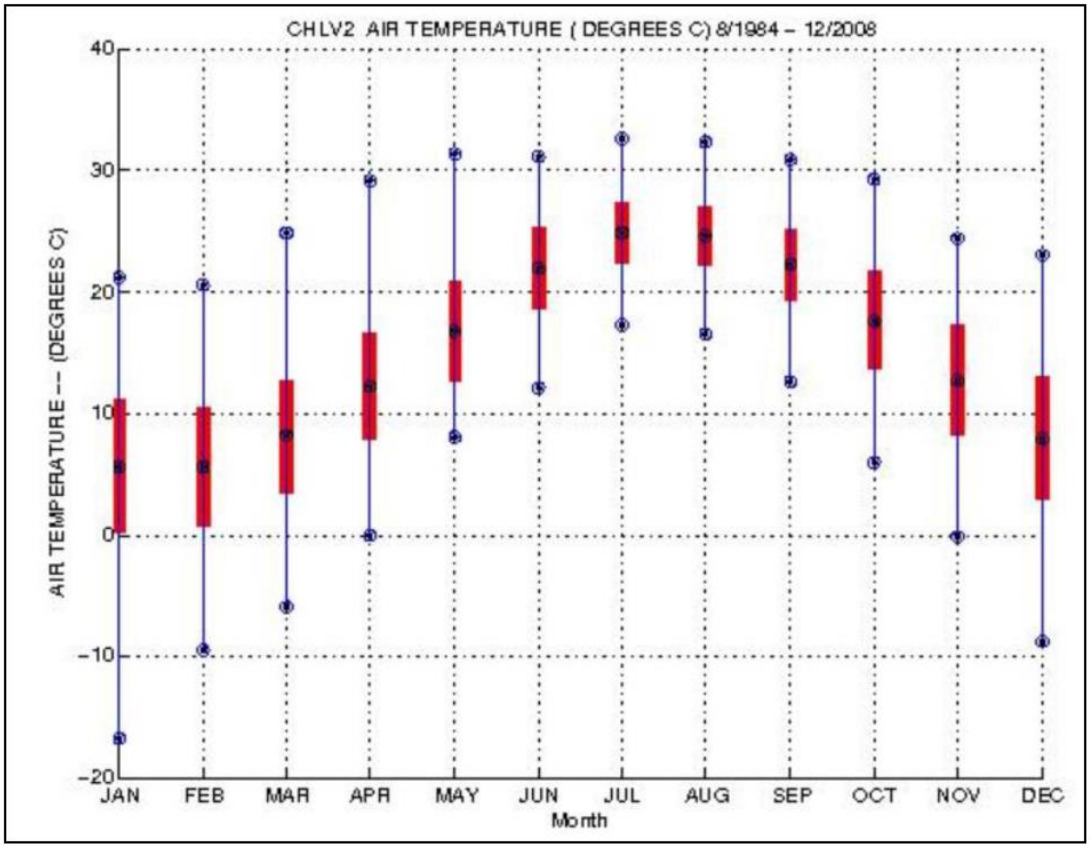
Month	Monthly Average Wind Speed (1984–2008)		Monthly Average of Hourly Peak Gust (1990–2005)		Monthly Maximum Hourly Peak Gust (1990–2005)	
	mph	m/s	mph	m/s	mph	m/s
January	19.1	8.5	23.8	10.6	79.2	35.4
February	18.6	8.3	23.1	10.3	75.1	33.6
March	18.8	8.4	23.2	10.4	83.0	37.1
April	18.5	8.3	23.4	10.5	72.5	32.4
May	16.2	7.2	20.4	9.1	64.2	28.7
June	14.3	6.4	17.7	7.9	55.7	24.9
July	13.1	5.9	16.8	7.5	72.5	32.4
August	13.1	5.9	16.7	7.5	98.9	44.2
September	15.2	6.8	19.6	8.8	93.3	41.7
October	16.0	7.2	20.4	9.1	73.9	33.0
November	17.5	7.8	21.6	9.7	63.5	28.4
December	18.3	8.2	23.6	10.6	87.0	38.9
Annual	16.6	7.4	20.8	9.3	98.9	44.2

Source: NOAA National Data Buoy Center 2021a.
Note: Data presented are for National Data Buoy Center Station CHLV2 (Chesapeake Light, Virginia).

I.2.3 Air Temperature and Precipitation

NOAA's National Centers for Environmental Information (NCEI), formerly the National Climatic Data Center, defines distinct climatological divisions to represent areas that are nearly climatically homogeneous. Locations within the same climatic division are considered to share the same overall climatic features and influences. The site of the Proposed Action is located within the Virginia tidewater division or Virginia Climate Division 1 (NCEI 2021b).

The mean average annual air temperature in the tidewater division of Virginia was 58.0°F (14.4 degrees Celsius [°C]) between 1895 and 2021 (NCEI 2021c). The seasonal mean ranged from 39.5°F (4.2°C) in winter (December through February) to 76.1°F (24.5°C) in summer (June through August) (NCEI 2021c). According to Dominion Energy's preliminary metocean analysis, air temperatures in the Project area range from -0.4 to 95°F (18 to 35°C) (Ramboll 2020; NOAA 2020 as both cited in BOEM 2021b). The monthly mean and extreme air temperatures are shown graphically in Figure I-2.



Source: NOAA 2020 as cited in BOEM 2021b.

Figure I-2 Monthly Mean, One Standard Deviation, and Monthly Extreme Air Temperatures at National Data Buoy Center Station CHLV2 (1984–2008)

Air temperature information is also available from NOAA's National Data Buoy Center Chesapeake Light, Virginia buoy (Station CHLV2) and Cape Henry, Virginia Station (Station CHYV2). This information is presented in Table I-2 and shows average air temperatures near the Lease Area ranging from 41 to 78°F (4.7 to 25.8°C), with the higher temperatures during the summer months (NOAA National Data Buoy Center 2021a; 2021b).

Table I-2 Average Air Temperature at NDBC Buoys Near the Lease Area

Average Air Temperature in °F														
Buoy	**Years**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
CHLV2	1984-2008	42.1 (5.6)	42.1 (5.6)	46.6 (8.1)	54.1 (12.3)	62.2 (16.8)	71.4 (21.9)	76.6 (24.8)	76.3 (24.6)	72.0 (22.2)	63.9 (17.7)	54.9 (12.7)	46.4 (8.0)	59.0 (15.0)
CHYV2	2006-2012	40.5 (4.7)	42.1 (5.6)	50.2 (10.1)	59.5 (15.3)	65.8 (18.8)	75.4 (24.1)	78.4 (25.8)	78.1 (25.6)	72.7 (22.6)	64.0 (17.8)	54.0 (12.2)	45.9 (7.7)	60.8 (16.0)

Source: NOAA National Data Buoy Center 2021a; 2021b.

The mean annual precipitation for the tidewater region of Virginia between 1895 and 2021 was 44.84 inches (113.9 centimeters) (NCEI 2021d). During the same period, the mean monthly precipitation ranged from 2.86 inches (7.3 centimeters) in November to 5.11 inches (13.0 centimeters) in July (NCEI 2021d). A summary of monthly and annual mean temperature and precipitation data collected for the Virginia tidewater division between 1895 and 2021 is presented in Table I-3.

Table I-3 Mean Temperatures and Precipitation for Virginia Tidewater Division (1895–2021)

Month	Average Mean Temperature		Maximum Mean Temperature		Minimum Mean Temperature		Total Mean Precipitation	
	°F	°C	°F	°C	°F	°C	Inches	cm
January	38.1	3.4	48.0	8.9	28.3	-2.1	3.37	8.56
February	39.7	4.3	50.1	10.1	29.2	-1.6	3.21	8.15
March	47.5	8.6	58.7	14.8	36.4	2.4	3.81	9.68
April	56.6	13.7	68.3	20.2	44.9	7.2	3.31	8.41
May	65.9	18.8	77.1	25.1	54.6	12.6	3.80	9.65
June	73.9	23.3	84.4	29.1	63.4	17.4	4.13	10.49
July	78.0	25.6	87.9	31.1	68.0	20.0	5.11	12.98
August	76.5	24.7	86.3	30.2	66.7	19.3	4.84	12.29
September	70.7	21.5	80.8	27.1	60.6	15.9	3.90	9.91
October	59.8	15.4	70.8	21.6	48.8	9.3	3.23	8.20
November	49.2	9.6	60.1	15.6	38.3	3.5	2.86	7.26
December	40.6	4.8	50.5	10.3	30.8	-0.7	3.31	8.41
Annual	**58.0**	**14.4**	**68.6**	**20.3**	**47.5**	**8.6**	**44.84**	**113.89**

Source: NCEI 2021c; 2021d.
°C = degrees Celsius; °F = degrees Fahrenheit; cm = centimeters.

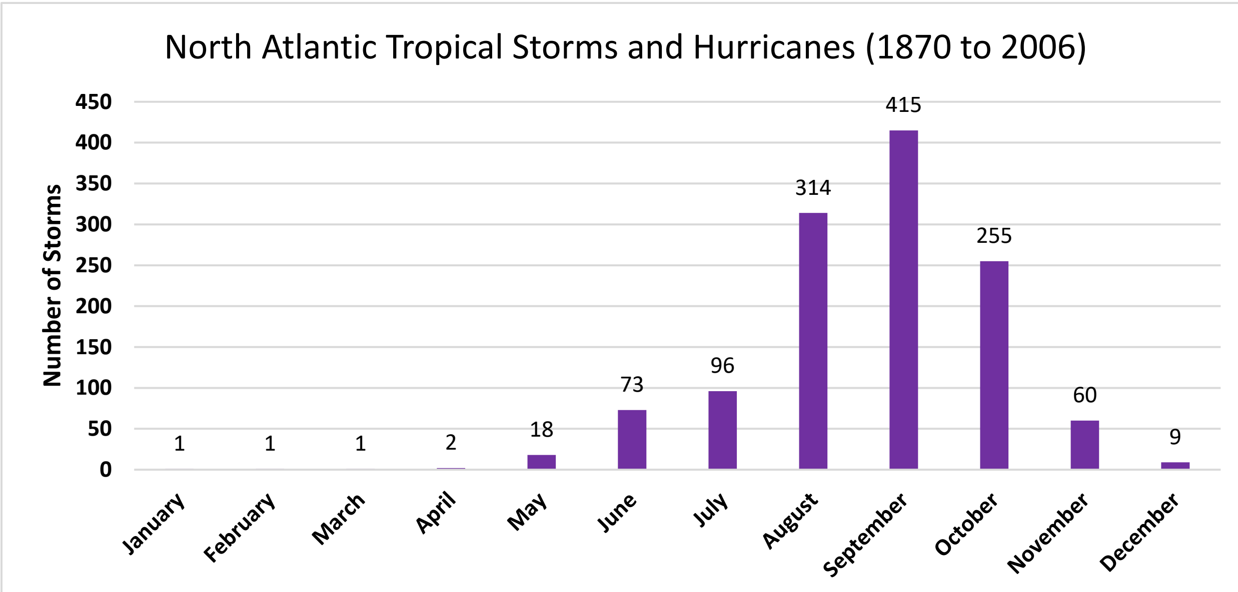
I.2.4 Extreme Storm Events

Storm events are known to occur within the Mid-Atlantic Bight and include, but are not limited to, tropical storms and hurricanes. Tropical storms and hurricanes tend to increase in intensity and frequency toward the southern portion of the East Coast. Furthermore, the storms will build and intensify offshore, indicating that the Offshore Project area may be subject to more extreme-weather events than the Onshore Project Area. Tropical storms and hurricanes can cause extreme waves and winds, extreme tides, and temporary shifts in the currents (BOEM 2021b).

The annual hurricane season typically occurs from the beginning of June to the end of November (BOEM 2021b). This is consistent with the peak period for tropical cyclones throughout the North Atlantic basin (Figure I-3) (McAdie et al. 2009). Such storms that travel along the coastline of the eastern U.S. have the potential to impact the Project area with high winds and severe flooding.

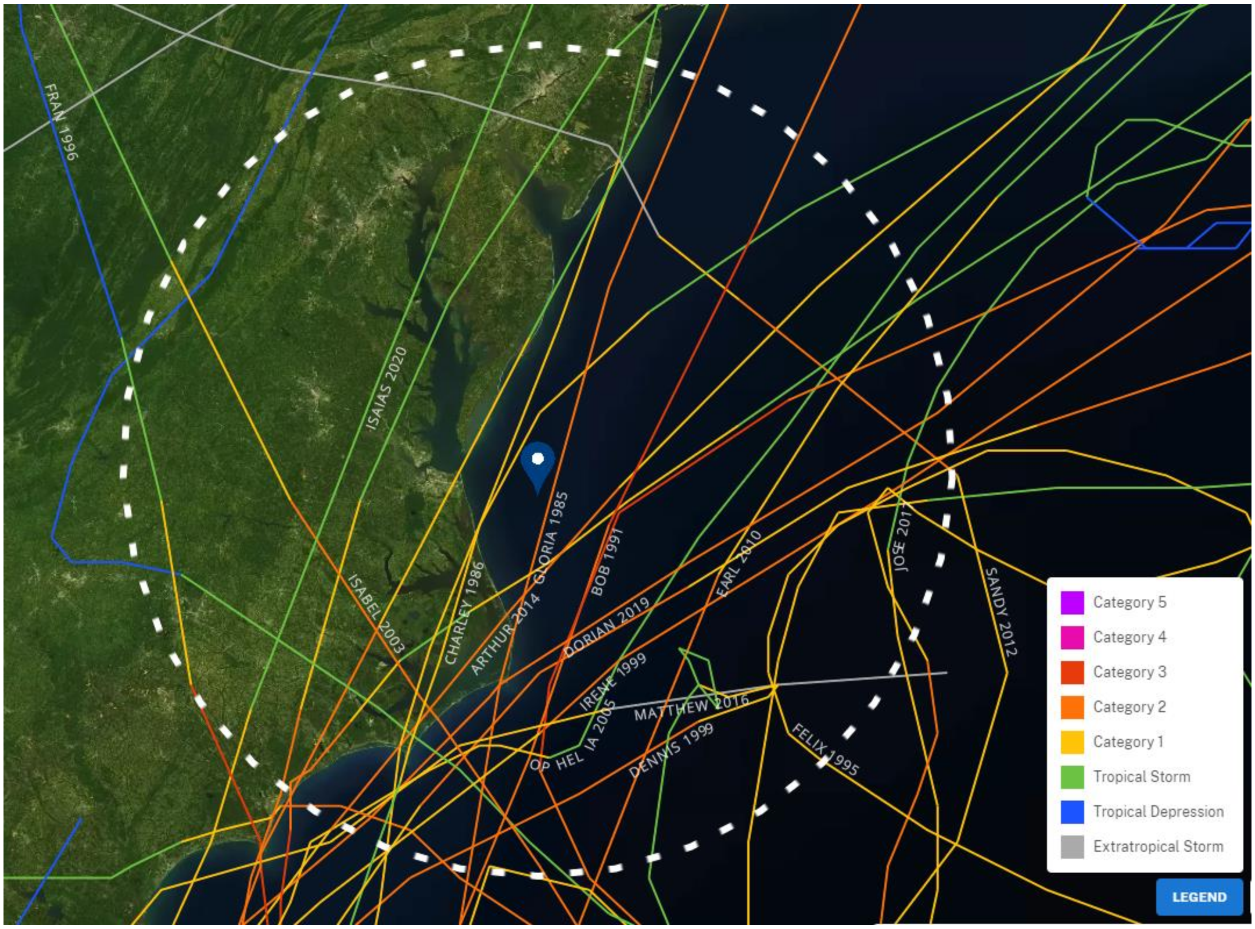
Figure I-4 identifies the hurricane tracks surrounding the Lease Area between 1984 and 2020 (NOAA 2021). Though data on tropical systems go back to 1851, the quality and consistency of the data are lacking the further back one looks. The analyzed storm period was selected based on the availability of consistent wind data for tropical and extratropical systems and for the Project area. The category for each storm is designated by a color for each segment of its track in Figure I-4. Table I-4 lists each of the hurricanes affecting the Lease Area and the corresponding maximum storm categories as the hurricane occurred within 200 nautical miles (370 kilometers) of the Lease Area for the corresponding period

(NOAA 2021). Most historical hurricanes affecting the Lease Area are Category 1, but storms as powerful as Category 3 hurricanes have passed nearby the Lease Area.



Source: McAdie et al. 2009

Figure I-3 Total Number of North Atlantic Basin Tropical Storms and Hurricanes per Month (1870–2006)



Source: NOAA 2021

Figure I-4 Tracks of Hurricanes that Occurred Within a Radius of 200 Nautical Miles (370 kilometers) Around the Lease Area Between 1984 and 2020

Table I-4 Hurricanes with Tracks Passing Within 200 Nautical Miles of Lease Area Between 1984 and 2020

Storm Name	Year	Maximum Storm Category Within 200 Nautical Miles of Lease Area
Isaias	2020	Category 1 Hurricane
Dorian	2019	Category 2 Hurricane
Florence	2018	Category 2 Hurricane
Maria	2017	Category 1 Hurricane
Jose	2017	Category 1 Hurricane
Matthew	2016	Category 1 Hurricane
Arthur	2014	Category 2 Hurricane
Sandy	2012	Category 2 Hurricane
Irene	2011	Category 1 Hurricane
Earl	2010	Category 2 Hurricane
Ophelia	2005	Category 1 Hurricane
Alex	2004	Category 2 Hurricane
Isabel	2003	Category 2 Hurricane
Irene	1999	Category 2 Hurricane
Floyd	1999	Category 2 Hurricane
Dennis	1999	Category 2 Hurricane
Bonnie	1998	Category 2 Hurricane
Fran	1996	Category 1 Hurricane
Bertha	1996	Category 2 Hurricane
Felix	1995	Category 1 Hurricane
Gordon	1994	Category 1 Hurricane
Emily	1993	Category 3 Hurricane
Bob	1991	Category 3 Hurricane
Charley	1986	Category 1 Hurricane
Gloria	1985	Category 2 Hurricane
Josephine	1984	Category 1 Hurricane

Source: NOAA 2021.
Notes: The Lease Area location was represented by a point with the following coordinates: Latitude 36.947, Longitude -75.217. Hurricane categories are identified as 1 through 5 based on the Saffir-Simpson scale.

The costliest weather event to ever affect the state of Virginia was Superstorm Sandy in 2012 (NCEI 2021a). Superstorm Sandy was, at its maximum, a Category 2 Hurricane within 200 nautical miles of the Lease Area but was considered a post-tropical storm as it affected onshore portions of Virginia. Superstorm Sandy caused severe coastal flooding from storm surges. In Wachapreague on the Eastern Shore of Virginia, tide gauges measured a storm surge of 4.95 feet (1.5 meters) and inundations of 2 to 4 feet (0.6 to 1.2 meters) were prevalent along the coast (Blake et al. 2013). During Superstorm Sandy, the Norfolk International Airport (location code KORF) recorded maximum sustained wind speeds of 34 knots (39.1 mph; 17.5 m/s), while marine observations at the Chesapeake Light, Virginia buoy (Station CHLV2) recorded maximum sustained wind speeds of 49 knots (56.4 mph; 25.2 m/s) and a peak gust of 59 knots (67.9 mph; 30.4 m/s) (Blake et al. 2013).

I.2.5 Potential General Impacts of Offshore Wind Facilities on Meteorological Conditions

A known impact of offshore wind facilities on meteorological conditions is the wake effect. A wind turbine generator (WTG) extracts energy from the free flow of wind, creating turbulence downstream of the WTG. The resulting “wake effect” is the aggregated influence of the WTGs for the entire wind farm on the available wind resource and the energy production potential of any facility located downstream. Christiansen and Hasager (2005) observed offshore wake effects from existing facilities via satellite with synthetic aperture radar to last anywhere from 1.2 to 12.4 miles (2 to 20 kilometers) depending on ambient wind speed, direction, degree of atmospheric stability and the number of turbines within a facility. During stable atmospheric conditions, these offshore wakes can be longer than 43.5 miles (70 kilometers).

Under certain conditions, offshore wind farms can also affect temperature and moisture downwind of the facilities. For example, from September 2016 to October 2017, a study using aircraft observations accompanied by mesoscale simulations examined the spatial dimensions of micrometeorological impacts from a wind energy facility in the North Sea (Siedersleben et al. 2018). Measurements and associated modeling indicated that measurable redistribution of moisture and heat were possible up to 62 miles (100 kilometers) downwind of the wind farm. However, this occurred only when (a) there was a strong, sustained temperature inversion at or below hub height and (b) wind speeds were greater than approximately 13.4 mph (6 m/s) (Siedersleben et al. 2018). Typically, air temperature will decrease with height above the sea surface in the lower atmosphere (i.e., the troposphere), and air will freely rise and disperse up to a “mixing height” (Holzworth 1972; Ramaswamy et al. 2006). A temperature inversion occurs when a warmer overlying air mass causes temperatures to increase with height; a strong inversion inhibits the further rise of cooler surface air masses, thus limiting the mixing height (Ramaswamy et al. 2006). Therefore, the North Sea study suggests that rapidly spinning turbines with hub heights at or above a strong inversion may induce mixing between air masses that would otherwise remain separated, which can significantly affect temperature and humidity downwind of a wind farm.

The mixing height over open waters of the North Atlantic Ocean is typically greater than 1,640 ft (500 m) above mean sea level, except over areas of upwelling, where the mixing height may be closer to the sea surface (Holzworth 1972; Fuhlbrügge et al. 2013). Table I-5 presents atmospheric mixing height data from the nearest measurement location to the Project area (Wallops Island, Virginia). As shown in the table, the minimum average mixing height is 640 meters (2,100 feet), while the maximum average mixing height is 1,505 meters (4,938 feet).

Table I-5 Representative Seasonal Mixing Height Data

Season	Data Hours Included[1]	Wallops Island, Virginia Average Mixing Height (meters)
Winter (December, January, February)	Morning – No-Precipitation Hours	692
	Morning – All Hours	739
	Afternoon – No-Precipitation Hours	1,098
	Afternoon – All Hours	1,010
Spring (March, April, May)	Morning – No-Precipitation Hours	640
	Morning – All Hours	687
	Afternoon – No-Precipitation Hours	1,489
	Afternoon – All Hours	1,369
Summer (June, July, August)	Morning – No-Precipitation Hours	672
	Morning – All Hours	720

Season	Data Hours Included[1]	Wallops Island, Virginia Average Mixing Height (meters)
	Afternoon – No-Precipitation Hours	1,505
	Afternoon – All Hours	1,413
Fall (September, October, November)	Morning – No-Precipitation Hours	662
	Morning – All Hours	717
	Afternoon – No-Precipitation Hours	1,241
	Afternoon – All Hours	1,178
Annual Average	Morning – No-Precipitation Hours	666
	Morning – All Hours	716
	Afternoon – No-Precipitation Hours	1,333
	Afternoon – All Hours	1,244

Source: USEPA 2021.
[1] Missing values are not included.

Díaz et al. (2019) reported that measurements over the Atlantic Ocean between 1981 and 2010 indicated a trend of decreasing strength and thickness of inversion layers, accompanied by a general increase in the mixing height, which is correlated with an increase in sea surface temperatures. Therefore, WTG hub heights are expected to remain well below the typical mixing height and associated temperature inversions over the open ocean in the Mid-Atlantic and Southeast U.S. regions. Thus, the redistribution of moisture and heat due to rotor-induced vertical mixing, and any associated shifts to the microclimate, would be limited to the immediate vicinity of a wind facility in this region.

Additionally, mixing height affects air quality by acting as a lid on the height to which air pollutants can vertically disperse. Lower mixing heights allow less air volume for pollutant dispersion and lead to higher ground-level pollutant concentrations than do higher mixing heights.

I.3. Water Quality

Figure I-5 shows impaired waterbodies within the geographic analysis area for water quality. Table I-6 contains a complete listing of 303(d) impaired waters in the geographic analysis area and the reasons for their impairment.

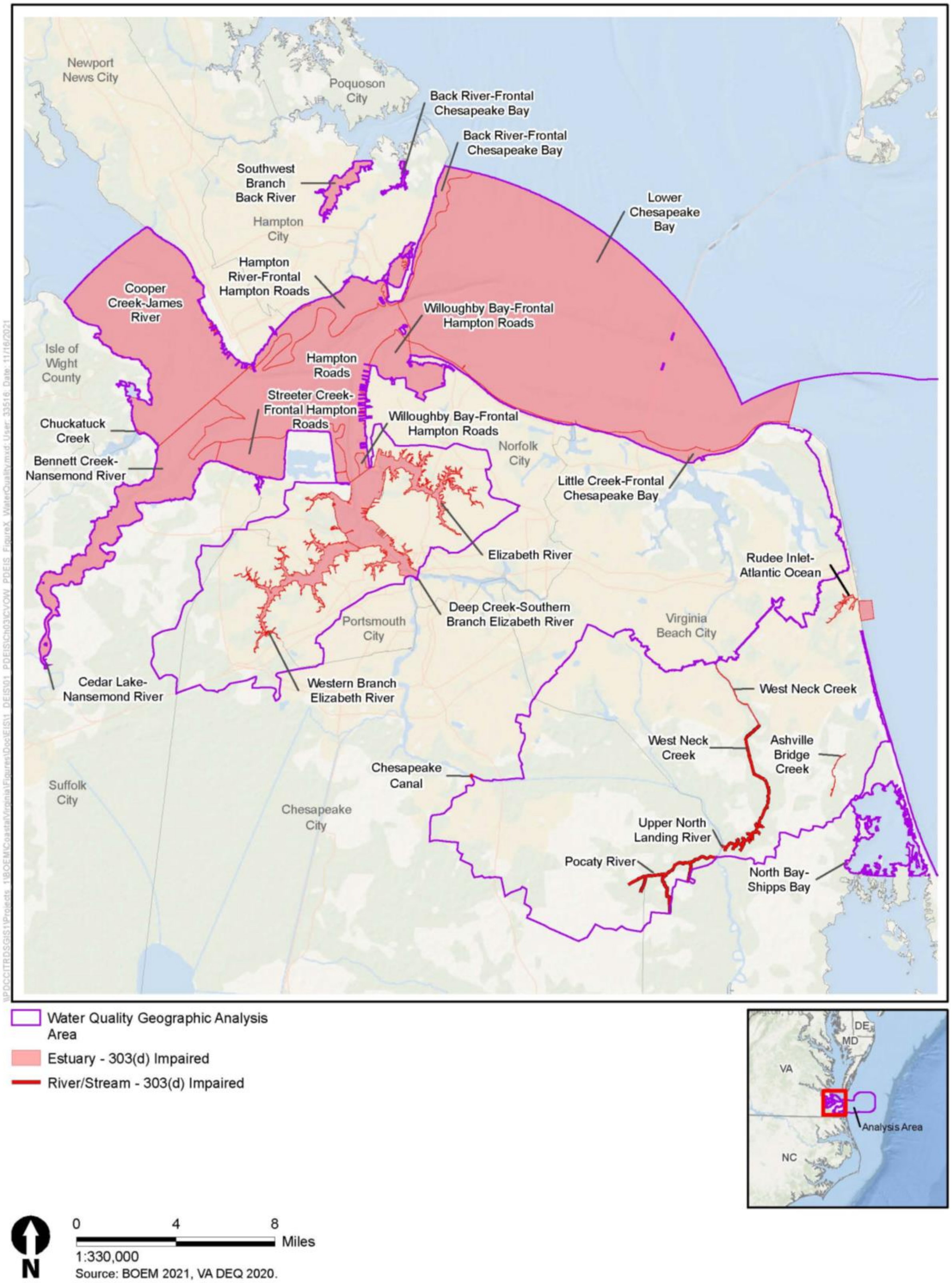


Figure I-5 303(d) Impaired Surface Waters in the Water Quality Geographic Analysis Area

Table I-6 303(d) Impaired Surface Waters in the Water Quality Geographic Analysis Area

Water Name	Location	Impairment Cause(s)	Source(s)
303(d) Impaired Estuarine Waters in the Geographic Analysis Area			
10th View Beach	Located along Chesapeake Bay, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
13th View Beach	Located along Chesapeake Bay, in Norfolk. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Atlantic Ocean Beaches - Croatan	Croatan Beach along shore of City of Virginia Beach. VDH bathing beach areas.	Enterococcus	Wet Weather Discharges (Non-Point Source)
Buckroe Beaches	From northeast of Buckroe Beach southwest to parallel with start of Mill Cr. Portion of CBP Segment CB8PH. No DSS shellfish condemnations.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Ches Bay Beaches	Located along Chesapeake Bay, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source

Water Name	Location	Impairment Cause(s)	Source(s)
Chesapeake Bay - CBP Segment CB8PH	This assessment unit is the mainstem portion of Chesapeake Bay Program segment CB8PH, located in the Virginia Chesapeake Bay between the mouths of the James River and mouth of Chesapeake Bay. HUC: 02080101.	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Chesapeake Bay - Off Little Creek BSS #068-017, Areas A & B	Virginia Dept of Health Shellfish (administrative) closure #068-017, Off Little Creek, Sections A and B. HUC: 02080101.[effective 2005-3-08]	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Chesapeake Bay - Off Little Creek BSS #068-017, Section C	Virginia Dept of Health Shellfish (administrative) closure #068-017, A portion of section C. Off Little Creek. HUC: 02080101.[effective 2005-3-08]	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Chesapeake Bay - S. Thimble Island BSS Condemnation #163	Virginia Dept of Health Shellfish zone #163. Open to shellfish harvesting as of 4/25/2007. S. Thimble Island. HUC: 02080101	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Clean Sediments, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Source Unknown, Non-Point Source, Sources Outside State Jurisdiction or Borders, Sediment Resuspension (Clean Sediment), Wet Weather Discharges (Non-Point Source)
Chicks Beach	Located along Chesapeake Bay near Chesapeake Bay Bridge Tunnel, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source

Water Name	Location	Impairment Cause(s)	Source(s)
Chuckatuck Creek and Mouth in James	South shore tributary to James R., after confluence with Brewers Creek to mouth. Portion of CBP segment JMSMH. DSS OPEN shellfish direct harvesting condemnation # 062-080 (effective 20171011).	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
DSS Inlet #1 - Unnamed Inlet at Mouth of SW Branch	South shore trib. to mainstem Back R. Located east of mouth of SW Branch. CBP Segment MOBPH. DSS shellfish harvesting condemnation # 054-021 C (effective 20181018).	Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Marina/Boating Sanitary On-vessel Discharges, Muni
DSS Inlet #2 - Unnamed Inlet S. Shore of SW Br. Back River	South shore trib. to Southwest Branch Back R. Located near mouth of SW Branch, west of unnamed DSS Inlet #1. DSS OPEN condemnation # 054-021 (effective 20181018). CBP Segment MOBPH.	Dissolved Oxygen, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Fort Monroe Beaches	All of Fort Monroe Beach from the start of Mill Cr south to Lighthouse Old Point Comfort. Portion of CBP Segment CB8PH. No DSS shellfish condemnations.	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Grandview Pier & Saltponds Beaches	From Grandview beach southwest to northeast of Buckroe Beach. Offshore of Buckroe Beach VDH monitoring. area Portion of CBP Segment CB8PH. No DSS shellfish condemnation present.	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source

Water Name	Location	Impairment Cause(s)	Source(s)
Grandview Pier & Saltponds Beaches [No TMDL]	From southernmost point of Grandview Beach southwest to northeast of Buckroe Beach. Shoreward of GRV01A06. Portion of CBP Segment CB8PH. DSS ADMIN shellfish condemnation # 055-216 A (effective 20080530).	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Harris River - Upper	South shore trib. to mainstem Back R. Adjacent to Fox Hill area. DSS shellfish condemnation # 054-215 A (effective 20181018). CBP Segment MOBPH.	Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Marina/Boating Sanitary On-vessel Discharges, Muni
James River - Along Lower North Shore	Mainstem along north shore, from Jail Point (Mulberry Isle) downstream to line following Rt. 664. CBP segment JMSMH. Portions of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518) & 057-007 A (effective 20120529).	Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
James River - Hilton Beach Area	North shore James R. NW of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080518).	Enterococcus, Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
James River - Hilton Village to Craney Island	Mainstem from a line between Hilton Village (Newport News)/Kings Creek (Isle of Wight) downstream to the end of DSS (OPEN) shellfish harvesting condemnation # 059-069 F (effective 20141219). CBP segment JMSMH.	Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown

Water Name	Location	Impairment Cause(s)	Source(s)
James River - Huntington Beach Area	North shore James R. near foot of James R. Bridge. Mainstem along north shoreline beach in Hilton Village area. CBP segment JMSMH. Portion of DSS (ADMIN) shellfish condemnation # 058-034 A (effective 20080508).	Enterococcus, Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
James River - Jail Point to Hilton Village	Mainstem from line between Jail Pt (Mulberry Isle) to Days Pt (Mouth Pagan R) downstream to line Hilton Village (Newport News)/Kings Creek (Isle of Wight). CBP segment JMSMH. DSS (OPEN) shellfish harvesting condemnation # 059-069 (effective 20141219).	Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
James River - Newport News Point to NW Corner Craney Isl.	Line following the Rt. 664 crossing mid-river, SW to mid-mouth Nansemond R. to SW tip Craney Isl. Line. The NW line from NW tip Craney Isl. to Lincoln Pk. CBP segment JMSMH. DSS (ADMIN) condition # 056-007 A, B, C (effective 20120529).	Estuarine Bioassessments, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown
James River at Hampton Roads Harbor	Mainstem from a line between Lincoln Park and the NW corner of Craney Isl. downstream to mouth at Hampton Roads Tunnel. CBP segment JMSPH. DSS (ADMINISTRATIVE) shellfish condemnation # 056-007 A (effective 20120529).	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Source Unknown

Water Name	Location	Impairment Cause(s)	Source(s)
Lake Rudee - Lower (Rudee Inlet Canal)	Lower portion of Lake Rudee, including Rudee Inlet Canal. From RM 0.4 (upstream of confluence of Lake Holly with Rudee Inlet canal) downstream through Inlet canal to mouth. Portion of DSS shellfish harvesting condemnation # 073-074 (effective 2013-06-11).	Fecal Coliform	Source Unknown
Lake Rudee - Upper	Lake Rudee, from end of Owl Creek downstream to approx. RM 0.4 (upstream of confluence of Lake Holly with Rudee Inlet canal). Portion of DSS shellfish condemnation # 073-074 A (effective 2013-06-11).	Fecal Coliform	Source Unknown
Lake Rudee - Upper (northwest trib.)	Tributary of Lake Rudee between Terrace Ct and Caspian Ave	Enterococcus, Fecal Coliform	Source Unknown
Lake Wesley - Upstream Branches	From start of both branches downstream to confluence with Rudee Inlet; eastern portion. Segment reflects status of station at mid-embayment. DSS shellfish condemnation # 073-074 A (effective 2013-06-11).	Enterococcus, Fecal Coliform	Source Unknown
	From start of both branches downstream to confluence with Rudee Inlet; western portions. Segment reflects status of station at mid-embayment. DSS shellfish condemnation # 073-074 A (effective 2013-06-11).	Fecal Coliform	Source Unknown
Nansemond River - Lower [No TMDL]	Nansemond R mouth. From Olds Cove downstream to mouth. CBP segment JMSMH. DSS (OPEN) condemnation 063-046 (effective 20140826) & 063-008 (effective 20170823).	(blank)	(blank)

Water Name	Location	Impairment Cause(s)	Source(s)
Newmarket Creek - Lower	South of Blue Bird Gap Farm area. From the I-64 crossing (RM 3.68) downstream to confluence with SW Br. Back R. CBP Segment MOBPH. Portion of DSS shellfish condemnation # 054-021 B (effective 20181018).	Enterococcus, Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wastes from Pet
North Community Beach	Located along Chesapeake Bay, in cities of Norfolk and Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Owl Creek - Lower	Headwaters tributary to Lake Rudee, located west of Lake Christine. Segment from mid-way point where creek broadens downstream to confluence with Lake Rudee. Portion of DSS shellfish direct harvesting condemnation # 073-074 A (effective 2013-06-11).	Fecal Coliform	Source Unknown
Owl Creek- Upper	Headwaters tributary to Lake Rudee, located west of Lake Christine. Segment from headwaters downstream to point where creek broadens. Portion of DSS shellfish direct harvesting condemnation # 073-074 A (effective 2013-06-11).	Enterococcus, Fecal Coliform	Source Unknown
Owl Creek- Upper Trib.	Headwaters tributary to Lake Rudee, located west of Lake Christine. Segment from headwaters upstream to the upper-middle portion. Portion of DSS shellfish direct harvesting condemnation # 073-074 A (effective 2013-06-11).	Enterococcus, Dissolved Oxygen, Fecal Coliform	Source Unknown

Water Name	Location	Impairment Cause(s)	Source(s)
Sara Constance Park and Ocean View Park Beaches	Located along Chesapeake Bay, in Norfolk. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	Enterococcus, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Shore Drive Beaches - East	Located along Chesapeake Bay, Virginia Beach. Portion of CBP segment CB8PH. No DSS shellfish direct harvesting condemnations present.	PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown, Non-Point Source
Southwest Br. Back River - Mouth	Lower portion to confluence with mainstem Back R. CBP Segment MOBPH. Portion of DSS shellfish (OPEN) condemnation # 054-021 (effective 20181018).	Estuarine Bioassessments, Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wastes from Pet
SW Br Back River - Incl Tides Mill Cr [TMDL area]	Headwaters of Southwest Branch (incl tidal Tides Mill Cr) downstream to Langley View. CBP segment MOBPH. Portion of DSS shellfish condemnation # 054-021 B (effective 20181018).	Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wastes from Pet
	Headwaters of Southwest Branch (incl tidal Tides Mill Cr) downstream to Langley View. CBP segment MOBPH. Portion of DSS shellfish condemnation seasonally restricted and conditionally condemned areas # 054-021 B (effective 20181018).	Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wastes from Pet

Water Name	Location	Impairment Cause(s)	Source(s)
Unsegmented estuaries in Back River - DSS	Non-segmented areas of C07E. CBP Segment MOBPH. DSS Condemnation # 054-021 B (effective date 20181018).	Dissolved Oxygen, Fecal Coliform, PCBs in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wastes from Pet
303(d) Impaired Streams in the Geographic Analysis Area			
Pocaty River	Pocaty River and selected tributaries from headwaters at mile 3.92 to confluence with North Landing River at mile 0.00.	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli), Dissolved Oxygen	Source Unknown, Non-Point Source, Crop Production (Crop Land or Dry Land), Agriculture, Urban Runoff/Storm Sewers
West Neck Creek - Lower	Segment and tribes. from widening of creek (RM 3.10) approx. 0.55 mile downstream of Indian River Road crossing downstream to mouth (RM 0.0) at confluence with North Landing River.	Escherichia coli (E. coli)	Source Unknown
West Neck Creek - Middle	Segment from south side of Princess Anne Road crossing (RM 6.20) downstream to widening of creek (RM 3.10) near Indian River Road crossing.	Escherichia coli (E. coli), Dissolved Oxygen, PCBs in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Source Unknown, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses Needed, Urban Runoff/Storm Sewers

Source: VDEQ 2020.

I.4. Wetlands

Notable natural habitats and/or rare natural communities are located within or adjacent to the Onshore Project Components. These include areas of the North Landing River, Gum Swamp, Pocaty River, and West Neck Creek which support a variety of wetland communities, including forested bottomlands. Additional information on these areas is provided below and in COP Section 4.2.2 and COP Appendix U, Wetland Delineation Report (Dominion Energy 2022). As stated in Chapter 2, Alternatives Including the Proposed Action, on October 7, 2022, Dominion Energy requested that BOEM remove from consideration Interconnection Cable Route Options 2, 3, 4, and 5. However, for context about notable natural habitats and/or rare natural communities within the geographic analysis area, BOEM has included discussion of Interconnection Cable Route Options 2, 3, 4 and 5 in the following subsections.

I.4.1 North Landing River

The North Landing River watershed occurs through large portions of western and southwestern portions of the city of Virginia Beach and eastern portions of the city of Chesapeake. Rare communities that are associated with the North Landing River and its tributaries include non-riverine swamp forest, pond pine (Pinus serotina) woodland and high pocosin subtype, peatland Atlantic white cedar (*Chamaecyparis thyoides*) forest, and several globally rare types of oligohaline marshes (VDCR-DNH 2001). The North Landing River Natural Area Preserve occurs approximately 1.7 miles (2.7 kilometers) southeast of the Onshore Project Area and consists of state-owned conservation lands maintained by the Virginia Department of Conservation and Recreation (VDCR). The North Landing River Preserve consists of approximately 7,599 acres (3,075 hectares) of conservation lands privately managed by The Nature Conservancy (TNC) and preserves large swathes of forested wetland habitat on the west side of the North Landing River from the Virginia-North Carolina border and northwards to include Gum Swamp. Two of the interconnection cable route options (1 and 6) would cross TNC-protected lands. Several of the interconnection cable route options screened by Dominion Energy and subsequently removed from consideration in this Draft EIS (Options 2, 3, 4, and 5) would also cross the North Landing River at its upper limits, in the vicinity of the North Landing River Bridge located on North Landing Road and Mount Pleasant Road. These areas support wetland types considered rare in the Commonwealth of Virginia including pocosins, which are characterized by dense evergreen shrubs and vines with scattered pond pine. These areas also contain numerous swamps and freshwater tidal marshes and host rare plant and wildlife species (VDCR-DNH 2020; TNC 2020). Rare plant and wildlife species with the potential to occur within these areas based on publicly accessible database searches is provided in this section below. Potential threats to these ecosystems include habitat loss and fragmentation and introduction of exotic and invasive species (VDCR-DNH 2001) (COP Section 4.2.2; Dominion Energy 2022).

Interconnection Cable Route Options (Option 5, which has been removed from consideration in this Draft EIS) would cross the northernmost portion of Naval Auxiliary Landing Field Fentress, north of Mount Pleasant Road. This area contains significant wetland habitats associated with the North Landing River. In a 2018 study at Naval Auxiliary Landing Field Fentress, a state rare community, bald cypress-mixed tupelo intermediate swamp, was documented on the facility north of Mount Pleasant Road (Dominion Energy 2021 citing NAVFAC 2019). The forested wetlands along the northern portion of Naval Auxiliary Landing Field Fentress are designated by the Navy as the “North Landing River Special Interest Area.” The area contains documented natural heritage resources and is managed to protect and enhance those resources (Dominion Energy 2021 citing NAVFAC 2019). The North Landing River Special Interest Area is geographically contiguous with TNC North Landing River Preserve protected lands discussed above (COP Section 4.2.2; Dominion Energy 2022).

I.4.2 Gum Swamp

Gum Swamp is located near the border of the city of Chesapeake and the city of Virginia Beach and directly north of the Intracoastal Waterway. Gum Swamp is crossed by Interconnection Cable Route Options 1 and 6. Gum Swamp includes large contiguous areas of forested wetlands extending from Stumpy Lake to the north, the Centerville Turnpike Bridge crossing of the Intracoastal Waterway to the southwest, and east to the North Landing River bridge. Located within the North Landing River watershed, Gum Swamp contains the western headwaters of the North Landing River, which adjoin the Intracoastal Waterway, also known as the Chesapeake and Albemarle Canal. Natural heritage community types within Gum Swamp include swamp tupelo (*Nyssa biflora*)–bald cypress swamps, and seasonally flooded forests/non-riverine swamp forests (VDCR-DNH 2001). Potential threats include drainage and hydrological perturbations, land use conversion, habitat loss, clearcutting and forest fragmentation, road construction, and non-point source pollution (COP Section 4.2.2; Dominion Energy 2022).

I.4.3 West Neck Creek (Upper and Lower)

The upper section of West Neck Creek, an eastern tributary of the North Landing River, is crossed by all of the interconnection cable route options. The lower portions of West Neck Creek contain rare natural heritage communities, including Atlantic white cedar swamp, big cordgrass (*Spartina cynosuroides*) oligohaline marsh, sweetbay (*Magnolia virginiana*)–red bay (*Persea borbonia*) shrub swamp, and threesquare bulrush (*Schoenoplectus americanus*)–cattail (*Typha spp.*) oligohaline marsh (VDCR-DNH 2001) (COP Section 4.2.2; Dominion Energy 2022).

I.4.4 Pocaty River

The Pocaty River occurs within the North Landing River watershed and is a western tributary of the North Landing River. The Pocaty River would be crossed by Interconnection Cable Route Option 5, which has been eliminated from further analysis this Draft EIS. This waterway contains extensive associated forested wetlands and documented natural heritage communities (designated by the VDCR-DNH as North Pocaty) situated west of the North Landing River and north of the Pocaty River and include tidal shrub swamp (southern bayberry [*Morella caroliniensis*]–Carolina willow [*Salix caroliniana*] type), pond pine woodland, and big cordgrass marsh (oligohaline type). These rare communities are predominantly owned by TNC and managed as a part of the North Landing River Natural Area Preserve, which is discussed above. Natural communities along the upper reaches of the Pocaty River are also managed by the Navy as the Pocaty Creek Special Interest Area, located along the southern boundary of Naval Auxiliary Landing Field Fentress. Potential hydrological threats include agricultural and urban non-point source pollution, toxic or hazardous materials spills on the Intracoastal Waterway, and shoreline damage from excessive boat traffic and wakes. Other threats include reduction or lack of a natural fire regime in fire-maintained marshes and peatland pond pine woodlands, and displacement of native marsh species by invasive clones of common reed (VDCR-DNH 2001) (COP Section 4.2.2; Dominion Energy 2022).

I.5. Navigation and Vessel Traffic

Table I-7 Allision and Collision Risk Summary (COP Appendix S Section 10.2.7 Table 10.2)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Vessel to vessel collision	Base case	1.08E-02 (1 in 93 years)	1.93E-02 (1 in 52 years)	8.50E-03 (1 in 118 years)
	Future case (10%)	1.30E-02 (1 in 77 years)	2.33E-02 (1 in 43 years)	1.03E-02 (1 in 97 years)
	Future case (20%)	1.55E-02 (1 in 65 years)	2.78E-02 (1 in 36 years)	1.23E-02 (1 in 81 years)
Powered vessel to structure allision	Base case	N/A	2.54E-03 (1 in 394 years)	2.54E-03 (1 in 394 years)
	Future case (10%)	N/A	2.80E-03 (1 in 357 years)	2.80E-03 (1 in 357 years)
	Future case (20%)	N/A	3.05E-03 (1 in 328 years)	3.05E-03 (1 in 328 years)
Drifting vessel to structure allision	Base case	N/A	3.27E-03 (1 in 306 years)	3.27E-03 (1 in 306 years)
	Future case (10%)	N/A	3.59E-03 (1 in 279 years)	3.59E-03 (1 in 279 years)
	Future case (20%)	N/A	3.92E-03 (1 in 255 years)	3.92E-03 (1 in 255 years)
Fishing vessel to structure allision	Base case	N/A	5.91E-04 (1 in 1,692 years)	5.91E-04 (1 in 1,692 years)
	Future case (10%)	N/A	6.41E-04 (1 in 1,560 years)	6.41E-04 (1 in 1,560 years)
	Future case (20%)	N/A	6.91E-04 (1 in 1,447 years)	6.91E-04 (1 in 1,447 years)

Risk	Scenario	Annual Frequency (Return Period)		
		Pre Wind Farm	Post Wind Farm	Change
Total	**Base case**	**1.08E-02 (1 in 93 years)**	**2.57E-02 (1 in 39 years)**	**1.49E-02 (1 in 67 years)**
	Future case (10%)	**1.30E-02 (1 in 77 years)**	**3.03E-02 (1 in 33 years)**	**1.73E-02 (1 in 58 years)**
	Future case (20%)	**1.55E-02 (1 in 65 years)**	**3.55E-02 (1 in 28 years)**	**2.00E-02 (1 in 50 years)**

Table I-8 FSA Summary (COP Appendix S Section 21 Table 21.1)

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
Commercial vessels	Deviations	Tolerable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Ongoing engagement with stakeholders, and • Promulgation of information.	**Further mitigation required to ascertain necessary mitigation to bring impact to within ALARP parameters**
	Increased vessel to vessel collision risk	Tolerable	• Application and use of safety zones up to 1,640 ft (500 m) radius during construction and decommissioning; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance around cable installation vessels; • Ongoing engagement with stakeholders; • Project Vessel AID Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; • Promulgation of information; and • Safety vessel where appropriate.	**Further mitigation required to ascertain necessary mitigation to bring impact to within ALARP parameters**
	Powered vessel to structure allision risk	Tolerable	• Application and use of safety zones up to 1,640-ft (500-m) radius during construction and decommissioning; • Charting of infrastructure; • Lighting and Marking;	**Further mitigation required to ascertain necessary mitigation to bring impact to within ALARP parameters**

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
			• Marine pollution contingency plans; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • Use of PATON.	
	Drifting vessel to structure risk	Tolerable	• Marine pollution contingency plans; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; and • Safety vessel where appropriate.	**Further mitigation required to ascertain necessary mitigation to bring impact to within ALARP parameters**
Military vessels	Deviations	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Ongoing engagement with stakeholders; and • Promulgation of Information.	Risk level has been reduced to ALARP and no further mitigation is required
	Increased vessel to vessel collision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640 feet (500 meters) radium during construction and decommissioning; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance around cable installation vessels; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; • Promulgation of Information; and • Safety vessel where appropriate	Risk level has been reduced to ALARP and no further mitigation is required

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
	Powered vessel to structure allision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Lighting and Marking; • Marine pollution contingency plans; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • USCG SAR trials; • Safety vessel where appropriate; and • Use of PATON.	Risk level has been reduced to ALARP and no further mitigation is required
	Drifting vessel to structure allision risk	Broadly Acceptable	• Marine pollution contingency plans; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required
Recreational vessels	Deviations	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Ongoing engagement with stakeholders; and • Promulgation of Information.	Risk level has been reduced to ALARP and no further mitigation is required
	Adverse weather conditions	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Lighting and Marking; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • Safety vessel where appropriate; and • Use of PATON	Risk level has been reduced to ALARP and no further mitigation is required

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
	Increased vessel to vessel collision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance around cable installation vessels; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; • Promulgation of Information; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required.
	Powered vessel to structure allision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Lighting and Marking; • Marine pollution contingency plans; • Minimum blade clearance; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • USCG SAR trials; • Safety vessel where appropriate; and • Use of PATON.	Risk level has been reduced to ALARP and no further mitigation is required.
	Drifting vessel to structure allision risk	Broadly Acceptable	• Marine pollution contingency plans; • Minimum blade clearance; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of information; • Provision of self-help capability;	Risk level has been reduced to ALARP and no further mitigation is required.

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
			• Emergency Response Plan; and • Safety vessel where appropriate.	
Commercial fishing vessels	Deviations	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Ongoing engagement with stakeholders; and • Promulgation of Information.	Risk level has been reduced to ALARP and no further mitigation is required.
	Adverse weather deviations	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Lighting and Marking; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • Safety vessel where appropriate; and • Use of PATON	Risk level has been reduced to ALARP and no further mitigation is required.
	Increased vessel to vessel collision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance around cable installation vessels; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; • Promulgation of Information; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required.
	Powered vessel to structure allision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Lighting and Marking;	Risk level has been reduced to ALARP and no further mitigation is required.

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
			• Marine pollution contingency plans; • Minimum blade clearance; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • USCG SAR trials; • Safety vessel where appropriate; and • Use of PATON.	
	Drifting vessel to structure allision risk	Broadly Acceptable	• Marine pollution contingency plans; • Minimum blade clearance; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of information; • Provision of self-help capability; • Emergency Response Plan; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required.
Anchored vessels	Displacement of Anchoring	Broadly Acceptable	• Cable Burial Risk Assessment; • Cable Installation Plan; • Charting of infrastructure (including prior to installation); • Minimum advisory safe passing distance around cable installation vessels; • Monitoring of cable and associated protection; • Ongoing engagement with stakeholders; and • Promulgation of information.	Risk level has been reduced to ALARP and no further mitigation is required.
	Underwater snagging or contact risk	Broadly Acceptable	• Cable Burial Risk Assessment; • Cable Installation Plan; • Charting of infrastructure (including prior to installation); • Monitoring of cable and associated protection; • Ongoing engagement with stakeholders; • Promulgation of information; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required.

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
Emergency responders	Emergency response capability	Broadly Acceptable	• Marine Coordination; • Marine pollution contingency plans; • Ongoing engagement with USCG vis specialist helicopter consultancy; • Operational SAR procedures; • Project vessel compliance with international and flag state regulations; • Provision of self-help capability; • Emergency Response Plan; • USCG SAR trials; and • WTG shut down procedures.	Risk level has been reduced to ALARP and no further mitigation is required.
Ports and Services	Restricted access at ports – Project Vessels	Broadly Acceptable	• Construction vessel and schedule notification system; • Marine Coordination; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; and • Promulgation of Information.	Risk level has been reduced to ALARP and no further mitigation is required.
Ports and Services	Restricted access at ports – Cable Installation	Broadly Acceptable	• Cable Burial Risk Assessment; • Cable Installation Plan; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance; • Monitoring of cables and associated protection; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; and • Promulgation of information.	Risk level has been reduced to ALARP and no further mitigation is required.
All users (cumulative)	Deviations	Broadly Acceptable	• Charting of infrastructure; • Construction vessel and schedule notification system; • Ongoing engagement with stakeholders; and • Promulgation of Information;	Risk level has been reduced to ALARP and no further mitigation is required.

User	Impact	ALARP Risk Level	Embedded Mitigation Measures	Additional Mitigation Measures
	Increased vessel to vessel collision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Construction vessel and schedule notification system; • Marine Coordination; • Minimum advisory safe passing distance around cable installation vessels; • Ongoing engagement with stakeholders; • Project Vessel AIS Carriage; • Project vessel compliance with international and flag state regulations; • Project vessel operational procedures; • Promulgation of Information; and • Safety vessel where appropriate.	Risk level has been reduced to ALARP and no further mitigation is required.
	Powered and drifting vessel to structure allision risk	Broadly Acceptable	• Application and use of safety zones up to 1,640-foot (500-meter) radius during construction and decommissioning; • Charting of infrastructure; • Lighting and Marking; • Marine pollution contingency plans; • Minimum blade clearance; • Ongoing engagement with stakeholders; • Operational SAR procedures; • Promulgation of Information; • Provision of self-help capability; • Emergency Response Plan; • Safety vessel where appropriate; and • Use of PATON.	Risk level has been reduced to ALARP and no further mitigation is required.

I.6. References Cited

I.6.1 Wetlands

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Appendix J. Overview of Acoustic Modeling Report

J.1. Introduction and Short Project Description

This appendix is focused on providing an overview of the methods, assumptions, and results of the technical acoustic modeling report prepared for the Project (COP Appendix Z; Dominion Energy 2022) and the accompanying exposure assessment included in the Letter of Authorization (LOA) application submitted to the National Marine Fisheries Service (NMFS) for incidental take authorization under the Marine Mammal Protection Act (MMPA) (Tetra Tech 2022a, 2022b). The Project would consist of up to 205 wind turbine generators (WTGs), up to three offshore substations (OSS), inter-array and export cables, and onshore components (interconnection cables, switching station[s] and substation). The Project would be on the OCS offshore Virginia in BOEM Lease Area OCS-A 0483. Primary noise-generating activities which have the potential to expose marine mammals to noise above recommended permanent threshold shift (PTS) and behavioral thresholds (NMFS 2018) include impact and vibratory pile driving during WTG and OSS foundation installation; impact pile driving during installation of goal post piles to support trenchless installation of the export cable offshore at the cable landing location; vibratory pile driving during cofferdam installation; and high-resolution geophysical (HRG) survey activities.

For the installation of the WTG and OSS foundations and installation of the cofferdam, underwater sound propagation modeling was completed using dBSea, a software developed by Marshall Day Acoustics for the prediction of underwater noise in a variety of environments. The three-dimensional model was built by importing bathymetry data and placing noise sources in the environment. Noise levels were calculated throughout the entire Offshore Project area and displayed in three dimensions (COP Appendix Z; Dominion Energy 2022). Noise associated with installation of the goal post piles and HRG surveys was modeled using guidance from NMFS which involved updates to their User Spreadsheet tool (NMFS 2018) to incorporate new adjustment factors in the spreadsheets which account for the accumulation of noise using the source characteristics (duty cycle and speed) following work by Silve et al. (2014) for PTS (i.e., Level A) thresholds; and a simple spreading loss calculation to estimate the distance to the behavioral (i.e., Level B) threshold (Tetra Tech 2022a).

Noise associated with vessel activity related to cable laying and WTG operation is also qualitatively discussed in COP Appendix Z (Dominion Energy 2022). However, these activities are not expected to result in harassment which could jeopardize the continued existence of any marine mammal populations due to the characteristics of these sound sources. Cable laying would be accomplished using a jet trencher or plow towed by a vessel equipped with dynamic positioning (DP) thrusters to maintain the vessel position. DP thruster sound source levels may vary, in part due to technologies employed and are not necessarily dependent on either vessel size, propulsion power, or the activity engaged. However, DP thruster noise is non-impulsive and continuous in nature reducing the risk of effect on marine mammal species. Tougaard et al. (2020) summarized available monitoring data on wind farm operational noise, including both older-generation, geared turbine designs and quieter, modern, direct-drive systems like those proposed for this Project. They determined that operating WTGs produces underwater noise on the order of 110 to 125 dB re 1 µPa SPL at a reference distance of 50 m, occasionally reaching as high as 128 dB re 1 µPa SPL, in the 10-Hz to 8-kHz range. This is consistent with the noise levels observed at the Block Island Wind Farm (Elliot et al. 2019) and the range of values observed at European wind farms. More recently, Stöber and Thomsen (2021) used monitoring data and modeling to estimate operational noise from larger (10-Megawatt), current-generation, direct-drive WTGs and concluded that these designs could generate higher operational noise levels than those reported in earlier research. This suggests that operational noise effects on marine mammals could be more intense and extensive than those considered herein; however, due to the relatively low source levels of operational WTGs, injury-level impacts are not considered likely. For these reasons, a detailed acoustic modeling analysis was not conducted for these sound sources and they will not be discussed further.

J.2. Acoustic Models and Assumptions

As mentioned above, the acoustic assessment for pile driving activities associated with installation of the WTG and OSS foundations and installation of the cofferdams relied on dBSea software developed by Marshall Day Acoustics for the prediction of underwater noise. Noise levels were calculated throughout the entire Offshore Project area and displayed in three dimensions. Levels were calculated in third octave bands. For the Project, two different solvers were used for the low and high-frequency ranges:

- dBSeaPE (Parabolic Equation Method): The dBSeaPE solver makes use of the parabolic equation method, a versatile and robust method of marching the sound field out in range from the sound source. This method is one of the most widely used in the underwater acoustics community and offers excellent performance in terms of speed and accuracy in a range of challenging scenarios.
- dBSeaRay (Ray Tracing Method): The dBSeaRay solver forms a solution by tracing rays from the source to the receiver. Many rays leave the source covering a range of angles, and the sound level at each point in the receiving field is calculated by coherently summing the components from each ray. This is currently the only computationally efficient method at high frequencies.

The underwater acoustic modeling analysis used a split solver, with dBSeaPE evaluating the 12.5 Hz to 200 Hz and dBSeaRay addressing 250 Hz to 20,000 Hz. Additional assumptions and information pertaining to pile driving sound source development and sound propagation modeling can be found in the acoustic modeling report (COP Appendix Z; Dominion Energy 2022).

For the installation of the goal post piles and HRG survey activities, distances to the PTS thresholds were calculated using the NMFS User Spreadsheet tool with adjustments to account for accumulation using the Safe Distance Methodology outlined by Silve et al. (2014) and source characteristics such as duty cycle and speed (e.g., pile strike rate for goal post installation, pulse rate for HRG survey equipment). Distances to the behavioral disturbance thresholds were calculated using the following formula:

$SPL(r) = SL - PL(r)$

Where SPL is the root-mean-square sound pressure level (in units of dB re 1 μPa) at a given range, r (in meters). SL is the estimated source level 1 meter from the source, and PL is the propagation loss calculated as:

$PL(r) = 20\log_{10}(r) + a(f) \times r/1{,}000$

Where a is an attenuation factor at a given frequency, f (Tetra Tech 2022a).

J.2.1 Physical Environment

The bathymetry information used in the modeling was obtained from the National Geophysical Data Center (NGDC) and the U.S. Coastal Relief Model (COP Appendix Z, citing NOAA and Information Service 2020; Dominion Energy 2022). The bathymetric data were sampled by creating a fan of radials at a given angular spacing. This grid was then used to determine depth points along each modeling radial transect. The underwater acoustic modeling was conducted over these radial planes in set increments depending on the acoustic wavelength and the sampled depth. These radial transects were used for modeling acoustic impacts during both the construction and operation of the Project, with each radial centered on the given Project sound source or activity (COP Appendix Z; Dominion Energy 2022) The water column properties change seasonally. Because the construction timeframe for WTGs and OSSs is expected from May to October, the June sound speed profile was selected as is exhibited maximum case characteristics for long-range noise propagation effects (Dominion Energy 2022).

The sediment layers used in the modeling and the main geoacoustic properties are defined in Table J-1 and J-2 for the WTG and OSS installation scenarios and the cofferdam installation scenarios, respectively. The term "compressional" refers to the fact that particle motion of the sound wave is in the same direction as propagation. The term "compressional sound speed" refers to the speed of sound in the sediment along the direction of acoustic propagation. The term "compressional attenuation" refers to how much sound (in dB) is lost per wavelength (λ) of the signal. Finally, density is the physical density (ρ) of the sediment. Ranges are provided for the different geoacoustic properties because the values vary depending on the location specifically being modeled for a given scenario (COP Appendix Z; Dominion Energy 2022).

Table J-1 Geoacoustic Properties of Sub-bottom Sediments as a Function of Depth for the WTG and OSS Modeling Scenarios

Seabed Layer (meters)	Material	Geoacoustic Properties
0 to 12	Sand	Cp = 1650 m/s αs (dB/λ) = 0.8 dB/λ ρ = 1900 kg/m^3
12 to 15	Clay	Cp = 1500 m/s αs (dB/λ) = 0.2 dB/λ ρ = 1500 kg/m^3
15 to 22	Dense Silty and	Cp = 1650 m/s αs (dB/λ) = 1.1 dB/λ ρ = 1800 kg/m^3
22 to 31	Stiff Sandy Clay	Cp = 1560 m/s αs (dB/λ) = 0.2 dB/λ ρ = 1600 kg/m^3
31 to 37	Clay	Cp = 1500 m/s αs (dB/λ) = 0.2 dB/λ ρ = 1500 kg/m^3
37 to 42	Silty Sand	Cp = 1650 m/s αs (dB/λ) = 1.1 dB/λ ρ = 1800 kg/m^3
42 to 53	Clay, Fine Sand	Cp = 1598 m/s αs (dB/λ) = 0.5 dB/λ ρ = 1575 kg/m^3
53 to 87	Sandy Silt	Cp = 1605 m/s αs (dB/λ) = 1.0 dB/λ ρ = 1700 kg/m^3
>87	Dense Sand	Cp = 1800 m/s αs (dB/λ) = 0.9 dB/λ ρ = 2000 kg/m^3

Source: COP Appendix Z, Table Z-5; Dominion Energy 2022.

Table J-2 Geoacoustic Properties of Sub-bottom Sediments as a Function of Depth for the Cofferdam Installation Modeling Scenario

Seabed Layer (meters)	Material	Geoacoustic Properties
0 to 2	Silty Sand	Cp = 1650 m/s αs (dB/λ) = 1.1 dB/λ ρ = 1800 kg/m^3
2 to 6	Medium Dense Sand	Cp = 1725 m/s αs (dB/λ) = 0.8 dB/λ ρ = 1950 kg/m^3
6 to 9	Lean Clay	Cp = 1485 m/s αs (dB/λ) = 0.1 dB/λ ρ = 1300 kg/m^3
9 to 15	Silty Sand	Cp = 1650 m/s αs (dB/λ) = 1.1 dB/λ ρ = 1800 kg/m^3
15 to 26	Sandy Lean Clay	Cp = 1560 m/s αs (dB/λ) = 0.2 dB/λ ρ = 1600 kg/m^3
26 to 32	Medium Dense Sand	Cp = 1725 m/s αs (dB/λ) = 0.8 dB/λ ρ = 1950 kg/m^3

Source: COP Appendix Z, Table Z-6; Dominion Energy 2022.

J.2.2 Vibratory Driving Source Details

The WTG monopile and OSS jacket foundations were both modeled using a vertical array of eight point sources for the deep location and five point sources for the shallow location, distributing the sound emissions from pile driving throughout the water column. The vertical array was assigned third-octave band sound characteristics adjusted for site-specific parameters discussed above, including expected hammer energy and number of blows. Third octave band center frequencies from 12.5 Hz up to 20 kHz were used in the modeling. In addition, a constant 15 dB/decade roll-off was applied to the modeled spectra after the second spectral peak. A roll-off is a filter, which can be imposed on a signal at either the low- or high-frequency range in order to more closely match expected sound propagation characteristics of that signal indicated by modeling or measurement results. Applying the 15 dB/decade roll-off is a conservative measure, which was based on guidance from NOAA Fisheries regarding the representation of pile-driving sound source characteristics in the high-frequency range (COP Appendix Z; Dominion Energy 2022).

If required, the temporary offshore cofferdams will be constructed by installing steel sheet piles in a tight configuration around an area of approximately 20 by 50 feet (6.1 by 15 meters). For estimating source levels and frequency spectra, the vibratory pile driver was estimated assuming an 1,800 kN vibratory force. Modeling was accomplished using adjusted one-third-octave band vibratory pile-driving source levels from measurements of a similar offshore construction activity and adjusted to account for the estimated force necessary for driving Project cofferdam sheet piles. The assumed sound source level for vibratory pile driving corresponded to and SEL of 195 dB re 1 $\mu Pa^2 m^2$ s (COP Appendix Z; Dominion Energy 2022).

J.3. Noise Attenuation

A range of potential sound reduction was applied to the modeled sound fields associated with impact pile driving. Attenuation factors of 6 dB and 10 dB were applied to all impact pile-driving scenarios to evaluate potential mitigated underwater noise impacts (COP Appendix Z; Dominion Energy 2022).

The main energy associated with vibratory pile driving is radiated at lower frequencies compared to impact piling, and sound waves below a lower cut-off frequency do not propagate in shallow waters. As a result, high peak levels can be avoided and continuous sound levels can be kept low. Noise emissions from vibratory pile driving are on the order of 10 to 20 dB below mitigated impact pile driving at identical monopiles (COP Appendix Z, citing Koschinski and Lüdemann 2020; Dominion Energy 2022). To date, there is very limited information available regarding the use, effectiveness, and noise emissions produced using vibratory pile driving for installation of larger pile diameters consistent with those proposed for the Project; therefore, further investigation is required. Correspondingly, the lower frequencies radiated by vibratory pile driving may restrict the ability of a bubble curtain to allow for a further 6 to 10 dB reduction in noise level. For the purposes of the Project underwater acoustic assessment, a 6 and 10 dB reduction was still applied for consistency. From a feasibility standpoint, it is unlikely that another noise mitigation measure (e.g., isolation casing, cofferdam) along with a bubble curtain would be implemented in the field. As indicated previously, use of vibratory pile driving is considered a somewhat mitigative activity, and unmitigated vibratory pile driving modeling results shown in COP Appendix Z, Section Z.6.2 suggest that vibratory pile driving, when compared to impact pile driving results, will likely not dictate noise mitigation measures used for the Project (COP Appendix Z; Dominion Energy 2022).

J.4. Methodology

Underwater acoustic model simulations were conducted for primary noise-generating activities occurring during Project construction and operation. The following subsections summarize the modeling calculations approach, modeled scenarios, and model input values contained in COP Appendix Z (Dominion Energy 2021).

J.4.1 Acoustic Modeling Scenarios

A summary of construction and operational scenarios included in the underwater acoustic modeling analysis is provided in Table J-3. Model scenarios included locations where potential underwater noise impacts of marine species were anticipated including impact and vibratory pile driving associated with WTG and OSS foundation installation; impact pile driving of the goal post piles; vibratory pile driving during cofferdam installation associated with nearshore trenchless installation activities; and HRG survey activity (COP Appendix Z; Dominion Energy 2022; Tetra Tech 2022a). The modeling scenarios for the WTG foundation installation occur at representative foundation locations; one at a shallow water depth of 69 feet (21 meters) (Universal Transverse Mercator [UTM] Coordinates: 459846 m, 4075324 m) within the Lease Area and another at a deep-water depth of 121 feet (37 meters) (UTM Coordinates: 48066 m, 4089018 m) within the Lease Area. These two locations were selected so that the effects of sound propagation at the range of water column depths occurring within the Lease Area could be observed. Sound fields for the OSS foundations were modeled at the location where the greatest sound propagation was expected out of the three proposed OSS locations. Installation of the goal post piles was modeled at one representative location, and the central cofferdam location was used as the representative location for this activity in the model (COP Appendix Z; Dominion Energy 2022). The source level for the vibratory hammer was developed using an empirical model similar to the model used for the impact hammer. Further details pertaining to the underwater sound propagation modeling analysis, pile driving sound source development, vibratory hammer sound source development, and a model verification completed for the CVOW Pilot Project is provided in COP Appendix Z (COP Appendix Z; Dominion Energy 2022).

The model accommodates for differences in hammer energy, number of strikes, installation duration, sound source level, and pile progression as appropriate for the jacket pin piles and/or monopiles. This analysis also assumes a conservative duration for the use of the vibratory hammer. The pile diameters selected for the impact pile-driving modeling scenarios were based on maximum Project Design Envelope considerations provided by Dominion Energy. Scenarios 1 through 8 occur at representative WTG locations while Scenario 9 occurs at the cofferdam locations at the Nearshore Trenchless Installation Area. Several of the scenarios (1, 2, 3, 4, and 5) include monopile foundation impact pile driving using the maximum rated hammer energy of 4,000 kilojoules (kJ); however, that hammer energy assumption is considered conservative. The actual transferred energy to the pile during installation will be less than the maximum rated hammer energy, with losses in energy from sources such as heat and friction. Scenarios 6, 7, and 8 represent activities associated with pin pile installation and Scenarios 4, 5, 7, and 8 represent activities that involve a combination of impact and vibratory pile driving to achieve installation (COP Appendix Z; Dominion Energy 2021). Propagation modeling was conducted using the maximum projected blow energy as applicable for the various scenarios; however, a soft start and pile progression were also incorporated into the model for each pile (see COP Appendix Z, Table Z-6; Dominion Energy 2021).

Table J-3 Underwater Acoustic Modeling Scenarios

Scenario	Activity Description	Maximum Hammer Energy (kilojoules)	Duration of Single Pile Installation (minutes)	Total Hammer Blows	Location (UTM Coordinates)	Sound Source Level[1]
1: Standard Driving Installation	Monopile Foundation (includes 1 pile per day) Diameter: 9.5 m	Impact Pile Driving: 4,000[2]	85	3,240	Deep: 480,666 m, 4,089,018 m Shallow: 459,846 m, 4,075,324 m	Lpk: 249 dB re 1 μPa m SEL_{1s}: 226 dB re 1 μPa^2m^2 s SPL: 236 dB re 1 μPa m
		Vibratory Pile Driving	60	N/A		SEL_{1s}: 202 dB re 1 μPa^2m^2 s
2: Hard-to-Drive Installation	Monopile Foundation (includes 1 pile per day) Diameter: 9.5 m	Impact Pile Driving: 4,000[2]	99	3,720	Deep: 480,666 m, 4,089,018 m Shallow: 459,846 m, 4,075,324 m	Lpk: 249 dB re 1 μPa m SEL_{1s}: 226 dB re 1 μPa^2m^2 s SPL: 236 dB re 1 μPa m
		Vibratory Pile Driving	30	N/A		SEL_{1s}: 202 dB re 1 μPa^2m^2 s
3: One Standard and One Hard-to-Drive Installation	Monopile Foundation (includes 2 piles per day) Diameter: 9.5 m	Impact Pile Driving: 4,000[2]	184	6,960	Deep: 480,666 m, 4,089,018 m 471,303 m, 4,085,595 m Shallow: 459,846 m, 4,075,324 m 467,653 m, 4,080,459 m	Lpk: 249 dB re 1 μPa m SEL_{1s}: 226 dB re 1 μPa^2m^2 s SPL: 236 dB re 1 μPa m

Scenario	Activity Description	Maximum Hammer Energy (kilojoules)	Duration of Single Pile Installation (minutes)	Total Hammer Blows	Location (UTM Coordinates)	Sound Source Level[1]
		Vibratory Pile Driving	90	N/A		SEL_{1s}: 202 dB re 1 μPa²m² s
4: OSS Foundation	Pile Jacket Foundation (includes 2 piles per day) Diameter: 2.8 m	Impact Pile Driving: 3,000	410	15,120	Deep: 480,666 m, 4,089,018 m Shallow: 459,846 m, 4,075,324 m	Lpk: 240 dB re 1 μPa m SEL_{1s}: 214 dB re 1 μPa²m² s SPL: 224 dB re 1 μPa m
		Vibratory Pile Driving	120	N/A		SEL_{1s}: 194 dB re 1 μPa²m² s
5: Cofferdam Installation	Cofferdam, Vibratory Pile Driving	Vibratory Pile Driving	60	NA	414,213 m, 4,074,917 m	SEL_{1s}: 195 dB re 1 μPa²m² s
6: Goal Post Pile Installation	Goal Post Piles (includes 2 piles per day) Diameter: 1.07 m	Impact Pile Driving	130	260	414,396 m 4,074,917 m	Lpk: 210 dB re 1 μPa m SEL_{1s}: 183 dB re 1 μPa²m² s

Source: COP Appendix Z, Table Z-7; Dominion Energy 2022
m = meter; kJ = kilojoule SEL_{1s} = sound exposure level over 1 second; Lpk= peak sound pressure; SPL = root-mean-square sound pressure level
[1] Source levels are based on the SERO Pile Driving Noise Data Spreadsheet - Humboldt Bay Bridges (CALTRANS 2015). N/A s included in the table for vibratory pile driving because this activity is not quantified in terms of hammer blows.
[2] 4,000 kJ corresponds to the maximum rated hammer energy; however, actual hammer energy transferred to the pile during installation will be less.

J.4.2 Threshold Range Calculations

To determine the ranges to the defined threshold isopleths, a maximum received level-over-depth approach was used. This approach uses the maximum received level that occurs within the water column at each sampling point. Both the R_{max} and the $R_{95\%}$ ranges were calculated for each of the regulatory thresholds. The R_{max} is the maximum range in the model at which the sound level was calculated. The $R_{95\%}$ is the maximum range at which a sound level was calculated excluding 5 percent of the R_{max}. The $R_{95\%}$ excludes major outliers or protruding areas associated with the underwater acoustic modeling environment. Regardless of shape of the calculated isopleths, the predicted range encompasses at least 95 percent of the area that would be exposed to sound at or above the specified level. All distances to injury thresholds presented in this Underwater Acoustic Assessment Report are presented in terms of the $R_{95\%}$ range (COP Appendix Z; Dominion Energy 2022).

J.5. Animal Movement Model Methodology

To estimate the number of animals expected to receive sound levels above established thresholds, Marine Acoustics, Inc. (MAI) conducted exposure modeling which combines animal movement modeling with the sound fields produced by each pile type and scenario using their Acoustic Integration Model© (AIM) (Tetra Tech 2022a). Different simulations were run in AIM for each species, modeling scenario, and modeled location in which simulated animals (i.e., animats) were randomly distributed throughout the modeling environment and the predicted received level was recorded every 30 seconds for each animat to create a sound exposure history. Animats move throughout the simulated environment following known behavioral rules for each species based on available studies (Tetra Tech 2022a). The sound exposure histories are then subsampled based on the expected duration of the activity (e.g., a monopile foundation may take up to 3 hours to install so 3 hour exposure histories were extracted from each scenario for each species), and then normalized using the ratio of real-world density estimates to the animat simulation densities for each species modeled (Tetra Tech 2022a).

J.6. Marine Species Present in the Project Area

J.6.1 Marine Mammal Presence and Seasonality for the Project Duration

Several sources of data, reports, and studies were reviewed by Dominion Energy to identify which marine mammals are expected to be present in the study area and their seasonal occurrence including: the most recent stock assessment reports from NMFS (Hayes et al. 2022); and Protected Species Observer (PSO) sighting data (and some Passive Acoustic Monitoring [PAM] data), which were also collected during Project-related vessel-based survey activities conducted in 2018–2019 which are provided in the PSO report sightings report (Milne 2018 as cited in COP Section 4.2; Dominion Energy 2022). The most recent 2020-2021 PSO sighting data made available since the Milne (2018) report was published are summarized below in Table J-4. Marine mammals known to occur in the marine waters of coastal and offshore Virginia are listed in Table J-5.

Table J-4 PSO Sighting Data Summary

PSO Sightings in 2020–2021 by Month																		
Species	**2020**									**2021[1]**								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Atlantic spotted dolphin	5	34	77	260	112	44	53						20	36	68			
Common bottlenose dolphin	10	59	102	107	303	377	150	124	27	3	20	6	11	126	46	362	130	
Common dolphin			27	46	16				224	840	366	620	945					
False killer whale						4												
Fin whale				1							13							
Humpback whale		1					7	1	23	10	25							
Minke whale									1					1				
North Atlantic right whale									3		3	1						
Pantropical spotted dolphin			72		7									10	10			
Pilot whale spp.					5											3		
Pygmy sperm whale								1										
Sperm whale					1													
Spinner dolphin			1															

Source: COP, Section 4.2, Table 4.2-19; Dominion Energy 2022.
[1] Data for 2021 are preliminary and will undergo additional review before reports are finalized.

Table J-5 Marine Mammals Known to Occur in the Marine Waters of Coastal and Offshore Virginia

Common Name	Scientific Name	Stock	Estimated Abundance	Known Offshore Project Area Distribution	Occurrence/Seasonality[1]	Federal Status	Virginia Status
High-Frequency Cetaceans							
Harbor Porpoise	*Phocoena*	Gulf of Maine/Bay of Fundy	95,543	Shallow, inshore and nearshore, estuarine and coastal waters	Common/Winter/Spring	MMPA—non- strategic	—
Mid-Frequency Cetaceans							
Atlantic Spotted Dolphin	*Stenella frontalis*	Western North Atlantic	39,921	Continental shelf and slope	Common/Year-round	MMPA—non- strategic	—
Atlantic White-Sided Dolphin	*Lagenorhynchus acutus*	Western North Atlantic	93,233	Continental shelf and slope	Uncommon/Fall/Winter/Spring	MMPA—non- strategic	—
Common Bottlenose Dolphin	*Tursiops truncatus*	Western North Atlantic	62,851	Deeper, offshore waters	Common/Year-round	MMPA—non- strategic	—
		Southern Migratory Coastal	3,751	Shallow, inshore, and nearshore, estuarine and coastal waters	Common/Year-round	MMPA—strategic	—
Clymene Dolphin	*Stenella clymene*	Western North Atlantic	unknown	Deeper, offshore waters	Extralimital/Summer	MMPA—non- strategic	—
Dwarf Sperm Whale	*Kogia sima*	Western North Atlantic	7,750	Continental shelf and deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
False Killer Whale	*Pseudorca crassidens*	Western North Atlantic	1,791	Continental shelf and deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
Fraser's Dolphin	*Lagenorhynchus hosei*	Western North Atlantic	unknown	Deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
Killer Whale	*Orcinus orca*	Western North Atlantic	unknown	Continental shelf and deeper, offshore waters	Uncommon/Year-round	MMPA—non- strategic	—
Long-finned Pilot Whale	*Globicephala melas*	Western North Atlantic	39,493	Continental shelf	Common/Year-round	MMPA—non- strategic	—

Common Name	Scientific Name	Stock	Estimated Abundance	Known Offshore Project Area Distribution	Occurrence/Seasonality[1]	Federal Status	Virginia Status
Short-finned pilot whale	*Globicephala macrorhynchus*	Western North Atlantic	28,924	Continental shelf	Uncommon/Year-round	MMPA—non- strategic	—
Pan-tropical Spotted Dolphin	*Stenella attenuata*	Western North Atlantic	6,593	Deeper, offshore waters	Uncommon /Summer	MMPA—non- strategic	—
Melon-headed whale	*Peponocephala electra*	Western North Atlantic	unknown	Continental shelf and deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
Pygmy Killer Whale	*Feresa attenuata*	Western North Atlantic	unknown	Deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
Pygmy Sperm Whale	*Kogia breviceps*	Western North Atlantic	7,750	Continental shelf and deeper, offshore waters	Uncommon/Year-round	MMPA—non- strategic	—
Risso's Dolphin	*Grampus griseus*	Western North Atlantic	35,493	Continental shelf	Common/Year-round	MMPA—non- strategic	—
Rough Toothed Dolphin	*Steno bredanensis*	Western North Atlantic	136	Continental shelf and deeper, offshore waters	Uncommon/Year-round	MMPA—non- strategic	—
Common Dolphin	*Delphinus delphis*	Western North Atlantic	172,974	Continental shelf and slope	Common/Year-round	MMPA—non- strategic	—
Sperm Whale	*Physeter macrocephalus*	North Atlantic	4,349	Deeper, offshore waters and slope	Uncommon/Year-round	MMPA—strategic; Endangered ESA	Endangered
Spinner Dolphin	*Stenellalongirostris orientalis*	Western North Atlantic	4,102	Deeper, offshore waters and slope	Uncommon/Year-round	MMPA—non- strategic	—
Striped Dolphin	*Stenella coeruleoalba*	Western North Atlantic	67,036	Deeper, offshore waters and slope	Uncommon/Year-round	MMPA—non- strategic	—
White Beaked Dolphin	*Lagenorhynchus albirostris*	Western North Atlantic	536,016	Continental shelf	Uncommon/Variable	MMPA—non- strategic	—
Blainville's Beaked Whale	*Mesoplodon densirostris*	Western North Atlantic	10,107	Deeper, offshore waters	Uncommon/Spring/Summer	MMPA—non- strategic	—

Common Name	Scientific Name	Stock	Estimated Abundance	Known Offshore Project Area Distribution	Occurrence/Seasonality[1]	Federal Status	Virginia Status
Cuvier's Beaked Whale	*Ziphius cavirostris*	Western North Atlantic	5,744	Deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
Gervais' Beaked Whale	*Mesoplodon europaeus*	Western North Atlantic	10,107	Deeper, offshore waters	Uncommon/Spring/Summer	MMPA—non- strategic	—
Sowerby's Beaked Whale	*Mesoplodon bidens*	Western North Atlantic	10,107	Deeper, offshore waters	Uncommon/Variable	MMPA—non- strategic	—
True's Beaked Whale	*Mesoplodon mirus*	Western North Atlantic	10,107	Deeper, offshore waters	Uncommon/Spring/Summer	MMPA—non- strategic	—
Low-Frequency Cetaceans							
Blue Whale	*Balaenoptera musculus*	Western North Atlantic	unknown	Continental shelf and deeper, offshore waters	Uncommon/Year-round	MMPA—strategic; Endangered ESA	Endangered
Fin Whale	*Balaenoptera physalus*	Western North Atlantic	6,802	Continental shelf and deeper, offshore waters	Common/Year-round	MMPA—strategic; Endangered ESA	Endangered
Humpback Whale (West Indies DPS)	*Megaptera novaeangliae*	Gulf of Maine	1,396	Continental shelf and coastal waters	Common/Fall/Winter/Spring	MMPA—non- strategic[2]	Endangered
Minke Whale	*Balaenoptera acutorostrata*	Canadian East Coast	21,960	Continental shelf	Common/Year-round	MMPA—non- strategic	—
Sei Whale	*Balaenoptera borealis*	Nova Scotia	6,292	Continental Shelf	Uncommon/Winter/Spring/Summer	MMPA—strategic; Endangered ESA	Endangered
North Atlantic Right Whale	*Eubalaena glacialis*	Western Atlantic	412	Continental shelf and coastal waters	Common/Year-round	MMPA—strategic; Endangered ESA	Endangered
Sirenians							
West Indian Manatee	*Trichechus manatus*	Florida	unknown	Coastal, bays, estuaries, and inlets	Extralimital/Variable	MMPA—strategic; Threatened ESA	Endangered
Phocid Pinnipeds in Water							
Gray Seal	*Halichoerus grypus*	Western North Atlantic	27,131	Coastal, bays, estuaries, and inlets	Uncommon/Fall/Winter/Spring	MMPA—non- strategic	—
Harbor Seal	*Phoca vitulina*	Western North Atlantic	75,834	Coastal, bays, estuaries, and inlets	Common/Fall/Winter/Spring	MMPA—non- strategic	—

Common Name	Scientific Name	Stock	Estimated Abundance	Known Offshore Project Area Distribution	Occurrence/Seasonality[1]	Federal Status	Virginia Status
Harp Seal	*Pagophilus groenlandicus*	Western North Atlantic	unknown	Coastal, bays, estuaries, and inlets	Uncommon/Winter/Spring	MMPA—non- strategic	—
Hooded Seal	*Cystophora cristata*	Western North Atlantic	unknown	Coastal, bays, estuaries, and inlets	Extralimital/Summer/Fall	MMPA—non- strategic	—

Source: COP, Section 4.2, Table 4.2-20; Dominion Energy 2022.
Notes:
Marine Mammal Protection Act (MMPA)
[1] Occurrence defined as:
Common: occurrences are regularly documented, and the study area is generally considered within the typical range of the species. Uncommon: occurrences are occasionally documented, and the study area is generally considered within the typical range of the species.
Extralimital: few occurrences have been documented and the study area is generally considered outside the typical range of the species; any occurrences would likely be of incidental individuals.
[2] Note that the humpback whale (*Megaptera novaeangliae*) was previously federally listed as endangered; however, based on the revised listing completed by NOAA Fisheries in 2016, the Distinct Population Segment (DPS) of humpback whales that occurs along the East Coast of the U.S., the West Indies DPS, is no longer considered endangered or threatened. The Commonwealth of Virginia has retained the endangered state listing status for the humpback whale.
Status denoted as (--) indicates no regulatory status for that species under Federal or Virginia authority.

J.6.2 Marine Mammal Densities

The marine mammal species potentially occurring in the Project modeling areas were determined by Tetra Tech (2022b) based on habitat-based marine mammal density models developed by Roberts et al. (2022). Density estimates are a necessary part of the analysis process to determine acoustic exposure for each potentially occurring marine mammal in an area. Density estimates for each marine mammal species or species group by season were derived from the best available scientific information (Table J-6). As per Dominion Energy's commitment to seasonal restrictions from November through April, no WTG or OSS foundation installation activities are planned for winter, so modeling was conducted for the remaining three seasons, with spring including the months of March through May, summer ranging from the months of June to August, and fall extending from September through November. Construction activities, however, are not planned to occur for the entirety of spring through fall. Monopile and OSS construction is planned for only part of spring (May) and part of fall (September through October) annually. Using the Roberts et al. (2022) density data (which are delineated by grid cell), the densities for all of the grid cells within the modeling area were averaged for each month to provide a monthly average density. The three seasonal densities were calculated as the average of the months within each of the three seasons when construction is expected to occur.

Some marine mammal species were modeled as representative groups rather than individual species. For instance, members of the same genus that inhabit the same type of habitat and have similar dive and swim behaviors, such as the two pilot whale species, were modeled as an inclusive generic group (pilot whales) rather than by their individual species (long- and short-finned pilot whales). The two potentially occurring species of phocid seals, the harbor and gray seals, were also modeled as a representative group (seals). A summer density for the seals is given as 0.00001 animals/km^2 which is not the density derived from Roberts et al. (2022). A higher density estimate, 0.0004 animals /km^2, was derived for the summer season for this species group from Roberts et al. (2022). However, the Roberts et al. (2022) derived density estimate is unrealistic given that neither seal species is expected to occur in the waters of the Project area during summer (Hayes et al. 2022). For harbor seals, Hayes et al. (2022) estimates the occurrence in mid-Atlantic waters to range only from September through May, not during summer. The summer distribution of both species is well documented in more northern waters. To reconcile the known distribution of these species with the need for a density estimate, the conservative density estimate of 0.00001 animals/km^2 was used to represent the summer density of both seal species.

Two bottlenose dolphin stocks are present within the Project area, but density values are only available in the Roberts et al. density data for the species. Hayes et al. (2022) defines the boundary between the Western North Atlantic, Southern Coastal Migratory stock and the Western North Atlantic, offshore stock of bottlenose dolphins as the 20 m isobath north of Cape Hatteras, North Carolina. The 20 m isobath was used with the Roberts et al. (2022) to differentiate the two stocks and derive densities for the bottlenose dolphins in the Project area less than 20 m for the Southern Coastal Migratory stock and more than 20 m for the offshore stock.

The modeled marine mammal animats were set to populate each of the model areas with representative nominal densities. In some cases, the modeled animat density was higher than the real-world density estimate. This "over population" ensures that the result of the animat model simulation is not unduly influenced by the chance placement of a few simulated marine mammals and provides statistical robustness without overestimating risk. To obtain final exposure estimates, the modeled results are normalized by the ratio of the modeled animat density to the real-world (Roberts et al. 2022) marine mammal seasonal density estimates. Density estimates for all species considered common in Table J-5, or have confirmed sightings within the Lease Area based on PSO data in Table J-4 are provided in Table J-6.

Table J-6 Mean Seasonal Density Estimates (animals/km^2) for the Potentially Occurring Marine Mammal Species in the Project Area

Marine Mammal Species or Model Group	Spring (May)	Summer (June to August)	Fall (September to October)
Atlantic spotted dolphin	0.00507	0.05873	0.03822
Common bottlenose dolphin Western North Atlantic Southern Coastal Migratory Stock[1]	0.13098	0.13509	0.13852
Common bottlenose dolphin Western North Atlantic Offshore Stock[1]	0.07352	0.07415	0.06439
Common dolphin	0.05355	0.00559	0.00103
Minke whale	0.00519	0.00028	0.00011
Fin whale[2]	0.00069	0.00036	0.00019
Harbor porpoise	0.00315	0.00000	0.00000
Humpback whale	0.00136	0.00023	0.00040
North Atlantic right whale[2]	0.00015	0.00004	0.00005
Pantropical spotted dolphin[3]	0.00008	0.00008	0.00008
Pilot whale *spp*. (long- and short-finned pilot whales)[4]	0.00098	0.00098	0.00098
Risso's dolphin	0.00084	0.00042	0.00021
Seals[5]	0.01828	0.00001	0.00047
Sei whale[2]	0.00021	0.00001	0.00004
Sperm whale[2]	0.00003	0.00000	0.00000

Source: Table 24, Tetra Tech 2022b.
[1] Common bottlenose dolphin density values from Duke University (Roberts et al. 2016b, 2017, 2018, 2020) are reported as "bottlenose" and not identified to stock. Given the foundation installation sound would be confined to beyond the 20 m isobath, where the offshore stock is anticipated to predominate, estimated Level B take for cofferdam installation was accrued to the offshore stock.
[2] Indicates species listed under the Endangered Species Act.
[3] Pantropical spotted dolphins are included due to challenges with PSO identification of Atlantic spotted versus pantropical spotted dolphins.
[4] Pilot whale density values from Duke University (Roberts et al. 2016a, 2016b, 2017, 2018, 2020) are reported as "Kogia *spp*." and are not species-specific.
[5] Seal density values from Duke University (Roberts et al. 2016a, 2016b, 2017, 2018, 2020) are reported as "seals" and not species-specific; therefore, 50% were attributed to harbor seals and 50% to gray seals.

J.6.3 Sea Turtle Presence and Seasonality for the Project Duration

Five species of sea turtles have historically been reported to occur in mid-Atlantic waters off the coast of Virginia, all of which are listed as threatened or endangered under the Endangered Species Act (ESA). These species include the federally endangered Atlantic hawksbill (*Eretmochelys imbricata*), federally threatened green (*Chelonia mydas*), federally Endangered Kemp's ridley (*Lepidochelys kempii*), federally endangered leatherback (*Dermochelys coriacea*), and federally threatened loggerhead (*Caretta caretta*) (COP Section 4.2; Dominion Energy 2021). Table J-7 provides a summary of key information for these species and their known distribution within the study area.

Table J-7 Sea Turtles Known to Occur in the Marine Waters of Coastal and Offshore Virginia

Common Name	Scientific Name	Estimated Abundance	Known Offshore Project Area Distribution	Occurrence[1] Seasonality	Federal Status	State of Virginia Status
Leatherback Sea Turtle	*Dermochelys coriacea*	34,000–94,000	Offshore, continental shelf and deeper	Uncommon/Year-round	Endangered	Endangered
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricata*	19,000[2]	N/A	Extralimital/Year-round	Endangered	Endangered
Green Sea Turtle (North Atlantic Distinct Population Segment)	*Chelonia mydas*	215,000[2]	Coastal, bays, estuaries, and inlets	Uncommon/Year-round	Threatened	Threatened
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	248,300	Coastal, bays, estuaries, and inlets	Common/Year-round	Endangered	Endangered
Loggerhead Sea Turtle (Northwest Atlantic Distinct Population Segment)	*Caretta*	588,000	Throughout: offshore, continental shelf and deeper; coastal, bays, estuaries, and inlets	Common/Year-round	Threatened	Threatened

Source: COP, Section 4.2, Table 4.2-28.
Notes:
[1] Occurrence defined as:
Common: Occurrences are regularly documented, and the study area is generally considered within the typical range of the species. Uncommon: Occurrences are occasionally documented, and the study area is generally considered within the typical range of the species.
Extralimital: Few occurrences have been documented, and the study area is generally considered outside the typical range of the species; any occurrences would likely be of incidental individuals.
[2] Abundance estimates based on current nesting female and sex ratio estimates.

J.6.4 Sea Turtle Densities

Two sources of sea turtle densities represent the best available at-sea density data for sea turtles in the Project area: U.S. Department of the Navy (DON 2007) and Barco et al. (2018) (Tetra Tech 2022). The DON (2007) density estimates were prepared for the Navy's U.S. Atlantic operating areas, which include the CVOW-C Project area. More recent loggerhead turtle density estimates for the Project area are available in Barco et al. (2018); however, these densities are much higher than the older DON (2007) estimates for the loggerhead turtle. Additionally, Barco et al. (2018) included a seasonal availability correction factor. Instead of selecting one of these loggerhead density estimates to apply to the exposure modeling output, both the DON (2007) and Barco et al. (2018) density estimates for the loggerhead turtle have been included.

Though green sea turtles may occur seasonally in the Project area, no at-sea density estimates are available for this species. Rather, the only available data for green sea turtles are those grouped into the "hardshelled guild" in the DON (2007) dataset, so the seasonal estimates from this guild were used as surrogate densities for green sea turtles (Tetra Tech 2022). Densities for all sea turtle species likely to occur in the Project area are provided in Table J-8.

Table J-8 Mean Seasonal Density Estimates (animals km^{-2}) for Sea Turtles Potentially Occurring in the Project Area

Common Name	Scientific Name	Spring (May)	Summer (June – August)	Fall (September and October)
Leatherback Sea Turtle	*Dermochelys coriacea*	0.00509	0.00427	0.00509
Green Sea Turtle [1]	*Chelonia mydas*	0.04561	0.07241	0.04867
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	0.04687	0.04687	0.04687
Loggerhead Sea Turtle (DON 2007)	*Caretta caretta*	0.13534	0.13062	0.13475
Loggerhead Sea Turtle (Barco et al. 2018)	*Caretta caretta*	2.514	1.385	1.289

Source: Appendix D, Table 8; Tetra Tech 2022.
Notes:
[1] Population data were insufficient to determine an individual species density estimate for green sea turtles from the DON (2007) dataset; therefore the hardshelled guild densities were used as a surrogate for green sea turtles in the Project area.

J.6.5 Seasonal Restrictions

Portions of the study area fall within the Mid-Atlantic U.S. North Atlantic Right Whale Seasonal Management Area (SMA). Restrictions associated with these dynamic management areas are in effect between November 1 and April 30 annually. Vessels transiting these areas must comply with NMFS regulations and speed restrictions as applicable for North Atlantic right whales.

J.7. Acoustic Impact Criteria

NMFS (2018) defined acoustic threshold criteria at which PTS and temporary threshold shift (TTS) are predicted to occur for each hearing group for impulsive and non-impulsive signals (Table J-9), which are presented in terms of dual metrics; SEL_{24h} and Lpk. The Level B (behavioral) harassment thresholds are also provided in Table J-9.

Table J-9 Acoustic Threshold Criteria for Marine Mammals

Hearing Group	Sound Source Type					
	Impulsive			Non-Impulsive		
	PTS-Onset	TTS-Onset	Behavior	PTS-Onset	TTS-Onset	Behavior
Low-frequency cetaceans	Lpk: 219 dB re 1 μPa SEL$_{24h}$: 183 dB re 1 μPa^2 s	Lpk: 213 dB re 1 μPa SEL$_{24h}$: 168 dB re 1 μPa^2 s	SPL:160 dB re 1 μPa	SEL$_{24h}$: 199 dB re 1 μPa^2 s	SEL$_{24h}$: 179 dB re 1 μPa^2 s	SPL: 120 dB re 1 μPa (continuous) SPL: 160 dB re 1 μPa (intermittent)
Mid-frequency cetaceans	Lpk: 230 dB re 1 μPa SEL$_{24h}$:185 dB re 1 μPa^2 s	Lpk: 224 dB re 1 μPa SEL$_{24h}$: 170 dB re 1 μPa^2 s		SEL$_{24h}$: 198 dB re 1 μPa^2 s	SEL$_{24h}$: 178 dB re 1 μPa^2 s	
High-frequency cetaceans	Lpk: 202 dB re 1 μPa SEL$_{24h}$:155 dB re 1 μPa^2 s	Lpk: 196 dB re 1 μPa SEL$_{24h}$: 140 dB re 1 μPa^2 s		SEL$_{24h}$: 173 dB re 1 μPa^2 s	SEL$_{24h}$: 153 dB re 1 μPa^2 s	
Phocid pinnipeds underwater	Lpk: 218 dB re 1 μPa SEL$_{24h}$:185 dB re 1 μPa^2 s	Lpk: 212 dB re 1 μPa SEL$_{24h}$: 170 dB re 1 μPa^2 s		SEL$_{24h}$: 201 dB re 1 μPa^2 s	SEL$_{24h}$: 181 dB re 1 μPa^2 s	

Sources: NMFS 2018.
μPa = micropascal; dB = decibel; PTS = permanent threshold shift; re = referenced to; SEL$_{24h}$ = sound exposure level over 24 hours; Lpk = peak sound pressure level; SPL = root-mean-square sound pressure level; TTS = temporary threshold shift.

NOAA Fisheries anticipates behavioral response for sea turtles from impulsive sources such as impact pile driving to occur at SPL 175 dB re 1 μPa, which has elicited avoidance behavior of sea turtles (Blackstock et al. 2018). There is limited information available on the effects of noise on sea turtles, and the hearing capabilities of sea turtles are still poorly understood. In addition, the U.S. Navy introduced a weighting filter appropriate for sea turtle impact evaluation in their 2017 document titled "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)" (Finneran et al. 2017). That weighting has been applied to both impulsive and non-impulsive criteria for PTS and TTS (Table J-10).

Fish noise injury thresholds have been established by the Fisheries Hydroacoustic Working Group, which was assembled by NOAA Fisheries with thresholds subsequently adopted by NOAA Fisheries. The NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO) has applied these standards for assessing the potential effects of ESA-listed fish species and sea turtles exposed to elevated levels of underwater sound produced during pile driving, which were just recently updated (GARFO 2019) (COP Appendix Z; Dominion Energy 2022). These noise thresholds are based on sound levels that have the potential to produce injury or illicit a behavioral response from fishes (Table J-10).

A Working Group organized under the American National Standards Institute-Accredited Standards Committee S3, Subcommittee 1, Animal Bioacoustics, also developed sound exposure guidelines for fish and sea turtles (Table J-11 ; Popper et al. 2014) (COP Appendix Z; Dominion Energy 2022). They identified three types of fishes depending on how they might be affected by underwater sound. The categories include fishes with no swim bladder or other gas chamber (e.g., flounders, dab, and other flatfishes); fishes with swim bladders in which hearing does not involve the swim bladder or other gas volume (e.g., salmonids); and fishes with a swim bladder that is involved in hearing (e.g., channel catfish) (COP Appendix Z; Dominion Energy 2022).

Table J-10 Acoustic Threshold Criteria for Fishes and Sea Turtles

Hearing Group	Impulsive Signals		Non-Impulsive Signals		Behavior (Impulsive and Non-Impulsive)
	PTS-Onset/Injury[1]	TTS-Onset	PTS-Onset/Injury[1]	TTS-Onset	
Fishes	Lpk: 206 dB re 1 μPa SEL_{24h}: 187 dB re 1 μPa^2 s	--	--	--	SPL: 150 dB re 1 μPa
Sea turtles	Lpk: 232 dB re 1 μPa SEL_{24h}: 204 dB re 1 μPa^2 s	Lpk: 226 dB re 1 μPa SEL_{24h}: 189 dB re 1 μPa^2 s	SEL_{24h}: 200 dB re 1 μPa^2 s	SEL_{24h}: 220 dB re 1 μPa^2 s	SPL: 175 dB re 1 μPa

Sources: Stadler and Woodbury (2009); GARFO 2019; Blackstock et al. 2018; Finneran et al. 2017.
-- = not applicable for fishes; μPa = micropascal; dB = decibel; PTS = permanent threshold shift; re = referenced to; SEL_{24h} = sound exposure level over 24 hours; Lpk = peak sound pressure level; SPL = root-mean-square sound pressure level; TTS = temporary threshold shift.
[1] PTS-onset thresholds are applicable for sea turtles based on work from Finneran et al. (2017), where GARFO (2019) only provides thresholds for acoustic injury in fish.

Table J-11 Acoustic Threshold Levels for Fishes

Hearing Group	Impulsive Sounds		Non-Impulsive Sounds		
	Mortality and Potential Mortal Injury	Recoverable Injury	TTS	Recoverable Injury	TTS
Fishes without swim bladders	Lpk: >213 dB re 1 μPa SEL_{24h}: >219 dB re 1 μPa^2 s	Lpk: >213 dB re 1 μPa SEL_{24h}: >216 dB re 1 μPa^2 s	SEL_{24h}: >186 dB re 1 μPa^2 s	--	--
Fishes with swim bladder not involved in hearing	Lpk: 207 dB re 1 μPa SEL_{24h}: 210 dB re 1 μPa^2 s	Lpk: 207 dB re 1 μPa SEL_{24h}: 203 dB re 1 μPa^2 s	SEL_{24h}: >186 dB re 1 μPa^2 s	--	--
Fishes with swim bladder involved in hearing	Lpk: 207 dB re 1 μPa SEL_{24h}: 207 dB re 1 μPa^2 s	Lpk: 207 dB re 1 μPa SEL_{24h}: 203 dB re 1 μPa^2 s	SEL_{24h}: 186 dB re 1 μPa^2 s	SPL: 170 dB re 1 μPa	SPL: 158 dB re 1 μPa
Eggs and larvae	Lpk: 207 dB re 1 μPa SEL_{24h}: 210 dB re 1 μPa^2 s	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	--	--

Sources: Popper et al. 2014.
μPa = micropascal; dB = decibel; SEL_{24h} = sound exposure level over 24 hours; Lpk = peak sound pressure level; SPL = root-mean-square sound pressure level; TTS = temporary threshold shift., N = near (10s of meters), I = intermediate (100s of meters), and F = far (1000s of meters); -- = not applicable.

J.8. Results

J.8.1 WTG and OSS Foundation Installation

The complete dBSea acoustic modeling results to assess distances to the various acoustic threshold levels identified above in Sections J.4.2 and J.7 are provided in COP Appendix Z (Dominion Energy 2022). The modeling scenarios analyzed are described in Table J-3 and include monopile impact pile-driving activities for pile diameters of 31.2 feet (9.5 meters) using hammer energy of 4,000 kilojoules, and pin pile impact pile driving for 9.2-foot (2.8-meter) pile diameter. Modeling scenarios also include a combination of vibratory and impact pile-driving activities to achieve installation as described for Scenarios 1, 2, 3, and 4 (Table J-3). All those activities may occur at the two representative WTG locations within the Lease Area, where one location is in the deepest region (121 feet [37 meters]) of the Lease Area while the other location is in the shallowest region (69 feet [21 meters]) of the Lease Area; and the one representative for the OSS where the greatest sound propagation ranges will occur.

The results for impact and vibratory pile driving for the representative WTG location at the deepest water depth and the representative OSS foundation location are shown in Table J-12, Table J-13, and Table J-14 for marine mammals, sea turtles, and fish, respectively. Results are presented without mitigation and with two different levels of mitigation: a 6-dB reduction and a 10-dB reduction. Noise mitigation requirements and methods have not been finalized at this stage of Project design; therefore, these two levels of reduction were applied to potentially mimic the use of noise mitigation options such as bubble curtains (COP Appendix Z; Dominion Energy 2022). The results in Table J-12 indicate that the unmitigated distances to the Lpk thresholds for marine mammals are generally below 1,640 feet (500 meters) except for results for the high-frequency cetaceans group. Thresholds to the SEL_{24h} PTS onset thresholds were larger for all marine mammal hearing groups (Table J-12). Similar results were seen for sea turtles (Table J-13) and fish (Table J-14), with ranges to applicable thresholds varying depending on the threshold value, installation method, and pile type. Expectedly, the largest ranges to thresholds are the ones for the marine mammal and fish behavioral response thresholds, which are and SPL of 160 and 120 dB re 1 µPa for marine mammals in response to impulsive and non-impulsive, continuous sound sources, respectively; and an SPL of 150 dB re 1 µPa for fish in response to all sound source types (Section J-7). Refer to COP Appendix Z, Figures Z-8 through Figure Z-31 for sound maps of unweighted and unmitigated underwater received sound pressure levels for deep and shallow modeling scenarios (Dominion Energy 2022).

Table J-12 Marine Mammal Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Impact and Vibratory Pile Driving for Installation of the Wind Turbine Generator and Offshore Substation Foundation Scenarios

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)				Distance to PTS Threshold (SEL_{24hr})				Distance to Behavioral Threshold (SPL)
		LFC	MFC	HFC	PPW	LFC	MFC	HFC	PPW	All Hearing Groups
Standard WTG Driving Installation – Impact Pile Driving	0	344	116	1,621	371	11,325	598	5,686	3,405	15,010
	6	182	67	927	213	6,020	320	2,946	1,852	8,700
	10	132	29	663	141	4,396	170	2,139	1,267	6,182
Standard WTG Driving Installation – Vibratory Pile Driving	0	--	--	--	--	414	0	367	104	21,404
	6	--	--	--	--	199	0	193	52	12,267
	10	--	--	--	--	141	0	85	0	10,114
Hard-to-Drive WTG Installation – Impact Pile Driving	0	344	116	1,621	371	12,423	664	6,273	3,809	15,010
	6	182	67	927	213	6,738	354	3,230	1,987	8,700
	10	132	29	663	141	4,980	187	2,304	1,358	6,182
Hard-to-Drive WTG Installation – Vibratory Pile Driving	0	--	--	--	--	356	0	507	133	21,404
	6	--	--	--	--	150	0	258	72	12,267
	10	--	--	--	--	113	0	120	31	10,114
One Standard and One Hard-to-Drive WTG Installation – Impact Pile Driving	0	344	116	1,621	441	14,363	840	7,647	4,651	15,010
	6	182	67	927	228	7,997	443	3,933	2,570	8,700
	10	132	29	663	158	5,663	226	2,884	1,756	6,182
One Standard and One Hard-to-Drive WTG Installation – Vibratory Pile Driving	0	--	--	--	--	534	0	507	133	21,404
	6	--	--	--	--	256	0	258	72	12,267
	10	--	--	--	--	158	0	120	31	10,114
OSS Piled Jacket – Impact Pile Driving	0	35	0	508	55	6,807	258	3,485	3,188	5,530
	6	0	0	284	0	3,697	121	1,938	1,746	3,291
	10	0	0	197	0	2,680	48	1,435	1,283	2,172
OSS Piled Jacket – Vibratory Pile Driving	0	--	--	--	--	218	0	190	63	8,921
	6	--	--	--	--	130	0	112	35	5,272
	10	--	--	--	--	75	0	68	0	3,601

Source: COP, Appendix Z; Dominion Energy 2022.

Table J-13 Sea Turtle Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Impact and Vibratory Pile Driving for Installation of the Wind Turbine Generator and Offshore Substation Foundation Scenarios

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)	Distance to PTS Threshold (SEL_{24hr})	Distance to Behavioral Threshold (SPL)
Standard Driving Installation – Impact Pile Driving	0	104	2,628	5,162
	6	48	1,408	2,829
	10	10	1,044	2,146
Standard Driving Installation – Vibratory Pile Driving	0	N/A	65	189
	6		18	119
	10		6	82
Hard-to-Drive Installation – Impact Pile Driving	0	104	2,918	5,162
	6	48	1,533	2,829
	10	10	1,142	2,146
Hard-to-Drive Installation – Vibratory Pile Driving	0	N/A	40	189
	6		0	119
	10		0	82
One Standard and One Hard-to-Drive Installation – Impact Pile Driving	0	104	3,685	5,162
	6	48	2,053	2,829
	10	10	1,410	2,146
One Standard and One Hard-to-Drive Installation – Vibratory Pile Driving	0	N/A	78	189
	6		24	119
	10		8	82
OSS Piled Jacket – Impact Pile Driving	0	0	1,695	2,041
	6	0	914	1,134
	10	0	653	742
OSS Piled Jacket – Vibratory Pile Driving	0	N/A	14	85
	6		0	38
	10		0	7

Source: COP, Appendix Z; Dominion Energy 2022.
OSS = offshore substation; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa² s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa); WTG = wind turbine generator.

Table J-14 Fish Acoustic Injury and Behavioral Threshold Distances (meters) During Impact and Vibratory Pile Driving for Installation of the Wind Turbine Generator and Offshore Substation Foundation Scenarios

Scenario	Noise Attenuation (dB)	Fish with no Swim Bladder		Fish with Swim Bladder Not Involved in Hearing		Fish with Swim Bladder Involved in Hearing		Eggs and Larvae		Fish <2 g		Fish ≥2 g		Behavioral (SPL)
		Lpk	SEL$_{24hr}$	Lpk	SEL$_{24hr}$	Lpk	SEL$_{24hr}$	Lpk	SEL$_{24hr}$	Lpk	SEL$_{24hr}$	Lpk	SEL$_{24hr}$	All Fish
Standard Driving Installation – Impact Pile Driving	0	605	810	1,007	1,729	1,007	2,348	1,007	1,729	1,105	14,940	1,105	11,907	36,030
	6	344	489	605	1,021	605	1,301	605	1,021	663	8,653	663	6,131	20,512
	10	242	352	402	748	402	955	402	748	445	6,131	445	4,501	15,010
Standard Driving Installation – Vibratory Pile Driving	0	-	-	-	-	-	-	-	-	-	3,188	-	2,199	2,528
	6	-	-	-	-	-	-	-	-	-	1,831	-	1,216	1,359
	10	-	-	-	-	-	-	-	-	-	1,216	-	796	903
Hard-to-Drive Installation – Impact Pile Driving	0	605	906	1,007	1,986	1,007	2,683	1,007	1,968	1,105	16,655	1,105	12,722	36,030
	6	344	540	605	1,120	605	1,466	605	1,120	663	9,302	663	6,824	20,512
	10	242	389	402	829	402	1,041	402	829	445	6,824	445	5,085	15,010
Hard-to-Drive Installation – Vibratory Pile Driving	0	-	-	-	-	-	-	-	-	-	2,476	-	1,641	2,528
	6	-	-	-	-	-	-	-	-	-	1,338	-	886	1,359
	10	-	-	-	-	-	-	-	-	-	886	-	601	903
One Standard and One Hard-to-Drive Installation – Impact Pile Driving	0	605	1,121	1,007	2,439	1,007	3,315	1,007	2,439	1,105	20,786	1,105	14,787	36,030
	6	344	672	605	1,386	605	1,860	605	1,386	663	11,508	663	8,291	20,512
	10	242	477	402	1,042	402	1,266	402	1,042	445	8,291	445	5,880	15,010
One Standard and One Hard-to-Drive Installation – Vibratory Pile Driving	0	-	-	-	-	-	-	-	-	-	3,822	-	2,666	2,528
	6	-	-	-	-	-	-	-	-	-	2,191	-	1,442	1,359
	10	-	536-	-	-	-	-	-	-	-	1,442	-	961	903
OSS Piled Jacket – Impact Pile Driving	0	172	536	311	1,231	311	1,599	311	1,231	344	10,069	344	7,306	13,641
	6	35	310	172	696	172	907	172	696	197	5,959	197	4,000	8,243
	10	0	213	74	488	74	633	74	488	94	4,000	94	2,959	5,530
OSS Piled Jacket – Vibratory Pile Driving	0	-	-	-	-	-	-	-	-	-	1,664	-	1,088	991
	6	-	-	-	-	-	-	-	-	-	887	-	569	540
	10	-	-	-	-	-	-	-	-	-	569	-	427	393

Source: COP, Appendix Z; Dominion Energy 2022.
OSS = offshore substation; PTS = permanent threshold shift; SEL$_{24h}$ = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa); WTG = wind turbine generator.

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J.8.2 Goal Post Pile Installation

Up to 12 goal posts consisting of nine 42-inch (1.07-meter) steel pipe piles for a total of 108 piles would be installed using impact pile driving (impulsive source) to support trenchless installation of the export cable offshore of the cable landing location. Sound fields were modeled at one representative location assuming two posts would be installed per day requiring up to 130 minutes to install both piles (COP Appendix Z; Dominion Energy 2022). For the goal posts, up to 260 strikes per pile were assumed for installation. All goal post piles would be installed between May 1 and October 31 in 2024 and would occur over a total of 24 days for all 108 piles, assuming up to two piles are installed per day. Similar to the WTG and OSS installation modeling, noise mitigation is also included assuming 0-, 6-, and 10-dB noise attenuation. Results of the modeling of the goal post pile installation are provided in Table J-15, Table J-16, and Table J-17 for marine mammals, sea turtles, and fish, respectively.

Table J-15 Marine Mammal Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Impact Pile Driving for Installation of the Goal Posts to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)				Distance to PTS Threshold (SEL_{24hr})				Distance to Behavioral Threshold (SPL)
		LFC	MFC	HFC	PPW	LFC	MFC	HFC	PPW	All Hearing Groups
Goal Post Pile Installation – Impact Pile Driving	0	2	0	31	3	591	21	704	316	1,450
	6	0	0	12	1	235	8	280	126	580
	10	0	0	7	0	127	4.5	152	68	314

Source: COP, Appendix Z Dominion Energy 2022.
HFC = high-frequency cetacean; LFC = low-frequency cetacean; MFC = mid-frequency cetacean; PPW = phocid pinniped in water; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

Table J-16 Sea Turtle Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Impact Pile Driving for Installation of the Goal Posts to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)	Distance to PTS Threshold (SEL_{24hr})	Distance to Behavioral Threshold (SPL)
Goal Post Pile Installation – Impact Pile Driving	0	0	0	0
	6	0	0	0
	10	0	0	0

Source: COP, Appendix Z Dominion Energy 2022.
PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

Table J-17 Fish Acoustic Injury and Behavioral Criteria Threshold Distances (meters) During Impact Pile Driving for Installation of the Goal Posts to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Fish with No Swim Bladder		Fish with Swim Bladder Not Involved in Hearing		Fish with Swim Bladder Involved in Hearing		Eggs and Larvae		Fish <2 g		Fish ≥2 g		Behavioral (SPL)
		Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	All Fish
Goal Post Pile Installation – Impact Pile Driving	0	-	-	-	-	-	-	-	-	-	-	-	-	6,750
	6	-	-	-	-	-	-	-	-	-	-	-	-	2,700
	10	-	-	-	-	-	-	-	-	-	-	-	-	1,450

Source: COP, Appendix Z Dominion Energy 2022.
PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

J.8.3 Cofferdam Installation

Vibratory pile driving will be used to install up to nine temporary cofferdams at the Offshore and Nearshore Trenchless Installation Punch-Out. The nine proposed locations are within the same general area; therefore, the center cofferdam was used as the representative location in the model (COP Appendix Z; Dominion Energy 2022). The cofferdams will be constructed using 20-inch (0.51-meter) steel sheet piles surrounding a 20-by-50-foot (6.1-by-15-meter) area. The modeling assumed up to 1,800 kilonewton vibratory force for all sheet piles, and source levels and spectral levels were obtained by adjusting measurements from similar offshore construction activity. The modeling assumed up to 60 minutes to install each pile, and included 0-, 6-, and 10-dB noise attenuation (Dominion Energy 2022). Installation activities are anticipated to take approximately 9 to 12 months in 2024, but all installation activities would occur between May and October to avoid peak NARW presence.

Table J-18, Table J-19, and Table J-20 summarize the maximum distances to acoustic thresholds for marine mammals, sea turtles, and fish, respectively.

Table J-18 Marine Mammal Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Vibratory Pile Driving for Installation of Cofferdams to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)				Distance to PTS Threshold (SEL_{24hr})				Distance to Behavioral Threshold (SPL)
		LFC	MFC	HFC	PPW	LFC	MFC	HFC	PPW	All Hearing Groups
Cofferdam Installation – Vibratory Pile Driving	0	--	--	--	--	108	0	0	0	3,097
	6	--	--	--	--	16	0	0	0	2,228
	10	--	--	--	--	0	0	0	0	1,814

Source: COP, Appendix Z Dominion Energy 2022.
HFC = high-frequency cetacean; LFC = low-frequency cetacean; MFC = mid-frequency cetacean; PPW = phocid pinniped in water; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

Table J-19 Sea Turtle Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) During Vibratory Pile Driving for Installation of Cofferdams to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Distance to PTS Threshold (Lpk)	Distance to PTS Threshold (SEL_{24hr})	Distance to Behavioral Threshold (SPL)
Cofferdam Installation – Vibratory Pile Driving	0	N/A	0	0
	6		0	0
	10		0	0

Source: COP, Appendix Z Dominion Energy 2022.
PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

Table J-20 Fish Acoustic Injury and Behavioral Criteria Threshold Distances (meters) During Vibratory Pile Driving for Installation of Cofferdams to Support Trenchless Installation of the Export Cable

Scenario	Noise Attenuation (dB)	Fish with No Swim Bladder		Fish with Swim Bladder Not Involved in Hearing		Fish with Swim Bladder Involved in Hearing		Eggs and Larvae		Fish <2 g		Fish ≥2 g		Behavioral (SPL)
		Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	Lpk	SEL_{24hr}	All Fish
Cofferdam Installation – Vibratory Pile Driving	0	-	-	-	-	-	-	-	-	-	567	-	506	470
	6	-	-	-	-	-	-	-	-	-	389	-	317	349
	10	-	-	-	-	-	-	-	-	-	317	-	206	248

Source: COP, Appendix Z Dominion Energy 2022.
PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); Lpk = peak sound pressure level (dB re 1 μPa); SPL = root-mean=square sound pressure level (dB re 1 μPa).

J.8.4 HRG Surveys

HRG survey activities may be required pre-, during-, and post-construction site characterization surveys in the Lease Area and export cable route corridor. The types of equipment that will be used during the proposed HRG surveys with operational frequencies less than 180 kHz include both impulsive and non-impulsive equipment such as parametric sub-bottom profilers; ultra-short baseline positioning equipment; compressed high-intensity radiated pulse (CHIRP) sonar; sparkers; and boomers (Tetra Tech 2022). Of these equipment types, only the CHIRP sonar, sparkers, and boomers have the potential to propagate sound to appreciable distances whereby marine mammals may be exposed to sound levels above established thresholds (Baker and Howsen 2021). Ranges to acoustic thresholds provided in Table J-21 for marine mammals were estimated using NMFS User Spreadsheets for PTS thresholds and interim guidance from NMFS (2019) for behavioral thresholds (Tetra Tech 2022). Only ranges to the SEL_{24h} PTS threshold for marine mammals are shown as these represent the maximum distances. Ranges to the acoustic thresholds for sea turtles and fish in Table J-21 were obtained from the Programmatic Biological Assessment conducted by BOEM (Baker and Howsen 2021).

Table J-21 Permanent Threshold Shift Onset and Behavioral Criteria Threshold Distances (meters) for Marine Mammals, Sea Turtles, and Fish During High-Resolution Geophysical Surveys

Equipment Type	Distance to PTS Threshold (SEL_{24hr})						Distance to Behavioral Threshold (SPL)		
	LFC	MFC	HFC	PPW	Sea Turtles	Fish ≥2 g	All Marine Mammals	Sea Turtles	All Fish
CHIRP Sonar	0	0	0.4	0	NA	NA	10.2	2	708
Sparker	0.1	0	1.5	0.1	0	9	100	90	1,996
Boomer	5.9	0.2	54.2	3.5	0	3.2	21.9	40	32

Source: COP, Appendix Z Dominion Energy 2022; Baker and Howsen 2021.
HFC = high-frequency cetacean; LFC = low-frequency cetacean; MFC = mid-frequency cetacean; NA = not applicable due to sound source being outside the hearing range of the group; PPW = phocid pinniped in water; PTS = permanent threshold shift; SEL_{24h} = sound exposure level over 24 hours (dB re 1 μPa^2 s); SPL = root-mean=square sound pressure level (dB re 1 μPa).

J.8.5 Animal Exposure Estimates

The modeled ranges represent the total area over which noise produced by the Project activity may exceed a given threshold following a single impact hammer strike or 1 second of vibratory hammering (for Lpk and SPL metrics) and for 24-hours of pile driving activity based on pre-defined piling schedules (for SEL_{24h} metric). The ranges only account for source characteristics and environmental parameters within the Action Area which contribute to how sound may propagate through the water. They do not incorporate animal movement or behavior to account for how any animal may respond to noise or how their movement would influence their total duration of exposure to the noise. This is accomplished through estimates of exposure using the animal movement modeling methodology described in Section J.5. No behavioral or animal movement information is available for fish species, so exposures could not be calculated for that group.

To estimate the number of marine mammals and sea turtles likely to be exposed above the acoustic thresholds discussed in Section J.7, a conservative construction schedule included all possible WTG monopile and OSS jacket foundation installation scenarios, and all possible HRG survey days was assumed (Tetra Tech 2022). The construction schedule used to estimate the number of exposures throughout the entire construction period is provided in Table J-22.

Table J-22 Proposed Pile Driving and High-Resolution Geophysical Survey Schedule Used to Estimate the Number of Marine Mammals and Sea Turtles Potentially Exposed to Above-Threshold Noise during Project Activities

Year	Month	Total Number of Foundations Installed	Number Standard WTG Installations	Number Hard-to-Drive WTG Installations	Number of Days with Two WTG Installed	Number of Active HRG Survey Days
2024	May	18	5	13	1	65
	June	25	6	19	6	
	July	26	7	19	6	
	August	2 WTG, 12 OSS	1	1	1	
	September	13	3	10	0	
	October	11	1	10	0	
2024 Total		95 WTG, 12 OSS	23	72	14	
2025	May	17	6	11	1	249
	June	24	8	16	6	
	July	26	8	18	6	
	August	20	6	14	6	
	September	5	2	3	0	
	October	3	1	2	0	
2025 Total		95	31	64	19	
2026	May	3	0	3	0	58
	June	5	0	4	0	
	July	5	0	4	0	
	August	4	0	3	0	
	September	1	0	1	0	
	October	0	0	0	0	
2026 Total		15	0	15	0	
2027 Total		NA	NA	NA	NA	368
2027 Total		NA	NA	NA	NA	368

Source: Tetra Tech 2022.
HRG = high-resolution geophysical; NA = not applicable for this activity as construction is assumed to be completed by 2026, whereas HRG surveys will continue after construction to ensure Project components are not in need of maintenance; OSS = offshore substation; WTG = wind turbine generator.

J.8.5.1. Marine Mammals

The total number of marine mammals exposed to above-threshold noise from all noise-producing activities under the Proposed Action is provided in Table J-23.

Table J-23 Total Number of Marine Mammal Exposed to Sound Levels Above PTS and Behavioral Thresholds from all Project Activities

Marine Mammal Species		PTS	Behavioral
WTG and OSS Foundation Installation (10 dB attenuation)			
LFC	NARW	3	6
	Fin whale	9	45
	Minke whale	18	113
	Humpback whale	9	36
	Sei whale	3	7
MFC	Sperm whale	0	3
	Atlantic spotted dolphin	0	4,473
	Common bottlenose dolphin (southern migratory coastal and western North Atlantic offshore stocks)	0	8,809
	Common dolphin	0	1,293
	Pantropical spotted dolphin	0	9
	Long- and Short-finned pilot whale	0	124
	Risso's dolphin	0	54
HFC	Harbor porpoise	3	49
PPW	Gray seal	2.5	128.5
	Harbor seal	2.5	128.5
Goal Post Pile Installation			
LFC	NARW	0	0
	Fin whale	0	0
	Minke whale	0	2
	Humpback whale	0	0
	Sei whale	0	0
MFC	Sperm whale	0	0
	Atlantic spotted dolphin	0	6
	Common bottlenose dolphin (southern migratory coastal and western North Atlantic offshore stocks)	0	46
	Common dolphin	0	6
	Pantropical spotted dolphin	0	0
	Long- and Short-finned pilot whale	0	0
	Risso's dolphin	0	1
HFC	Harbor porpoise	0	0
PPW	Gray seal	0	1
	Harbor seal	0	1

Marine Mammal Species		PTS	Behavioral
Cofferdam Installation			
LFC	NARW	0	1
	Fin whale	0	1
	Minke whale	0	2
	Humpback whale	0	1
	Sei whale	0	0
MFC	Sperm whale	0	0
	Atlantic spotted dolphin	0	37
	Common bottlenose dolphin (southern migratory coastal and western North Atlantic offshore stocks)	0	267
	Common dolphin	0	28
	Pantropical spotted dolphin	0	0
	Long- and Short-finned pilot whale	0	1
	Risso's dolphin	0	0
HFC	Harbor porpoise	0	7
PPW	Gray seal	0	14
	Harbor seal	0	14
HRG Surveys (5-Year Total)			
LFC	NARW	0	5
	Fin whale	0	5
	Minke whale	0	13
	Humpback whale	0	8
	Sei whale	0	3
MFC	Sperm whale	0	0
	Atlantic spotted dolphin	0	22,160
	Common bottlenose dolphin (southern migratory coastal and western North Atlantic offshore stocks)	0	1,858
	Common dolphin	0	22,160
	Pantropical spotted dolphin	0	100
	Long- and Short-finned pilot whale	0	125
	Risso's dolphin	0	125
HFC	Harbor porpoise	0	90
PPW	Gray seal	0	87
	Harbor seal	0	87

Source: Tetra Tech 2022b.
dB = decibels; HRG = high-resolution geophysical; LFC = low-frequency cetacean; MFC = mid-frequency cetacean; NARW = North Atlantic right whale; OSS = offshore substation; PTS = permanent threshold shift; WTG = wind turbine generator.

J.8.5.2. Sea Turtles

The total number of marine mammals exposed to above-threshold noise from all noise-producing activities under the Proposed Action is provided in Table J-24.

Table J-24 Annual Estimated Number of Sea Turtles Exposed to Sound Levels Above PTS and Behavioral Thresholds from Installation of the Wind Turbine Generator and Offshore Substation Foundation Scenarios

Species	Construction Year	PTS Exposures	Behavioral Exposures
Green sea turtles	2024	26	123
	2025	25	118
	2026	4	19
Total		**55**	**260**
Kemp's ridley sea turtle	2024	20	96
	2025	18	84
	2026	3	14
Total		**41**	**194**
Leatherback sea turtle	2024	57	270
	2025	2	9
	2026	1	2
Total		**60**	**281**
Loggerhead sea turtle (Barco et al. 2018)[1]	2024	657	3,134
	2025	597	2,829
	2026	91	450
Total		**1,345**	**6,413**

Source: Tetra Tech 2022.
dB = decibels; PTS = permanent threshold shift.
[1] Exposures for the loggerhead sea turtles comprise the estimates scaled using densities from Barco et al. (2018) rather than the DON (2007) as these represent the maximum potential for exposure to above-threshold noise from the Proposed Action.

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Appendix K. List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent

This Environmental Impact Statement (EIS) is available in electronic form for public viewing at https://www.boem.gov/renewable-energy/state-activities/CVOW-C. Hard copies and digital versatile disks (DVDs) of the EIS can be requested by contacting the Program Manager, Office of Renewable Energy in Sterling, Virginia. Publication of this Draft EIS initiates a 60-day comment period where government agencies, members of the public, and interested stakeholders can provide comments and input. The Bureau of Ocean and Energy Management (BOEM) will accept comments in any of the following ways.

- In hard copy form, delivered by hand or by mail, enclosed in an envelope labeled "CVOW-C COP EIS" and addressed to Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166. Comments must be received or postmarked no later than February 14, 2023.
- Through the regulations.gov web portal by navigating to http://www.regulations.gov and searching for docket number "BOEM-2022-0069." Click the "Comment Now!" button to the right of the document link. Enter your information and comment, then click "Submit."
- By attending one of the EIS public meetings at the locations and dates listed in the Notice of Acceptance (NOA) and providing written or verbal comments. BOEM will use comments received during the public comment period to inform its preparation of the Final EIS, as appropriate. EIS notification lists for the Project are provided in Table K-1 through Table K-4.

K.1. Notification List

Table K-1 Federal Agencies

Agency	Contact
Cooperating Federal Agencies	
USEPA	Carrie Traver, NEPA Reviewer, USEPA Region 3
NOAA, NMFS	Sue Tuxbury, BOEM Activities/Hydropower, Greater Atlantic Regional Fisheries Office, Habitat and Ecosystems Services Division
USCG	George Detweiler, USCG, Marine Transportation Specialist, Navigation Standards Division (CG-NAV-2), Office of Navigation Systems
DOI, BSEE	Juliette Giordano, Lead Environmental Protection Specialist
USACE	Nicole Woodward, Norfolk District Regulatory Branch
DOI, USFWS	Caleb Spiegel, Marine Bird Biologist, Population Branch, Northeast Region
DOD	Steven Sample, Executive Director, DoD Siting Clearinghouse
Participating Federal Agencies	
National Park Service	Mary Krueger, Energy Specialist, Project Lead

USEPA = U.S. Environmental Protection Act; NOAA = National Oceanic and Atmospheric Administration; NMFS = National Marine Fisheries Service; USCG = U.S. Coast Guard; DOI = U.S. Department of the Interior; BSEE = Bureau of Safety and Environmental Enforcement; USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service; DOD = U.S. Department of Defense; NEPA = National Environmental Policy Act

Table K-2 State and Local Agencies or Other Interested Parties

Agency	Contact
Cooperating State Agencies	
VA DOE	Al Christopher, Director
Libraries	
Meyera E. Oberndorf Central Library (Virginia Beach, VA)	Clara Hudson, Support Services Administrator
Slover Library (Norfolk, VA)	Victoria Lannetti, Public Relations Office Assistant

VA DOE = Virginia Department of Energy

Table K-3 Tribes and Native Organizations

Agency	**Contact** (Primary and Alternates, as designated by the tribe)
Chickahominy Indian Tribe	Stephen Adkins, Chief Dana Adkins Wayne Adkins
Chickahominy Indian Tribe, Eastern Division	Doris Austin, Councilwoman Jessica Philips
Delaware Nation	Erin Paden, Historic Preservation Director Deborah Dotson, President of Executive Committee
Monacan Indian Nation	Kenneth Branham, Tribal Chief Kaleigh Pollak, Tribal Historic Preservation Officer
Nansemond Indian Nation	Keith Anderson, Assistant Chief/Environmental Project Director Earl Bass, Chief
Pamunkey Indian Tribe	Warren Taylor, Natural Resources Manager
Rappahannock Tribe	Woodie Walker, Director, Department of Environmental Services Anne Richardson, Chief Mark Fortune, Assistant Chief
Upper Mattaponi Indian Tribe	Frank Adams, Chief Reggie Tupponce, Tribal Administrator Leigh Mitchell, Natural Resources and Environmental Protection Coordinator
Coharie Tribe	Greg Jacobs, Tribal Administrator Phillip Bell
Lumbee Tribe of North Carolina	Karen Bird, Grants and Planning Manager Tammy Maynor, Interim Tribal Administrator
Nottoway Indian Tribe of Virginia	Lynette Allston, Chief
Patawomeck Indian Tribe of Virginia	Charles Bullock, Chief Minnie Lightner

Table K-4 Section 106 Consulting Parties

Government or Organization	Participating Consulting Parties	Contact (Primary and Alternates, as designated by the agency or organization)
SHPOs and State Agencies	Virginia Department of Historic Resources	Julie Langan, Director/ State Historic Preservation Officer Roger Kirchen, Director, Review and Compliance Division
Federal Agencies	ACHP	Christopher Daniel, Program Analyst, Federal Property Management Section
	USACE, Eastern Virginia Regulatory Section	Brian Denson, Environmental Scientist Peter Kube, Chief
	US Navy Region Mid-Atlantic	Heather Robbins, Cultural Resources Supervisor Clay Swindell
	USCG	Matthew Creelman, Program Manager, Private Aids to Navigation John Stone, Coast Guard Headquarters Office of Navigation CDR Matt Meskun, Prevention Department Head, Sector Virginia George Detweiler, Coast Guard Headquarters Office of Navigation
	National Park Service, Interior Region 1 North Atlantic	Mary Krueger, Regional Energy Specialist Katherine Schlegel, Historical Landscape
	USFWS	Mike Hoff, Refuge Manager Mackay Island National Wildlife Refuge and Currituck National Wildlife Refuge Amy Wood, Regional Historic Preservation Officer
	U.S. Fleet Forces Command	Laura Busch, Natural Resources Program Manager, Fleet Installations and Environment James Casey
	Virginia Army National Guard	Susan Smead, Cultural Resources Program Manager
Federal Facilities	Colonial National Historic Park	Kym Hall, alternate to NPS Interior Region 1 Mary Krueger
	NASA Wallops Flight Facility	Randall Stanley, Historic Preservation Officer
	USFWS Back Bay National Wildlife Refuge	Kathryn Owens, Acting Refuge Manager Lauren Mowbray, Refuge Biologist
	USFWS Chincoteague National Wildlife Refuge	John Kasbohm, Refuge Manager Meta Griffin, Refuge Manager
Federally Recognized Tribes	Chickahominy Indian Tribe	Stephen Adkins, Chief Dana Adkins Wayne Adkins

Government or Organization	Participating Consulting Parties	Contact (Primary and Alternates, as designated by the agency or organization)
	Chickahominy Indian Tribe-Eastern Division	Doris Austin, Councilwoman Jessica Philips
	Delaware Nation	Erin Paden, Historic Preservation Director Deborah Dotson, President of Executive Committee
	Monacan Indian Nation	Kenneth Branham, Tribal Chief Kaleigh Pollak, Tribal Historic Preservation Officer
	Nansemond Indian Nation	Keith Anderson, Assistant Chief/Environmental Project Director Earl Bass, Chief
	Pamunkey Indian Tribe	Warren Taylor, Natural Resources Manager
	Rappahannock Tribe	Woodie Walker, Director, Department of Environmental Services Anne Richardson, Chief Mark Fortune, Assistant Chief
	Upper Mattaponi Indian Tribe	Frank Adams, Chief Reggie Tupponce, Tribal Administrator Leigh Mitchell, Natural Resources and Environmental Protection Coordinator
Non-Federally Recognized Tribes	Coharie Tribe	Greg Jacobs, Tribal Administrator Phillip Bell
	Lumbee Tribe of North Carolina	Karen Bird, Grants and Planning Manager Tammy Maynor, Interim Tribal Administrator
	Nottoway Indian Tribe of Virginia	Lynette Allston, Chief
	Patawomeck Indian Tribe of Virginia	Charles Bullock, Chief Minnie Lightner
Local Government Nongovernmental Organizations or Groups	Accomack County	G. Christian Guvernator IV, Environmental Programs Director
	City of Norfolk	Kenneth C. Alexander, Mayor Susan McBride, Principal Planner (Historic Preservation)
	City Virginia Beach	Mark Reed, Historic Preservation Planner Robert M. Dyer, Mayor
	Town of Chincoteague	J. Arthur Leonard, Mayor Michael T. Tolbert, Town Manager
	Town of Eastville	Jim Sturgis, Mayor
	Council of Virginia Archaeologists	Eleanor Breen, President
Nongovernmental Organizations or Groups	Eastern Shore of Virginia Historical Society	Hilary Hartnett-Wilson, Executive Director

Government or Organization	Participating Consulting Parties	**Contact** (Primary and Alternates, as designated by the agency or organization)
	Nansemond River Preservation Alliance	Elizabeth Taraski, President/CEO
	Preservation Virginia	Elizabeth Kostelny, Chief Executive Officer Sonja Ingram, Preservation Field Services Manager
	Virginia African American Cultural Center	Amelia Ross-Hammond, Founder and Chairman Wayne Jones

SHPO = State Historic Preservation Office; ACHP = Advisory Council on Historic Preservation; USCG = U.S. Coast Guard; CDR = Commander; NASA = National Aeronautics and Space Administration; NPS = National Park Service; CEO = Chief Executive Officer

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Appendix L. Other Impacts

L.1. Unavoidable Adverse Impacts of the Proposed Action

The Council on Environmental Quality's (CEQ) National Environmental Policy Act (NEPA)-implementing regulations (40 Code of Federal Regulations [CFR] 502.16(a)(2)) require that an Environmental Impact Statement (EIS) evaluate the potential unavoidable adverse impacts associated with a Proposed Action. Adverse impacts that can be reduced by mitigation measures but not eliminated are considered unavoidable. Table L-1 provides a listing of such impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction phase and would be temporary. Chapter 3, *Affected Environment and Environmental Consequences*, provides additional information on the potential impacts listed below.

All impacts from planned activities are still expected to occur as described in the No Action Alternative analysis in this EIS, regardless of whether the Proposed Action is approved.

Table L-1 Potential Unavoidable Adverse Impacts of the Proposed Action

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Air Quality	• Air quality impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation
Bats	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic
Benthic Resources	• Suspension and re-settling of sediments due to seafloor disturbance • Conversion of soft-bottom habitat to new hard-bottom habitat • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor alternations • Disturbance, displacement, and avoidance behavior due to habitat loss/ alteration, equipment activity and noise, and vessel traffic • Individual mortality due to construction activities
Birds	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic • Increased risk of individual injury and mortality due to collision with WTGs
Coastal Habitat and Fauna	• Habitat alteration and removal of vegetation, including trees • Temporary avoidance behavior by fauna during construction activity and noise-producing activities • Individual fauna mortality due to collision with vehicles or equipment during clearing and grading activities, particularly species with limited mobility
Commercial Fisheries and For-Hire Recreational Fishing	• Disruption of access or temporary restriction in harvesting activities due to construction of offshore Project elements • Disruption of harvesting activities during operations of offshore wind facility • Changes to target species stemming from alterations in species composition due to habitat modification • Changes in vessel transit and fishing operation patterns • Changes in risk of gear entanglement or availability of target species
Cultural Resources	• Impacts on viewsheds of historic properties • Physical impacts to archaeological and architectural historic properties

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Demographics, Employment, and Economics	• Disruption of commercial fishing, for-hire recreational fishing, and marine recreational businesses during offshore construction and cable installation • Hindrances to ocean economy sectors due to the presence of the offshore wind facility, including commercial fishing, recreational fishing, sailing, sightseeing, and supporting businesses
Environmental Justice	• Disruption of commercial fishing, for-hire recreational fishing, and marine recreation during offshore construction and cable installation and infrequent maintenance • Noise, vibration and dust disruptions from proposed action and staging operations • Delays in travel along affected roadways • Loss of employment or income due to disruption to commercial fishing, for-hire recreational fishing, or marine recreation businesses • Hindrances to subsistence fishing due to offshore construction and operation of the offshore wind facility
Finfish, Invertebrates, and Essential Fish Habitat	• Suspension and re-settling of sediments due to seafloor disturbance • Displacement, disturbance, and avoidance behavior due to construction-related impacts, including noise, vessel traffic, increased turbidity, sediment deposition, and EMF • Individual mortality due to construction activities • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor surface alterations • Conversion of soft-bottom habitat to new hard-bottom habitat
Land Use and Coastal Infrastructure	• Conversion of undeveloped areas to utility right-of-way or easement or cable maintenance or replacement • Land use disturbance due to construction as well as effects due to noise, vibration, and travel delays • Potential for accidental releases during construction
Marine Mammals	• Increased risk of injury (TTS or PTS) to individuals due to underwater noise from pile-driving activities during construction • Disturbance (behavioral effects) and acoustic masking due to underwater noise from pile driving, shipping and other vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical drilling surveys), WTG operation, and dredging during construction and operations • Increased risk of individual injury and mortality due to vessel strikes • Increased risk of individual injury and mortality associated with fisheries gear
Navigation and Vessel Traffic	• Congestion in port channels • Increased navigational complexity, vessel congestion, and allision risk within the offshore Wind Farm Area • Potential for disruption to marine radar on smaller vessels operating within or in the vicinity of the Project, increasing navigational complexity • Hindrances to SAR missions within the offshore Wind Farm Area
Other Uses	• Disruption to offshore scientific research and surveys and species monitoring and assessment • Increased navigational complexity for military or national security vessels operating within the Wind Farm Area • Changes to aviation and air traffic navigational patterns • Interference with radar systems

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Recreation and Tourism	• Disruption of coastal recreation activities during onshore construction, such as beach access • Viewshed effects from the WTGs altering enjoyment of marine and coastal recreation and tourism activities • Disruption to access or temporary restriction of in-water recreational activities from construction of offshore Project elements • Temporary disruption to the marine environment and marine species important to fishing and sightseeing due to turbidity and noise • Hindrances to some types of recreational fishing, sailing, and boating within the area occupied by WTGs during operation • Potential recreational vessel delay within the ports serving construction
Sea Turtles	• Increased risk of for individual injury and mortality due to vessel strikes during construction, O&M, and decommissioning • Disturbance, displacement, and avoidance behavior due to habitat disturbance and underwater noise during construction
Scenic and Visual Resources	• Alterations to the ocean, seascape, landscape character units' character, and effects on viewer experience, by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid
Water Quality	• Increase in suspended sediments due to seafloor disturbance during construction, O&M, and decommissioning
Wetlands	• Loss/conversion of existing wetland habitat and surface water alterations, including increased sediment deposition and removal of vegetation during construction

EMF = electromagnetic field; O&M = operations and maintenance; PTS = permanent threshold shift; SAR = search and rescue; SAV = submerged aquatic vegetation; TTS = temporary threshold shift; WTG = wind turbine generator

L.2. Irreversible and Irretrievable Commitment of Resources

CEQ's NEPA-implementing regulations (40 CFR 1502.16(a)(4)) require that an EIS review the potential impacts on irreversible or irretrievable commitments of resources resulting from implementation of a Proposed Action. CEQ considers a commitment of a resource irreversible when the primary or secondary impacts from its use limit the future options for its use. Irreversible commitment of resources typically applies to impacts on nonrenewable resources such as marine minerals or cultural resources. The irreversible commitment of resources occurs due to the use or destruction of a specific resource. An irretrievable commitment refers to the use, loss, or consumption of a resource, particularly a renewable resource, for a period of time.

Table L-2 provides a listing of potential irreversible and irretrievable impacts by resource area. EIS Chapter 3 and Appendix G provide additional information on the impacts summarized below.

Table L-2 Irreversible and Irretrievable Commitment of Resources by Resource Area for the Proposed Action

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Air Quality	No	No	BOEM expects air pollutant emissions to comply with permits regulating compliance with air quality standards. Emissions would be temporary during construction activities. To the extent that the Proposed Action displaces fossil-fuel energy generation, overall improvement of air quality would be expected.
Bats	Yes	No	Irreversible impacts on bats could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bat displacement from foraging habitat.
Benthic Resources	No	No	Although local mortality of benthic fauna and habitat alteration are likely to occur, BOEM does not anticipate population-level impacts on benthic organisms; habitat could recover after decommissioning activities.
Birds	Yes	No	Irreversible impacts on birds could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bird displacement from foraging habitat.
Coastal Habitat and Fauna	No	No	Although limited removal of habitat associated with clearing and grading for construction of the onshore export cable and substation are likely to occur, BOEM does not anticipate population-level impacts on flora or fauna; coastal habitat could recover after construction in some areas, and after decommissioning activities in other areas.
Commercial Fisheries and For-Hire Recreational Fishing	No	Yes	Based on the anticipated duration of construction and O&M activities, BOEM does not anticipate irreversible impacts on commercial fisheries. The Project could alter habitat during construction and operations, limit access to fishing areas during construction, or reduce vessel maneuverability during operations. However, the conceptual decommissioning of the Project would reverse those impacts. Irretrievable impacts (lost revenue) could occur due to the loss of use of fishing areas at an individual level.
Cultural Resources	Yes	Yes	Although unlikely, unanticipated removal or disturbance of previously unidentified cultural resources onshore and offshore could result in irreversible and irretrievable impacts.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Demographics, Employment, and Economics	No	Yes	Construction activities could temporarily increase contractor demand, housing needs, supply requirements, and demand for local businesses, leading to an irretrievable loss of workers for other projects. These factors could lead to increased housing and supply costs.
Environmental Justice	No	Yes	Impacts on environmental justice communities could occur due to loss of income or employment for low-income workers in marine industries; this could be reversed by Project decommissioning or by other employment, but income lost during Project operations would be irretrievable.
Finfish, Invertebrates, and Essential Fish Habitat	No	No	Although local mortality of finfish and invertebrates and habitat alteration could occur, BOEM does not anticipate population-level impacts on finfish, invertebrates, and essential fish habitat. It is expected that the aquatic habitat for finfish and invertebrates would recover following decommissioning activities.
Land Use and Coastal Infrastructure	Yes	Yes	Land use required for construction and operational activities could result in a minor irreversible impact. Construction activities could result in a minor irretrievable impact due to the temporary loss of use of the land for otherwise typical activities. Onshore facilities may or may not be decommissioned.
Marine Mammals	No	Yes	Irreversible impacts on marine mammal populations could occur if one or more individuals of an ESA-listed species were injured or killed or if those populations experienced behavioral effects of high severity. With implementation of mitigation measures, developed in consultation with NMFS (e.g., timing windows, vessel speed restrictions, safety zones), the potential for an ESA-listed species to experience high-severity behavioral effects or be injured or killed would be reduced or eliminated. No irreversible high-severity behavioral effects from Project activities are anticipated, as described in Section 3.15; however, due to the uncertainties from lack of information that are outlined in Appendix D, these effects are still possible. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of displacement from the Project area.
Navigation and Vessel Traffic	No	Yes	Based on the anticipated duration of construction and operations, BOEM does not anticipate impacts on vessel traffic to result in irreversible impacts. Irretrievable impacts could occur due to changes in transit routes, which could be less efficient during the life of the Project.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Other Uses	No	Yes	Disruption of offshore scientific research and surveys would occur during proposed Project construction, operations, and decommissioning activities. Disruption of military training exercises and traffic in the Wind Farm Area, the Cable Landing Location, and Onshore Export Cable would last throughout the life of the project (being the highest during construction) until decommissioning was complete. Dominion Energy would coordinate with DoD to minimize impacts.
Recreation and Tourism	No	No	Construction activities near the shore could result in a minor, temporary loss of use of the land for recreation and tourism purposes.
Sea Turtles	No	Yes	Irreversible impacts on sea turtles could occur if one or more individuals of species listed under the ESA were injured or killed; however, the implementation of mitigation measures, developed in consultation with NMFS, would reduce or eliminate the potential for impacts on listed species. Irreversible impacts could occur if individuals or populations grow more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear caught on the structures, or due to displacement from the Project area.
Scenic and Visual Resources	No	No	Long-term (until post-decommissioning) seascape unit, open ocean unit, and landscape units' character alterations, and effects on viewer experience, by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid would occur.
Water Quality	No	No	BOEM does not expect activities to cause loss of, or major impacts on, existing inland waterbodies. Turbidity impacts in marine and coastal environments would be short term and minor.
Wetlands	Yes	Yes	Removal of wetland vegetation and the permanent conversion of wetland areas resulting from the construction of the interconnection cable could potentially create irreversible and irretrievable impacts.

BOEM = Bureau of Ocean Energy Management, ESA = Endangered Species Act, NMFS = National Marine Fisheries Service, O&M = operations and maintenance, SAV = submerged aquatic vegetation, USFWS = U.S. Fish and Wildlife Service

L.3. Relationship Between the Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

CEQ's NEPA-implementing regulations (40 CFR 502.16(a)(3)) require that an EIS address the relationship between short-term use of the environment and the potential impacts of such use on the maintenance and enhancement of long-term productivity. Such impacts could occur as a result of a reduction in the flexibility to pursue other options in the future, or assignment of a specific area (land or marine) or resource to a certain use that would not allow other uses, particularly beneficial uses, to occur at a later date. An important consideration when analyzing such effects is whether the short-term environmental effects of the action will result in detrimental effects on long-term productivity of the affected areas or resources.

As assessed in EIS Chapter 3 and Appendix G, BOEM anticipates that the majority of the potential adverse effects associated with the Proposed Action would occur during construction activities and would be short term in nature and minor to moderate in severity/intensity. These effects would cease after decommissioning activities. In assessing the relationships between short-term use of the environment and the maintenance and enhancement of long-term productivity, it is important to consider the long-term benefits of the Proposed Action, which include:

- Promotion of clean and safe development of domestic energy sources and clean energy job creation;
- Promotion of renewable energy to help ensure geopolitical security, combat climate change, and provide electricity that is affordable, reliable, safe, secure, and clean;
- Delivery of power to the Virginia and North Carolina energy grid to contribute to the state's renewable energy requirements; and
- Increased habitat for certain fish species.

Based on the anticipated potential impacts evaluated in this document and the Draft EIS that could occur during Proposed Action construction, O&M, and decommissioning, and with the exception of some potential impacts associated with onshore components, BOEM anticipates that the Proposed Action would not result in impacts that would significantly narrow the range of future uses of the environment. Removal or disturbance of habitat associated with onshore activities could create long-term irreversible impacts. For purposes of this analysis, BOEM assumes that the irreversible impacts presented in Table L-2 would be long term. After completion of the Proposed Action's operations and decommissioning phases, however, BOEM expects the majority of marine and onshore environments to return to normal long-term productivity levels.

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