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Ocean Wind 2 Offshore Wind Farm

OREC Application

Attachments to Section 9

December 2020

Attachment 9.1 – Environmental Impact Assessment

December 2020

Table of Contents

List of Tables

List of Figures

List of Acronyms

°C	Celsius
°F	Fahrenheit
ADLS	Aircraft Detection Lighting System
AMAPPS	Atlantic Marine Assessment Program for Protected Species
ANL	Argonne National Laboratory
BC	black carbon
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CH_4	methane
COI	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP	Construction and Operations Plan
CWFNJ	Conserve Wildlife Foundation of New Jersey
DPS	Distinct Population Segment
EBS	Ecological Baseline Studies
EEZ	Exclusive Economic Zone
eGRID	Emissions & Generation Resource Integrated Database
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FLiDAR	floating light and detection ranging
FR	Federal Register
ft	foot
HDD	horizontal directional drilling
IPaC	Information, Planning and Consultation
m	meter
MARCO	Mid Atlantic Regional Council on the Ocean
MDAT	Marine life Data and Analysis Team
MLLW	mean lower low water
MMSC	Marine Mammal Stranding Center
MOVES	Motor Vehicle Emission Simulator
N.J.A.C.	New Jersey Administrative Code
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NJAAQS	New Jersey Ambient Air Quality Standards
NJBPU	New Jersey Board of Public Utilities
NJDEP	New Jersey Department of Environmental Protection
nm	nautical mile

NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrogen oxide
O_3	ozone
O&M	operations and maintenance
OCS	offshore substation/converter station
OnSS	onshore substation/converter station
Pb	lead
PJM	Pennsylvania-New Jersey Maryland Interconnection
PM	particulate matter
$PM_{2.5}$	particles with a diameter smaller than 2.5 micrometers
PM_{10}	particles with a diameter smaller than 10 micrometers
PSU	practical salinity unit
SAV	submerged aquatic vegetation
SEFSC	Southeast Fisheries Science Center
SO_2	sulfur dioxide
U.S.C.	United States Code
UME	Unusual Mortality Events
US	United States
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WEA	Wind Energy Area
WTG	wind turbine generator

1 Introduction

The Applicant proposes to construct the Ocean Wind 2 Project (the Project) to provide clean and reliable energy to the state of New Jersey. The Project would be located approximately 13 miles off the coast of New Jersey and consists of state of the art wind turbine generators (WTG), associated array cables, offshore substation/converter station (OCS) subsea and onshore export cables, and onshore substation/converter station (OnSS) to provide connection to the Pennsylvania-New Jersey-Maryland Interconnection (PJM) grid.[1]

The individual wind turbine size, total number of WTGs, and other aspects of the Project may change prior to final permitting and construction; however, the Project, as presented in Section 2 of this Application, reflects the current best available technological solution for minimizing environmental impact and serves as the basis for this analysis.

1.1 Key Message of this Assessment

The key message of this Environmental Impact Analysis (EIA) is as follows:

- The Project design has integrated, and will continue to integrate minimization and/or avoidance measures to reduce environmental impacts into every aspect of the design.
- A credible and robust approval schedule and permitting plan provides greater certainty that the Project will deliver on its environmental and other commitments in support of New Jersey's renewable energy goals.
- The Applicant's staff are knowledgeable environmental professionals with unrivaled experience developing similarly sized utility scale offshore wind projects in New Jersey.

1.2 Objective of Environmental Impact Analysis

The Applicant has prepared this preliminary EIA to evaluate the potential environmental impacts of the design, installation, operation and maintenance (O&M), and eventual decommissioning of the proposed Project and its components (e.g., offshore WTG, cables, substation/converter stations and other support apparatus) as required to support this Application. The EIA is intended to support the New Jersey Board of Public Utilities' (NJBPU) decision making process to select the optimal site for equipment installation, and to support the application for and acquisition of permits required for the installation, O&M, and decommissioning of the Project by providing a scientifically rigorous description of all associated environmental impacts from pre construction activities through decommissioning including, but not limited to, environmental; water use; water quality; avian; marine mammals; sea turtle; noise; aesthetics; tourism; navigation; endangered species; seabed disruption of marine life; morbidity or mortality among avian, mammal or benthic populations; emissions of combustion byproducts to the air or oil or other toxic releases to the ocean; or solid

[1] For the purpose of clarity, the term "PJM grid" as used here, refers to the electric transmission grid system operated by the regional transmission organization, PJM Interconnection LLC.

waste generation (New Jersey Administrative Code [N.J.A.C.] 14:8 6.5(a)(11)(xiv)(1)) (see Solicitation #2, Solicitation Guidance Document at p. 20).

Since receiving the Lease on May 10, 2016, the Applicant has been characterizing existing conditions in the Lease Area and assessing potential impacts through desktop assessments, field surveys, agency consultation, and stakeholder outreach. The Project team is working with federal and state agencies, tribal nations, and other stakeholders to assess environmental resources of concern, avoid and mitigate potential Project effects, and obtain the permits and approvals needed for construction and operation of Ocean Wind 1 and Ocean Wind 2 projects.

1.3 Relationship to Other Regulatory Approvals

The Project requires that a Construction and Operations Plan (COP) be submitted to Bureau of Ocean Energy Management (BOEM). BOEM will commission an Environmental Impact Statement (EIS) to fully evaluate environmental and socioeconomic impacts, fulfilling their National Environmental Policy Act (NEPA) obligations. In addition, the Project will be subject to various federal approvals under the One Federal Decision Executive Order 13807, State environmental permits and local approvals. The permitting plan for the Project is provided in Section 13 of this Application. The Project is currently in the early design stage and the Applicant expects that the design will be further refined as additional information becomes available after submittal of the Application as shown in the schedule in Section 11. Environmental impacts will be assessed as the Project develops and impact assessments, best management practices (BMPs) and mitigation and monitoring will be coordinated with the regulatory agencies at that time to address such impacts.

2 Affected Environment

This chapter summarizes the existing environmental resources in the Project Area, which for purposes of this Attachment 9.1 is defined as the Lease Area, submarine export cable alignments, and the onshore landfall, cable alignments and potential substation/converter station sites. In the sections below, the Project Area is divided into two different study areas, one for offshore and one for onshore (see Figure 2-1). Section 2 of the Application summarizes the Project description and Section 12 discusses the base case interconnection point and four alternative interconnection points.

[redacted]

[redacted]

2.1 Physical Resources

The Applicant has conducted early desktop and geotechnical and geophysical field investigations within the Lease Area. In Section 2 of this Application, Table 2.9 summarizes the surveys conducted and survey dates. The purpose of these surveys is to gain a general understanding of the seabed and subsurface geological conditions as well to address the geophysical and geotechnical risks The surveys provided information regarding the geological conditions for both the seabed and the subsurface geology The information includes descriptions of seabed sediments, seabed features, geohazards and geotechnical properties in support of the COP as required by 30 Code of Federal Regulations (CFR) 585.626(a) and Hazard reporting detailed in 30 CFR 585.627(a)1.

For the offshore cable area options, seabed conditions, hazards and subsurface geological conditions are assessed based on the desktop study and existing bathymetric data Additional information on the meteorological and marine conditions at the Lease Area can be found in Section 3.2.1 of this Application.

2.1.1 Oceanography, Climate, and Weather

The climate of the Project Area is characteristic of the eastern coastal region of the United States (US) with mild seasons and storms throughout the year with precipitation in the form of rain and snow being most common (New Jersey Department of Environmental Protection [NJDEP] 2010a). The mean season air temperature during the winter ranges from approximately 32 43°F (0 6°C); during spring ranges from approximately 54 64°F (12-18°C); during the summer ranges from approximately 68-75°F (20-24°C); and during the fall ranges from 50-57°F (10-14°C) (NJDEP 2009). Winds during the summer are typically from the southwest and flow parallel to the shore while winds in the winter months are typically from the northwest and flow perpendicular to the shore. Spring and fall are more variable, with wind currents from either the southwest or northeast (Schofield *et al.* 2008).

The offshore xport cable area experiences semi diurnal tides with an average period of 12 hours 25 minutes and a maximum amplitude of about 10 to 15 centimeters per second (4 to 6 inches per second) (NJDEP 2009).

The Applicant has been collecting wind and wave data from two stations located in the Lease Area, Stations F220 and F230 (see Figure 2.1-1). The majority of the waves originate from the southeast with significant wave height typically less than 6.6 feet (ft; 2 meters [m]) and significant wave period of less than 6 seconds for both Stations F220 and F230 (see Figure 2.1-2 and Figure 2.1-3).

Extratropical storms, including northeasters, are common in the Project Area from October to April. These storms bring high winds and heavy precipitation, which can lead to severe flooding and storm surges. Hurricanes that travel along the coastline of the eastern US have the potential to impact the Project Area with high winds and severe onshore flooding.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.1.2 Geological Resources

Based on the geophysical survey, water depths in the Lease Area vary from -46 ft (-14.0 m) mean lower low water (MLLW) in the northern part to -135 ft (41.2 m) MLLW in the southern part. From the coastline to the Lease Area there is a shallow slope with an average gradient of less than 1 degree.

Along the xport cable route options, in federal water outside the 3 nautical miles (nm) maritime limit the water depths vary from approximately -32.8 ft (10 m) depth MLLW to close to 131.2 ft (40 m) depth MLLW. In New Jersey waters depth range is from approximately 6.6 ft (2 m) to 49.2 ft (15 m) [redacted]

Within the Lease Area the seabed sediment consists predominantly of medium to coarse sand with areas of gravelly sand and gravel deposits (Fugro Marine Geoservices, Inc. 2017; Alpine

Ocean Seismic Survey Inc. [Alpine] 2017a). [redacted]

2.1.3 Water Quality

Waters within the Project Area consist of temperate ocean, coastal, brackish, and fresh water.

2.1.3.1 Salinity

The salinity signature of the Lease Area and along the offshore xport cable route area is characterized by high seasonal variability due to the seasonal river discharge and wind variations. The mean seasonal sea surface salinity for winter is approximately 30 to 31.6 practical salinity unit (PSU) and for spring is approximately 29 to 31.6 PSU. This range for spring is caused by the Hudson River outflow during the spring freshet, where the freshwater is close to the coast. The sea surface salinity ranges between approximately 30.25 and 31.5 PSU for the summer and between 31.5 and 31.75 PSU for the fall (NJDEP 2010a). The waters of the Lease Area are open oceanic waters that are well circulated by both wind and tides. Median salinity measured in the Lease Area for the period of 2003-2016 was 32.2 PSU, with a full range spanning 29.4 to 34.4 PSU (n=4,205) (Guida *et al.* 2017). This salinity is in the euhaline range (30 to 40 PSU) typical for seawater (Venice salinity classification system: Anonymous 1958).

2.1.3.2 Temperature

In the Lease Area over the period of 2003 to 2016, seasonal fluctuation spanned as much as 68°F (20°C) at the surface and 59°F (15°C) at the bottom, with thermal stratification beginning in April and increasing into August (Guida *et al.* 2017). Actual surface and bottom temperatures varied substantially from year to year, particularly during the fall. Surface to bottom temperature gradients were warmer at the surface and cooler at the bottom, with a stratified condition in spring and summer and isothermal condition following the fall turnover during winter. Surveys conducted from 2008 and 2009 along the New Jersey coast, where xport cable routes would be, show the minimum sea surface temperature value collected was 36°F (2°C) during winter and the maximum sea surface temperature value collected was 79°F (26°C) during summer (NJDEP 2010a).

2.1.3.3 Nutrients

Nutrient concentrations, as approximated by phytoplankton concentration as chlorophyll, were measured via remote sensing techniques. In the coastal areas, chlorophyll a values are higher compared to the offshore areas due to input of nutrients from anthropogenic sources (NJDEP 2010a). Phytoplankton blooms during the fall and winter seasons are driven by stratification decreases due to frequent storms and seasonal overturn, with winter bloom generally extending to a mean depth of 135 ft (41 m) or 24 nm offshore (NJDEP 2010a). During the summer months phytoplankton blooms are common when winds blow surface waters away from the coast and the deeper, cooler, nutrient rich waters well up from the depths, and nutrients combine with sunlight fueling phytoplankton blooms.

2.1.3.4 Water Quality Monitoring

NJDEP conducts annual coastal water quality monitoring as required by the Federal Clean Water Act. These data are used for New Jersey's Integrated Report to identify impaired waters. Based on data provided on the Section 303(d) of the Clean Water Act List of Water Quality Limited Waters (United States Environmental Protection Agency [USEPA] 2016), New Jersey impaired waters include Arthur Kill, Raritan Bay, Raritan River, Sandy Hook Bay, Shrewsbury River, Shark River, and portions of the Atlantic coast.

The monitoring program includes 250 locations and 1,000 samples collected per year for dissolved oxygen, nutrients, and chlorophyll. Table 2.1-1 provides the results from the annual coastal water quality monitoring from 1989-2009 at the locations collected in the New Jersey Atlantic Ocean waters, which represent locations within the offshore xport cable route area.

Table 2.1 1. Results from annual coastal water quality samples taken from ffshore export cable route area (1989 2009).

Water Quality Parameter (No. of Samples)	Unit	Mean	Count
Raritan Bay			
Ammonia	µg/L	188	11
Nitrate	µg/L	314	115
Total Nitrogen	µg/L	852	114
Total Phosphorus	µg/L	93	48
Chlorophyll a	µg/L	14	61
Dissolved Oxygen	mg/L	8.7	113
Sandy Hook Bay			
Ammonia	µg/L	97	160
Nitrate	µg/L	209	169
Total Nitrogen	µg/L	681	168
Total Phosphorus	µg/L	81	84
Chlorophyll a	µg/L	14	102
Dissolved Oxygen	mg/L	8.5	167
Shrewsbury River			
Ammonia	µg/L	74	235
Nitrate	µg/L	157	240
Total Nitrogen	µg/L	641	237
Total Phosphorus	µg/L	96	146
Chlorophyll a	µg/L	17	161
Dissolved Oxygen	mg/L	7.5	238
Shark River			
Ammonia	µg/L	71	328
Nitrate	µg/L	67	333
Total Nitrogen	µg/L	351	330
Total Phosphorus	µg/L	39	206
Chlorophyll a	µg/L	2	245
Dissolved Oxygen	mg/L	6.3	334
Atlantic Ocean			
Ammonia	µg/L	27	1188

Water Quality Parameter (No. of Samples)	Unit	Mean	Count
Nitrate	µg/L	38	1218
Total Nitrogen	µg/L	314	1201
Total Phosphorus	µg/L	39	803
Chlorophyll a	µg/L	3	1021
Dissolved Oxygen	mg/L	7.7	1188

Source: Connell 2010.

2.1.3.5 Acidification

Based on data provided in the Mid-Atlantic Ocean Data Portal (Mid-Atlantic Regional Council on the Ocean [MARCO], Undated), there are several ocean acidification monitoring sites in the area, where carbon dioxide (CO_2), total alkalinity, dissolved inorganic carbon, and other parameters are monitored to measure ocean, coastal, and estuarine acidification (MARCO Undated). In 2012 and 2013, the fronts probability, which measures upper ocean processes that influence the spatial distribution of biological productivity by controlling the accumulation of marine debris, was low across all seasons (winter, spring, summer, and fall) within the Project Area (MARCO Undated). The 2011-2013 seasonal maximum values of ocean net primary productivity indicate that net primary productivity was highest during the summer (June, July, August) and fall (September, October, November), and lowest in the winter (January, February, December) (MARCO Undated).

2.1.3.6 Flood Zone Data

The flood zone data is derived from the Federal Emergency Management Agency (FEMA) effective and preliminary Flood Insurance Rate Maps (FIRM) (FEMA 2019). The effective FIRMs available for the Project onshore study area are dated from 2009 (prior to Hurricane Sandy). Following Sandy, preliminary FIRMs were developed in 2014-2015. According to the preliminary maps, the areas around major watercourses and tributaries fall within Zone A (100-year floodplain), Zone AE (100-year floodplain with base flood elevations and floodways), and Zone X (500-year floodplain). Zone VE (coastal zone subject to wave action) occurs along the shorelines of major river corridors such as Raritan River and Arthur Kill.

2.1.4 Air Quality

The Project may affect air quality during construction, O&M, and decommissioning activities. Onshore emissions will occur in the onshore xport cable areas and at point of interconnection. Offshore emissions will be located within the Outer Continental Shelf, including State offshore waters for activities in the Lease Area and the Offshore Export Cable Area.

Federal and State air regulations protect human health and the environment through ensuring that the impacts of background, existing sources and proposed sources are in compliance with ambient air quality standards. National Ambient Air Quality Standards[2] (NAAQS) have been promulgated for six air pollutants, known as criteria air pollutants. The six criteria air pollutants are carbon

[2] Clean Air Act (42 U.S.C. §§7401-7671q). Retrieved from: https://www.epa.gov/criteria-air-pollutants/naaqs-table.

monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) (including PM_{10} [particles with a diameter smaller than 10 micrometers] and $PM_{2.5}$ [particles with a diameter smaller than 2.5 micrometers]), and sulfur dioxide (SO_2). NAAQS are expressed as primary standards, which are intended to protect human health, and secondary standards, which are intended to protect public welfare. Public welfare considerations include protection against damage to animals, crops and buildings. NAAQS have varying averaging times and forms that define a NAAQS exceedance for each pollutant and standard.

Individual states may establish State specific ambient air quality standards. The State of New Jersey has promulgated primary and secondary ambient air quality standards (New Jersey Ambient Air Quality Standards [NJAAQS]) [3] which are generally the same but not identical to the NAAQS. In this Application, the more stringent of either the NAAQS or the NJAAQS is used to compare with potential Project impacts Table 2.1-2 shows both the NAAQS and the NJAAQS side by side.

Table 2.1 National Ambient Air Quality Standards and New Jersey Ambient Air Quality Standards

Pollutant	Averaging Period	National Ambient Air Quality Standards [1]		New Jersey Ambient Air Quality Standards [2]	
		Primary µg/m³	Secondary µg/m³	Primary µg/m³	Secondary µg/m³
Carbon Monoxide (CO)	8-hour [3]	10,000	None	10,000	**10,000**
	1-hour [3]	40,000	None	40,000	**40,000**
Lead (Pb)	Rolling 3-month average [4]	1.5	1.5	1.5	1.5
Nitrogen Dioxide (NO_2)	Annual [4]	100	100	100	100
	1-hour [5]	**188**	None	None	None
Ozone (O_3)	8-hour [6]	**147**	**147**	None	None
	1-hour [3]	None	None	235	160
Particulate Matter (PM_{10})	24-hour [7]	**150**	**150**	None	None
Particulate Matter ($PM_{2.5}$)	Annual [8]	**12**	**15**	None	None
	24-hour [9]	**35**	**35**	None	None
Sulfur Dioxide (SO_2)	Annual [4,10]	80	None	80	**60**
	24-hour [3,10]	365	None	365	**260**
	3-hour [3]	None	1300	None	1300
	1-hour [11]	**196**	None	None	None
Suspended Particulate Matter	24-hour [3]	None	None	**260**	**150**
	Annual [12]	None	None	**75**	**60**

Note: When there is a difference between the NAAQS and the NJAAQS, the more stringent of the standards is in bold text.

[1] Source of National Ambient Air Quality Standards: USEPA (2018a). Retrieved from: https://www.epa.gov/criteria-air-pollutants/naaqs-table.

[2] Source of New Jersey Ambient Air Quality Standards: New Jersey (2008). Retrieved from: https://www.state.nj.us/dep/aqm/rules27.html, Subchapter 13.

[3] Not to be exceeded more than once per year

[4] Not to be exceeded

[5] 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years

[3] N.J.A.C. 7:27-13. Retrieved from: https://www.state.nj.us/dep/aqm/rules27.html.

Pollutant	Averaging Period	National Ambient Air Quality Standards[1]		New Jersey Ambient Air Quality Standards[2]	
		Primary	Secondary	Primary	Secondary
		µg/m³	µg/m³	µg/m³	µg/m³

[6] Annual 4th-highest daily maximum 8-hour concentration, averaged over 3 years
[7] Not to be exceeded more than once per year on average over 3 years
[8] Annual mean, averaged over 3 years
[9] 98th percentile, averaged over 3 years
[10] USEPA revoked the annual and 24-hour SO_2 NAAQS in 2010. However, they remain in effect until one year after the area's initial attainment designation, unless designated as nonattainment. New Jersey maintains both a 24-hour and annual SO_2 standard.
[11] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[12] Not to be exceeded (Geometric mean)

All areas of the US are classified by USEPA as *attainment*, *nonattainment*, or *unclassified* for the criteria air pollutants. An area in attainment is in compliance with all NAAQS. An area in nonattainment is not in compliance with one or more NAAQS. An unclassified area cannot be classified as attainment or nonattainment based on available information, but is treated as an area in attainment. If an area was in nonattainment at any point in the last twenty years but is currently in attainment or is unclassified, then the area is termed a *maintenance* area.

The official record of the attainment status of all areas in the United States is published in 40 CFR. Part 81: Designation of Areas for Air Quality Planning Purposes and can also be found in the USEPA's Green Book.[3] For all coastal areas along the Atlantic Ocean, the attainment status boundary extends 3 nm, to the seaward boundary.[4]

General Conformity regulations require that projects which are considered federal actions and result in direct and indirect emissions in a nonattainment or maintenance area be compared to *de minimis* thresholds for the nonattainment or maintenance area(s) in which project emissions occur. Due to anti backsliding provisions of the Clean Air Act, the Project must consider the potential applicability of all previously designated nonattainment or maintenance areas, regardless of whether or not the standard for which it was designated nonattainment or maintenance has since been revoked. The Project may result in emissions in one or more of the following nonattainment or maintenance areas within New Jersey:

- Philadelphia-Wilmington-Atlantic City, PA NJ MD-DE (8-hr 1997 ozone standard; 8 hr 2008 ozone standard; 8-hr 2015 ozone standard);
- New York N. New Jersey-Long Island, NY NJ CT (1-hr 1979 ozone standard; 8 hr 2008 ozone standard; 8 hr 2015 ozone standard);
- Philadelphia-Wilmington-Trenton, PA NJ DE-MD (1-hr 1979 ozone standard);
- Atlantic City, NJ (1 hr 1979 ozone standard; 1971 carbon monoxide standard);
- Perth Amboy, NJ (1971 carbon monoxide standard);

[3] https://www.epa.gov/green-book
[4] 43 U.S.C. §§1301-1315 (2002); USEPA. (2017, June 28). General Conformity Training Module 3.1: Applicability Analyses. Retrieved from https://www.epa.gov/general-conformity/general-conformity-training-module-31-applicability-analyses.

- Philadelphia Camden Co, PA NJ (1971 carbon monoxide standard); and
- Penns Grove, NJ (1971 carbon monoxide standard).

Direct and indirect Project emissions are projected to result from the construction of onshore equipment and onshore cabling, marine vessels as they travel to and from ports to the Project Area, helicopters as they travel to and from airports to the Project Area, and offshore emergency engines.

A portion of the Project emissions will be subject to 40 CFR Part 55, promulgated by USEPA to regulate air emissions of Outer Continental Shelf sources. An Outer Continental Shelf source is defined in 40 CFR 55.2 as any equipment, activity, or facility that:

(1) Emits or has the potential to emit any air pollutant;
(2) Is regulated or authorized under the Outer Continental Shelf Lands Act (43 U.S.C. § 1331 *et seq.*); and
(3) Is located on the Outer Continental Shelf or in or on waters above the Outer Continental Shelf.

This definition shall include vessels only when they are:

A. Permanently or temporarily attached to the seabed and erected thereon and used for the purpose of exploring, developing or producing resources therefrom, within the meaning of section 4(a)(1) of Outer Continental Shelf Lands Act (43 U.S.C. § 1331 *et seq.*); or
B. Physically attached to an Outer Continental Shelf facility, in which case only the stationary source aspects of the vessels will be regulated.

The Project will obtain an Outer Continental Shelf permit for sources of air emissions which are considered Outer Continental Shelf sources, in accordance with 40 CFR Part 55.

2.2 Biological Resources

2.2.1 Benthic Invertebrates

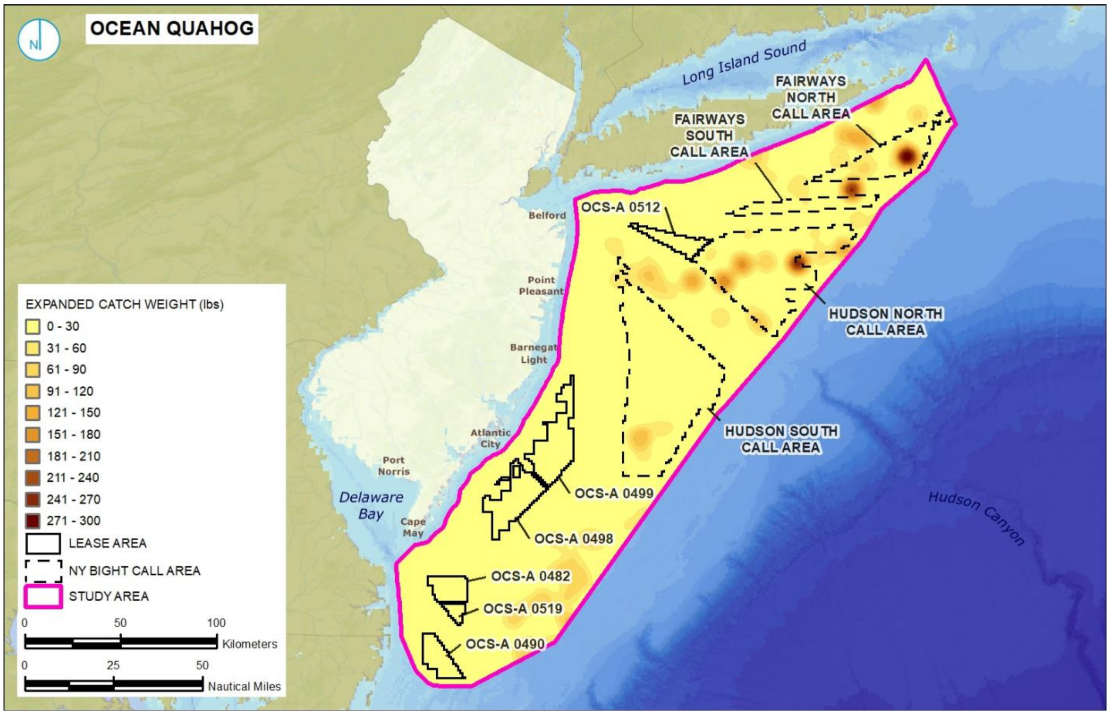
This section describes the benthic resources in the marine/estuarine environment of the offshore and coastal Project Areas and freshwater environments of the Project onshore study areas for the Project.

2.2.1.1 Marine/Estuarine Environment

Primary resources included floating light and detection ranging (FLiDAR) surveys of the Lease Area, the Mid-Atlantic Ocean Data Portal description of benthic habitat, Habitat Mapping and Assessment of Northeast Wind Energy Areas (Guida *et al.* 2017), an Assessment of Ecological Status of Benthic Communities in New Jersey Marine Coastal Waters (Ramey, Kennish, & Petrecca 2011), and NJDEP's Ocean/Wind Power Ecological Baseline Studies (NJDEP 2010b). Data consists of both grab samples and imagery that span spring, summer, and fall, across multiple years. These resources allow for the characterization of species community composition, abundance, and diversity in the Project Area. The benthic community within the Lease Area and within the offshore and nearshore portions of the xport cable route are consistent and typical of benthic communities found in sands and fine sediments. During Project planning and development, a benthic habitat assessment will be conducted to identify unique habitats.

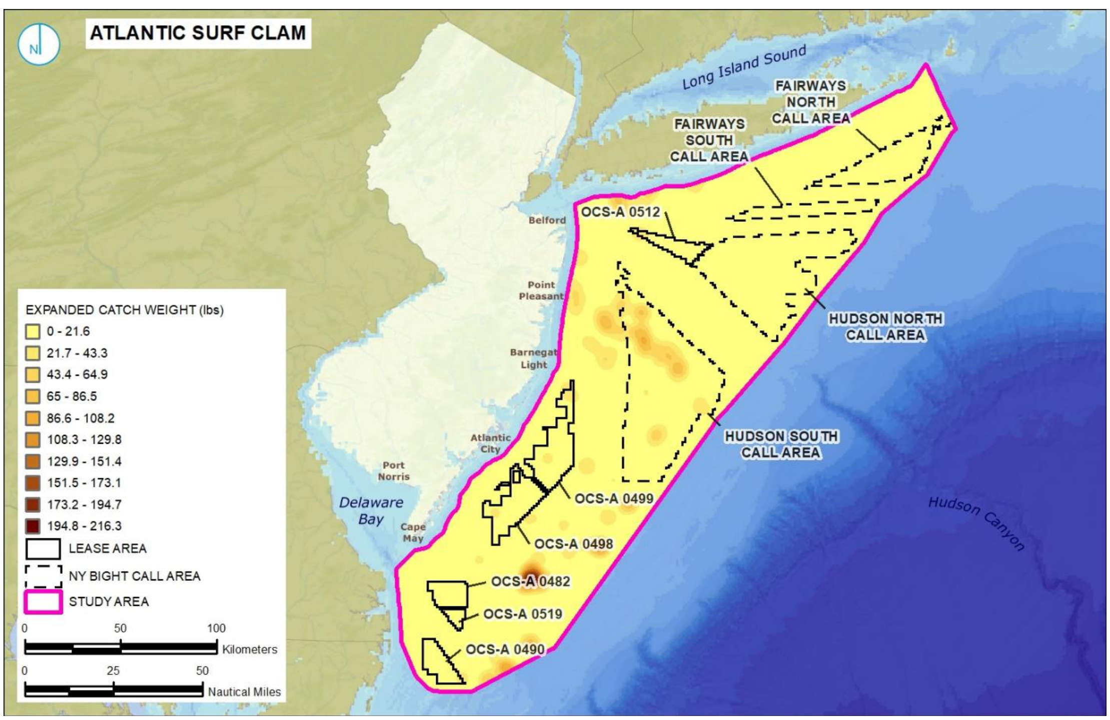
Previous studies conducted by various entities indicate that benthic macrofauna communities vary by depth in the Project Area. In 2017, benthic habitat surveys were conducted in the Lease Area, referenced as Alpine 2017a Fauna reported in the sandy bottom habitats of the Lease Area included Annelida, Arthropoda, Mollusca, and Echinodermata (Alpine 2017a). Along the inner shelf of New Jersey, common macrofauna include echinoderms (e.g. sea stars, sea urchins, and sand dollars), cnidarians (e.g. sea anemones and corals), mollusks (e.g. bivalves, cephalopods, and gastropods), bryozoans, sponges, amphipods, and crustaceans (NJDEP 2010b). The mid shelf is dominated by sand dollars and surf clams from approximately 130 ft to 230 ft (40 to 70 m) (NJDEP 2010b) and various epifauna (e.g. rock crabs, hermit crabs, horseshoe crabs, spider crabs, and lobsters (NJDEP 2010b). Common crustaceans found in the near shore coastal areas include hermit crabs (*Pagurus* spp.), Atlantic rock crab (*Cancer irrotatus*), and sevenspine bay shrimp (*Crangon septemspinosa*) (NJDEP 2010b) Ramey *et al*. (2011) identified 540 benthic macrofaunal species/taxa in New Jersey coastal waters.

Shellfish species of concern in the New Jersey Wind Energy Area (WEA) include Atlantic sea scallop (*Placopecten magellanicus*), Atlantic surf clam (*Spisula solidissima*), and ocean quahog (*Arctica islandica*). A comprehensive multi scale benthic assessment conducted by National Oceanic and Atmospheric Administration (NOAA) Northeast Fisheries Science Center (NEFSC) in collaboration with Woods Hole Oceanographic Institution and the University of Massachusetts Dartmouth, did not find ocean quahog in the Lease Area. Sea scallops were found within the Lease Area in the northeast portion and the adjacent lease area OCS-A 0499. The New Jersey Offshore Wind Strategic Plan includes an analysis of benthic invertebrates in the region. Within the Project Area species of concern are present in low abundances and are less susceptible (NJBPU 2020) (see Figure 2.2-1 through Figure 2.2 6).



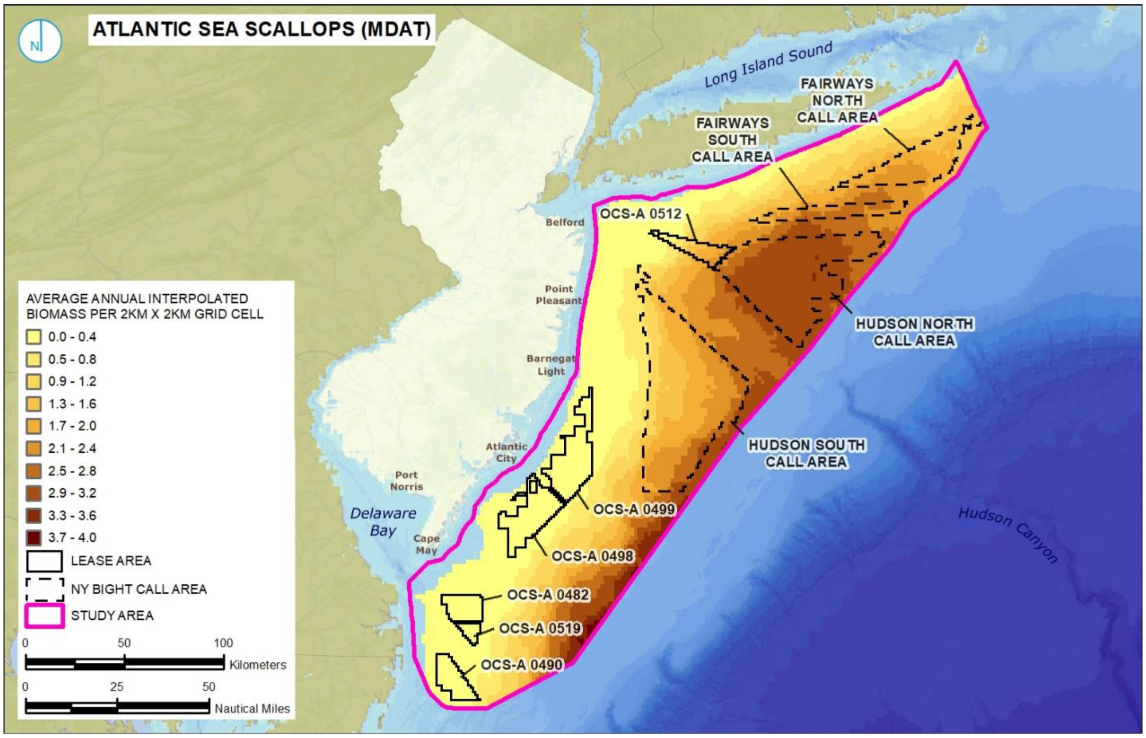
Source: NJBPU 2020

Figure 2.2 1 Expanded catch weight (lbs) of ocean quahog.



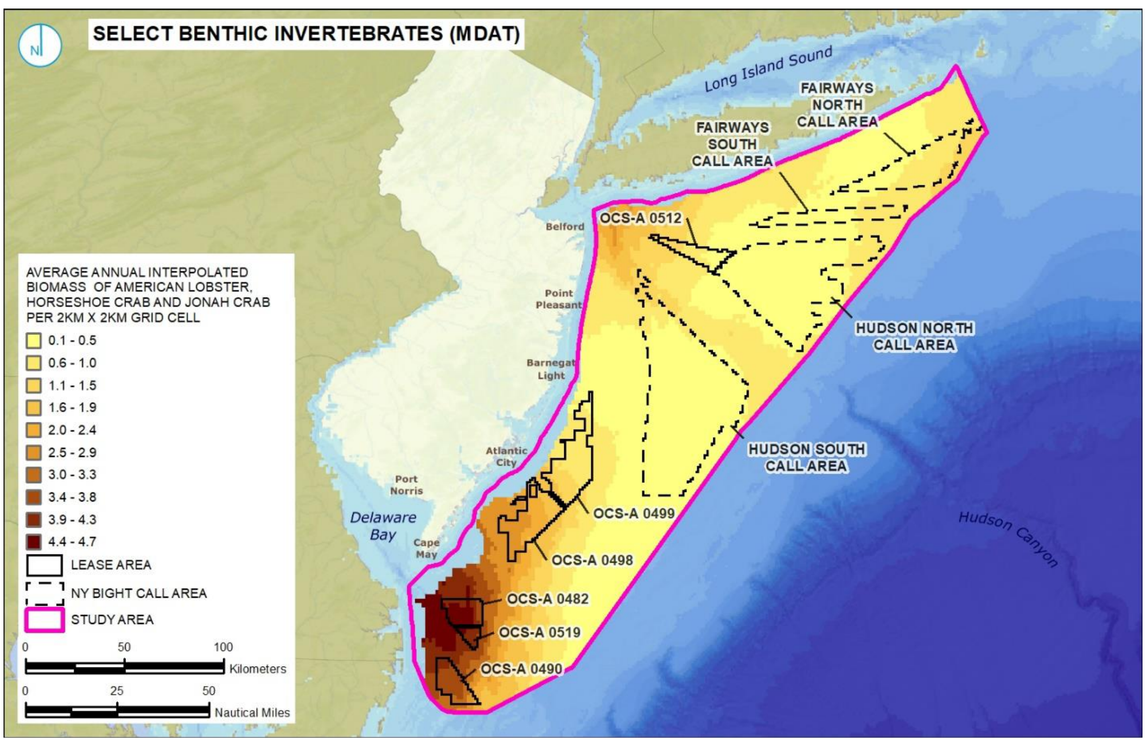
Source: NJBPU 2020

Figure 2.2 2. Expanded catch weight (lbs) of Atlantic surf clam



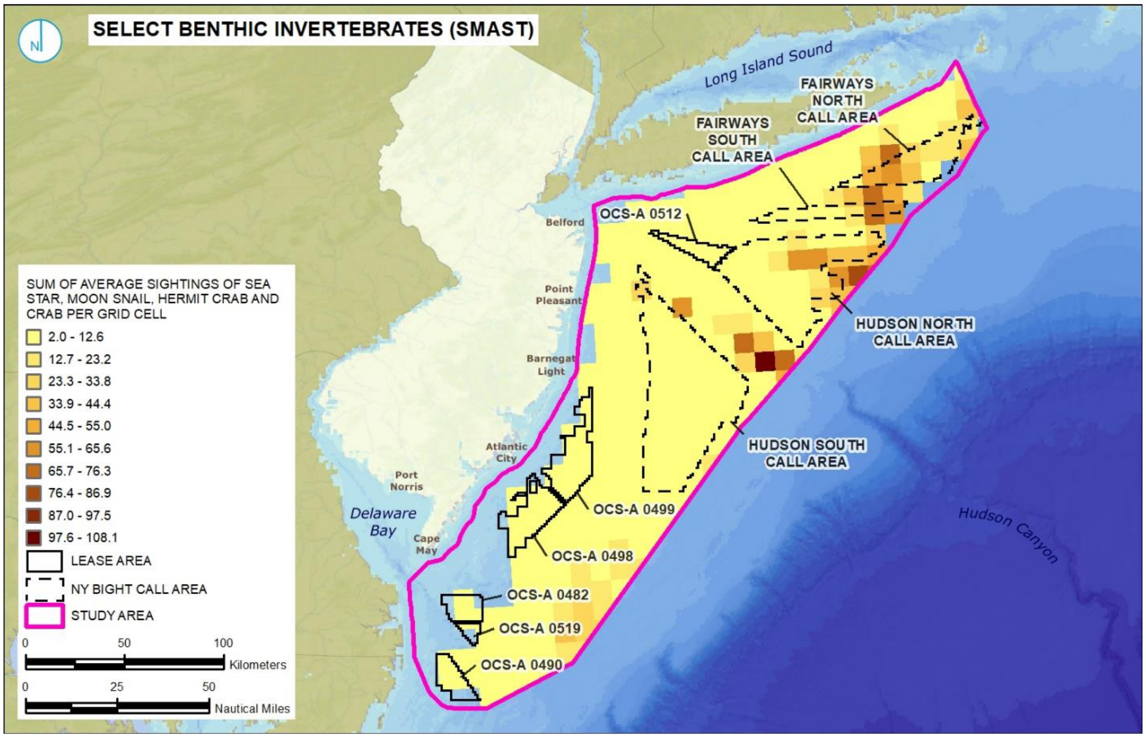
Source: NJBPU 2020

Figure 2.2 3 Average annual interpolated biomass (per 2 km X 2 km grid cell) of Atlantic Sea Scallop.



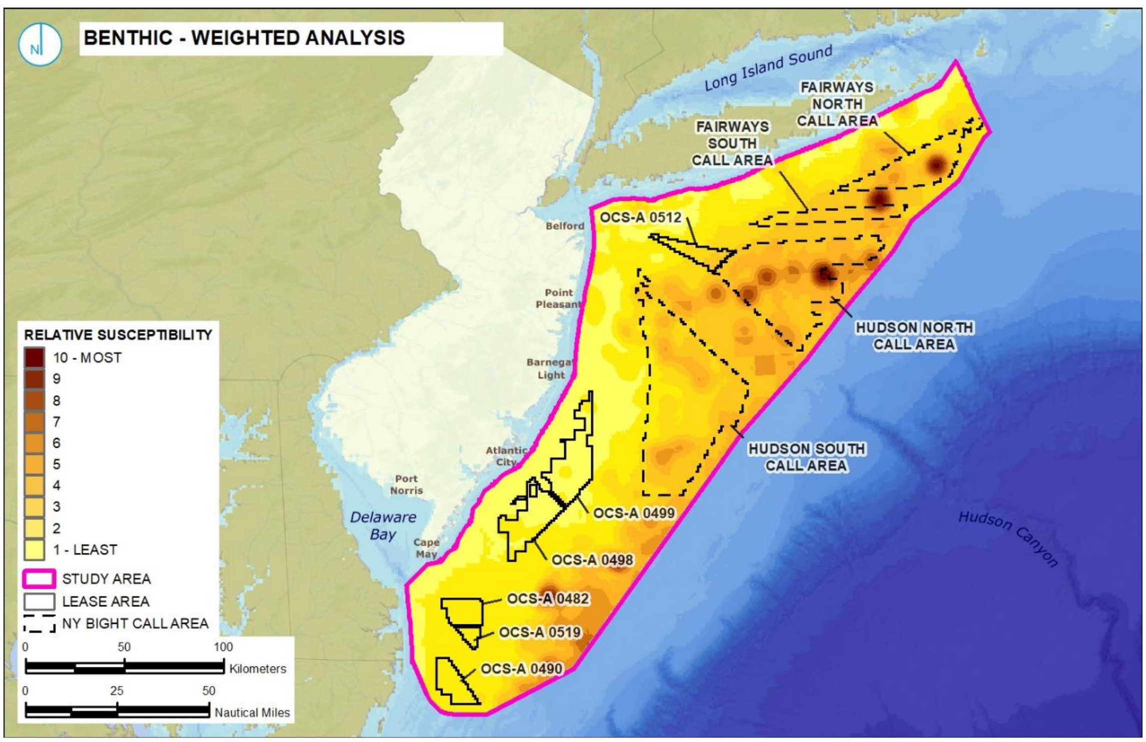
Source: NJBPU 2020

Figure 2.2 4 Average annual interpolated biomass (per 2 km X 2 km grid cell) of American Lobster, Horseshoe Crab, and Jonah Crab.



Source: NJBPU 2020

Figure 2.2 5 Sum of average ightings (per grid cell) of Sea Star, Moon Snail, Hermit Crab, and Crab.



Source: NJBPU 2020

Figure 2.2 6 Relative usceptibility of benthic invertebrates within the Study Area.

The benthic macroinvertebrates most typically found in the New York/New Jersey Harbor include annelids (oligochaetes and polychaetes), arthropods (Ampeliscidae), and mollusks (bivalves and gastropods) (United States Army Corps of Engineers [USACE] 2017) The occurrence and abundance of these taxa vary considerably both seasonally and spatially (USACE 2017). [redacted]

2.2.1.2 Freshwater

The Project onshore study area lies [redacted] The NJDEP's Bureau of Freshwater and Biological Monitoring conducts macroinvertebrate sampling across State and provides regular monitoring reports, including many freshwater streams that are located within the onshore study area (NJDEP 2012a 2012b). [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.2.2 Submerged Aquatic Vegetation

NJDEP submerged aquatic vegetation (SAV) maps show no current documented seagrasses within the coastal or offshore habitats of the Project Area (NJDEP 2019). As they are not expected to be present, SAV are not considered further in this report. SAV presence will be included in site specific surveys that may be conducted at the selected landfall location.

2.2.3 Phytoplankton

Phytoplankton distribution is patchy and dependent on water temperature, light, and nutrient concentration. It is denser in nearshore areas where there is input of nutrients such as dissolved nitrogen, phosphorus, and silica from land sources. In general, in continental shelf and slope waters, the concentration of chlorophyll a (the means of measuring phytoplankton concentration) decreases with distance from shore and with increasing water depth. Phytoplankton within the coastal waters are typically dominated by chromophytic algae with diatoms being the major phytoplankton taxa present (NJDEP 2010a).

Seasonal water changes off the coast of New Jersey regulate zooplankton productivity, species composition, and spatial distribution. In general, zooplankton display a strong seasonal pattern with a spring enhancement of biomass within the upper 656 ft (200 m) of the water column. Typically, maximum abundance occurs during spring between April and May on the outer shelf (dominated by *Pseudocalanus* sp. and *Calanus finmarchicus*) as well as late summer between August and September on the inner shelf (dominated by *C. typicus* *Ternora longicornis*). The lowest abundance begins in November and reaches a minimum in February (NJDEP 2010a).

2.2.4 Finfish and Essential Fish Habitat

Finfish and essential fish habitat are covered in Section 10 of this Application.

2.2.5 Marine Mammals

This section describes marine mammal species that occur in Offshore study area for the Project, which includes the Lease Area and offshore xport cable route area (see Figure 2.2-10 Table 2.2-1) Summary information on threatened or endangered marine mammals protected under the Federal Endangered Species Act (ESA) are presented in Section 2.2.3.1. The information contained in this section was obtained from literature review, agency consultations, and ongoing site investigations. Information reviewed included published scientific literature; reports prepared by government agencies, academic institutions, and non governmental organizations; Protected Species Observer daily reports from ongoing site investigation surveys; NEPA documents; biological opinions issued on actions in or near the Project Area; and regulatory documents associated with Marine Mammal Protection Act authorizations.

[redacted]

Figure 2.2 10. Marine mammal sightings and density data collected during NJDEP (2010b) surveys, in relation to the Project.

Table 2.2 1 Marine mammal species that have been documented, or are likely to occur, in the Offshore study area and their status, population estimate, abundance, and seasonal occurrence.

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under Marine Mammal Protection Act[b]	ESA Status	Critical Habitat in the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
Low-Frequency Cetaceans (7 Hz to 35 kHz)	North Atlantic Right Whale *(Eubalaena glacialis)*	Western North Atlantic	428	Strategic, Depleted	Endangered	Cape Cod Bay, Stellwagen Bank, and the Great South Channel and calving areas off Cape Canaveral, Florida to Cape Fear, North Carolina	Regular	Year-round
	Humpback Whale (*Megaptera novaeangliae*)	Gulf of Maine	1,396	None	Delisted	N/A	Regular	Spring, Summer, Fall (possibly year-round)
	Fin Whale (*Balaenoptera physalus*)	Western North Atlantic	7,418	Strategic, Depleted	Endangered	N/A	Regular	Spring, Summer, Fall (possibly year-round)
	Blue Whale (*Balaenoptera musculus*)	Western North Atlantic	Unknown (402 minimum)[d]	Strategic, Depleted	Endangered	N/A	Rare	Spring, Summer
	Sei Whale (*Balaenoptera borealis*)	Nova Scotia	6,292	Strategic, Depleted	Endangered	N/A	Rare	Spring, Summer
	Minke Whale (*Balaenoptera acutorostrata*)	Canadian Eastern Coastal	24,202	None	None	N/A	Regular	Spring, Summer and Winter (possibly year-round)
	Sperm Whale (*Physeter macrocephalus*)[e]	North Atlantic	4,349	Strategic, Depleted	Endangered	N/A	Uncommon	Spring, Summer, Fall

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under Marine Mammal Protection Act[b]	ESA Status	Critical Habitat in the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
Mid-Frequency Cetaceans (150 Hz to 160 kHz)	Atlantic White-Sided Dolphin *(Lagenorhynchus acutus)*	Western North Atlantic	93,233	None	None	N/A	Regular	Winter
	Risso's Dolphin *(Grampus Griseus)*[e]	Western North Atlantic	35,493	None	None	N/A	Uncommon	Year-round
	Short-finned Pilot Whale (*Globicephala macrorhynchus*)	Western North Atlantic	28,924	Strategic	None	N/A	Uncommon	Year-round
	Long-finned Pilot Whale *(Globicephala melas)*	Western North Atlantic	39,215	Strategic	None	N/A	Rare	Year-round
	Striped Dolphin (*Stenella coeruleoalba*)	Western North Atlantic	67,036	None	None	N/A	Rare	Fall, Winter (possibly year-round)
	Atlantic Spotted Dolphin *(Stenella frontalis)*	Western North Atlantic	39,921	None	None	N/A	Uncommon	Summer, Fall
	Common Dolphin (*Delphinus delphis*)	Western North Atlantic	172,825	None	None	N/A	Regular	Fall, Winter (possibly year-round)
	Common Bottlenose Dolphin *(Tursiops truncatus)*[f]	Western North Atlantic, Northern Migratory Coastal	6,639	Strategic, Depleted	None	N/A	Regular	Year-round (most frequently in Spring and Summer)
	Common Bottlenose Dolphin *(Tursiops truncatus)*[f]	Western North Atlantic, Offshore	62,851	None	None	N/A	Regular	Year-round (most frequently in Spring and Summer)

	Species (Scientific Name)	Stock, as Designated by NMFS	Best Population Estimate in SAR[a]	Strategic Status Under Marine Mammal Protection Act[b]	ESA Status	Critical Habitat in the Project Area	Occurrence within Project Area[c]	Seasonal Occurrence within Project Area
High-Frequency Cetaceans (275 Hz to 160 kHz)	Harbor Porpoise (*Phocoena phocoena*)	Gulf of Maine-Bay of Fundy	95,543	None	None	N/A	Regular	Winter (possibly during Spring and Summer)
Phocid Pinnipeds (50 Hz to 86 kHz)	Harbor Seal (Phoca vitulina)[e]	Western North Atlantic	75,834	None	None	N/A	Regular	Spring, Fall, Winter
	Gray Seal (*Halichoerus grypus*)[e]	Western North Atlantic	27,131	None	None	N/A	Regular	Spring, Fall
	Harp Seal (Pagophilus groenlandicus)	Western North Atlantic	Unknown	None	None	N/A	Rare	Spring, Winter
	Hooded seal (*Cystophora cristata*)	Western North Atlantic	Unknown	None	None	N/A	Rare	Spring, Winter

[a] Best population estimates provided in the SAR (Hayes *et al.* 2020) generally consider only the portion of the population found in US Atlantic Exclusive Economic Zone waters and may not include the entire US range depending on available survey data.

[b] The Marine Mammal Protection Act defines a "strategic" stock as a marine mammal stock (a) for which the level of direct human-caused mortality exceeds the potential biological removal level; (b) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or (c) which is listed as a threatened or endangered species under the ESA, or (d) is designated as depleted.

[c] Occurrence in the Offshore Survey Corridor was derived from sightings and information in NJDEP 2010b; NEFSC & SEFSC 2010, 2011, 2012, 2013, 2014, 2015, 2016; Roberts *et al.* 2016; and Palka *et al.* 2017; Hayes *et al.* 2020. The species known to occur in the Project Area and vicinity, and expected to occur in the survey area, are addressed based on their reported occurrence of rare to regular (i.e., common).

[d] The population estimate is reported as the minimum population estimate in the SAR (Hayes *et al.* 2020).

[e] Density models (Palka *et al.* 2017) predicted that typically deep-water species such as Risso's dolphins and sperm whales are present at very low densities in offshore edges of several wind energy Project Areas that are either close to the continental shelf break or extend into deeper waters.

[f] Palka *et al.* (2017) pooled the Offshore and Northern Migratory Coastal Stocks of bottlenose dolphin in a single density estimate; likewise, gray, harbor and unidentified seals were pooled in a single estimate

[g] Seasonal abundance estimates for marine mammals, derived from density models in the New Jersey Wind Energy Project Area. From: Supplement to Final Report BOEM 2017-071, Atlantic Marine Assessment Program for Protected Species: 2010-2014 Appendix I (Palka *et al.* 2017). Seasons are depicted as follows: Spring (March - May); Summer (June - August); Fall (September - November); Winter (December - February).

[h] Hearing ranges taken from National Marine Fisheries Service (NMFS) 2016; Hz = hertz, kHz = kilohertz

All marine mammals are protected under the Marine Mammal Protection Act (16 United States Code [U.S.C.] §§ 1361 *et seq.*). The Marine Mammal Protection Act requires NOAA and the United States Fish and Wildlife (USFWS) to continuously monitor the population status of marine mammals. If that monitoring determines that a population has dropped below its optimum level, the population is designated as "depleted." In such case a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

Twenty marine mammal species were identified as expected to or may occur regularly or rarely in the Project Area. These species, their status and seasonality are listed in Table 2.2-1. Five of the marine mammals known or expected to occur off the coast of New Jersey are listed as endangered pursuant to the Federal ESA of 1973 (16 U.S.C. 1531 *et seq.*): blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), North Atlantic right (*Eubalaena glacialis*), sei (*Balaenoptera borealis*), and sperm (*Physeter macrocephalus*) whales (see Table 2.2-1). Because of their status, these species are addressed separately from the other marine mammal species (see Table 2.2-1) that are expected to occur in the Project Area.

2.2.5.1 ESA Threatened and Endangered Species

2.2.5.1.1 Blue Whales

The distribution of blue whales in the western North Atlantic generally extends from the Arctic to at least mid latitude waters. Although blue whales are sighted frequently off eastern Canada, most notably in the Gulf of St. Lawrence, some data suggest that blue whales rarely visit the US Atlantic Exclusive Economic Zone (EEZ) (Cetacean Density Distribution Mapping Working Group (CetMap) 2020; Hayes *et al.* 2020). However, a passive acoustic monitoring study funded by the New York State Department of Environmental Conservation reported that blue whales were present about 20 nm southeast of the entrance to New York Harbor in late winter and early spring. No blue whales were observed in the Project Area during the Ecological Baseline Studies (EBS), but recent sightings of blue whales off the coast of Virginia include a vessel sighting of a juvenile in April 2018 (Engelhaupt *et al.* 2019), and a sighting of an adult whale made in February 2019 during a systematic aerial survey (Cotter 2019). The aerial sighting was recorded in deep waters beyond the shelf break, but the vessel sighting was over the shelf near the 50-meter isobath. Both sightings are considered extremely rare, and constitute the southernmost sightings of blue whales off the US East Coast in the US Atlantic EEZ. Nevertheless, this assessment assumes blue whales could occur in the Project Area.

2.2.5.1.2 Fin Whales

Fin whales are common in the US Atlantic EEZ waters, from Cape Hatteras, North Carolina northward While they prefer deeper waters of the continental shelf (300 to 600 ft [91 to 183 m]), they are regularly observed anywhere from coastal to abyssal areas (Hayes *et al.* 2020).

Fin whales were observed during all seasons of the EBS (NJDEP 2010b). The EBS results indicate that the nearshore waters off New Jersey serve as nursery habitat because of the occurrence of a cow-calf pair. The EBS estimated a year round abundance of two individuals offshore of New Jersey (NJDEP 2010b). Fin whales were observed in the WEAs in the fall 2012 aerial, spring 2013 aerial, spring 2014 aerial, and summer 2016 shipboard Atlantic Marine Assessment Program for Protected Species (AMAPPS) surveys (NEFSC & Southeast Fisheries Science Center (SEFSC) 2012, 2013, 2014, 2016). Fin whales were recorded in the Lease Area during the summer 2017 HRG survey (Alpine 2017b) and during the Geotechnical 1A Survey in winter 2017-2018 (Smultea Environmental Sciences 2018). For the New Jersey WEA, seasonal estimates calculated for fin whales showed low numbers during the spring, summer and fall (Palka *et al.* 2017).

There have not been any Unusual Mortality Events (UMEs) documented for fin whales in the last three decades. However, only stranded fin whales have been documented in the Project Area; no free swimming fin whales have been observed. Six fin whales are reported to have stranded along the New Jersey coast from 2011-2015. Of these six whales, five were determined to be the result of vessel strikes, with the remaining individual being ruled an entanglement.

2.2.5.1.3 North Atlantic Right Whales

North Atlantic right whales are known to occur off the coast of New Jersey (NJDEP 2010b). During the EBS surveys, North Atlantic right whales were observed (i.e., detected visually or acoustically) during every season. Feeding behavior was recorded, as was the presence of a cow–calf pair, suggesting that near shore waters off New Jersey serve as feeding and nursery habitat. Initial sightings of females, and subsequent confirmations of these same individuals in calving grounds, illustrate that these waters are part of the species' migratory corridor (Whitt *et al.* 2013). North Atlantic right whales may use the waters off New Jersey for short periods of time as they migrate and/or follow prey movements, or they may remain in the area for extended periods of time. North Atlantic right whales were observed in the Spring 2014 aerial and the Winter/Spring 2015 aerial AMAPPS surveys (NEFSC & SEFSC 2014, 2015). A single North Atlantic right whale occurred in the Project Area during the Geotechnical 1A Survey in winter 2017-2018 (Smultea Environmental Sciences 2018), but no North Atlantic right whales were observed during the Ocean Wind 1 Offshore Wind Farm Survey in summer 2017 in the Project vicinity (Alpine 2017b). Three North Atlantic right whale sightings within the Project Area were reported between December 13 and 14 2018 (NOAA Fisheries 2020b).

In April 2014 a single North Atlantic right whale stranded off Atlantic City, New Jersey due to entanglement. Beginning in 2017, elevated mortalities in North Atlantic right whales have been documented, primarily in Canada but some in the US, and were collectively declared an UME The current total confirmed mortalities for the 2017-2020 North Atlantic Right Whale UME are 31 dead stranded whales (21 in Canada; 10 in the US), and the leading category for the cause of death for this UME is human interaction, specifically from entanglements or vessel strikes (NOAA Fisheries 2020a) In June 2020, a calf was found dead, floating offshore of Elberon, New Jersey, with a sharp, blunt force trauma due to a vessel strike (NOAA Fisheries 2020a). In October 2020, an adult was seriously injured off Sea Bright, New Jersey due to entanglement (North Atlantic right whale ID #4680). A Seasonal Management Area is in place for this species at the entrance of the Delaware Bay from November 1 through April 30.

2.2.5.1.4 Sei Whales

Sei whales occur in every ocean except the Arctic Ocean. Sei whales are often associated with deeper waters and areas along the continental shelf edge (Hain *et al.* 1985); however, this general offshore pattern of sei whale distribution is disrupted during occasional incursions into more shallow and inshore waters (Hayes *et al.* 2020). In the western Atlantic Ocean, sei whales occur from Labrador to Nova Scotia in the summer months and migrate south to Florida, the Gulf of Mexico, and the northern Caribbean (Mead 1977; Gambell 1985; Hayes *et al*. 2020).

Sei whales are most common on Georges Bank and into the Gulf of Maine and the Bay of Fundy during spring and summer, primarily in deeper waters. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with North Atlantic right whales in the southern Gulf of Maine and in the Bay of Fundy.

Sei whales are occasionally killed in collisions with vessels. Of three sei whales that stranded along the Atlantic coast of the US between 1975 and 1996, two showed evidence of collisions with ships (Laist *et al.* 2001). Between 1999 and 2005, there were three reports of sei whales being struck by vessels along the Atlantic Coast of the US and the Maritime Provinces of Canada (Cole *et al.* 2005, Nelson *et al.* 2007). Two of these ship strikes were reported as having resulted in the death of the sei whale.

Sei whales are unlikely to be encountered in the Project Area, although small numbers have been documented there during the spring and summer months (Hayes *et al*. 2020). They are encountered closer to shore during years when oceanographic conditions force planktonic prey, such as copepods and euphausiids, to shelf and inshore waters (Payne *et al*. 1990). During the EBS surveys, no sei whales were recorded (NJDEP 2010b). There are no stranding records of sei whales in New Jersey during the National Marine Fisheries Service (NMFS) reported timeframe of 2008-2012. There are no documented UMEs for Sei whale in the North Atlantic Ocean.

2.2.5.1.5 Sperm Whales

Sperm whales occur in every ocean except the Arctic Ocean. In the western Atlantic Ocean, sperm whales are distributed in a distinct seasonal cycle, concentrated east-northeast of Cape Hatteras in winter and shifting northward in spring when whales are found throughout the Mid-Atlantic Bight (Hayes *et al*. 2020). Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight.

Sperm whales have a strong preference for the 3,281 ft (1,000 m) depth contour and seaward. While deep water is their typical habitat, sperm whales have been observed near Long Island, New York, in water between 135-180 ft (41-55 m; Scott and Sadove 1997). When they are found relatively close to shore, sperm whales are usually associated with sharp increases in bottom depth where upwelling occurs and biological production is high, implying the presence of a good food supply (Clarke 1956).

Sperm whales could potentially occur in the Project Area. Sperm whales were not visually documented by the EBS (NJDEP 2010b); however, Palka *et al*. (2017) estimate occurrence of sperm whales off of New Jersey at very low densities, concentrated in spring and fall migration. There are no stranding records of sperm whales in New Jersey during the NMFS reported timeframe of years 2008-2012. There are no reported UMEs for sperm whales in the North Atlantic Ocean.

2.2.5.2 Pinnipeds

Four species of pinnipeds have the potential to occur in the coastal waters of New Jersey: harbor seals *(Phoca vitulina)*, gray seals *(Halichoerus grypus)*, hooded seals *(Cystophora cristata)*, and harp seals *(Pagophilus groenlandicus)*, although harbor and gray seals are the most likely to occur in the Project Area (see Table 2.2-1).

The two species of pinnipeds most likely to occur in the Project Area are the harbor seal and gray seal. The effects on pinnipeds of various impact producing factors associated with offshore wind farm development have been relatively well studied in the U.K. and Europe (BOEM 2018). The acoustic ecology of harbor and gray seals is similar, although gray seals have a slightly lower hearing threshold and bandwidth (Asselin *et al*. 1993; Ruser *et al.* 2014).

Harbor seals are the dominant pinniped species in the Project Area. They are year round inhabitants of the coastal waters of eastern Canada and Maine, occur seasonally along mid-Atlantic shores from September through late May (Hayes *et al* 2020), but are typically observed in New Jersey seasonally, between November and April. The three major haul out (resting) sites in New Jersey are (1) Great Bay, which is the largest haul out south of Long Island, New York; (2) Barnegat Inlet/Barnegat Lighthouse, and (3) Sandy Hook which is close to the Project Area (Slocum *et al.* 2005; Slocum and Davenport 2009; NJDEP 2010b).

Little is known about the habitat use and foraging grounds of harbor and gray seals in mid-Atlantic waters. Individuals of both species were captured and instrumented with telemetry tags from 2012 2015 as part of the AMAPPS effort, and spatially explicit at sea density models were developed for seals sighted during aerial surveys (Palka *et al.* 2017). However, all animals were captured in Maine and Massachusetts, and results did not pertain to the Project Area.

Historically, harbor seals were observed only sporadically south of New Jersey, but in recent years this species has been seen regularly as far south as North Carolina, and regular seasonal haul out sites of up to 40 60 animals have been documented on the eastern shore of Virginia and the Chesapeake Bay (Rees *et al.* 2016). Gray seals were considered locally extinct in US waters prior to the 1980s due to human exploitation, but in recent decades have been recolonizing their former range from Maine to New Jersey (Wood *et al.* 2011). Population trends for harbor seals are not available, but gray seal abundance is likely increasing, and both species are extending the seasonal intervals in which they inhabit mid-Atlantic waters (Hayes *et al.* 2020).

In March 2019, Ocean Wind 1 conducted aerial surveys for seals along the New Jersey coastline from Sandy Hook to Great Bay, New Jersey, with a focus on three known haul out sites: Sandy Hook, Barnegat Bay, and Great Bay. This timeframe was selected to coincide with the maximum number of seals expected to be hauled out (Slocum and Davenport 2009). Aerial surveys with a Protected Species Observer aboard were conducted on March 9, but no seals were observed. On March 17, a high resolution aerial digital survey of the three haul-out sites was conducted. Surveys were flown using a 1974 Cessna U206F, flying at an altitude of approximately 1,000 ft. In total, 45 seals were detected in the digital images: 6 in the Sandy Hook area, 5 in the Barnegat Light area, and 34 in the Fish Island Great Bay area. The majority of the seals detected were in the water, with very few hauled out, making species identification difficult. Only 7 of the 45 seals were identified to species, all of which were identified as probable harbor seals.

2.2.6 Sea Turtles

Five sea turtle species have been reported to occur in the Project Area: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles. There are no known nesting locations along the coast of New Jersey, other than a few reports of animals coming ashore without successfully nesting. Although sea turtles have been reported in these waters throughout the year, most sea turtles are more likely to occur in the Project Area from spring through fall as they migrate through New Jersey waters to foraging areas in the North Atlantic and wintering area near Cape Hatteras (NJDEP 2010b). Therefore, sea turtles that occur in the Project Area would be migrating through the Project Area or foraging in the area. All of these sea turtles are listed as endangered or threatened pursuant to the Federal ESA and by the State of New Jersey.

Although hawksbill sea turtles have been reported from the Project Area and are listed as endangered by the State of New Jersey, they rarely occur north of Florida. They were not observed in NJDEP's Ocean/Wind Power Ecological Baseline Studies (NJDEP 2010b), the AMAPPS study (Palka *et al.* 2017), or the other baseline data collection studies discussed previously in this document. There are also no records of them having stranded along the New Jersey coast since 1995 (unpublished Marine Mammal Stranding Center [MMSC] data). Based on these data, these turtles are not likely to be exposed to the activities or impact producing factors associated with the Project and will not be considered further in this document.

Similarly, the Project Area does not overlap with critical habitat that has been designated for sea turtles. Critical habitat for green sea turtles has been designated on Culebra Island, Puerto Rico (63 Federal Register [FR] 46693), for hawksbill sea turtles on Mona and Monita Islands, Puerto Rico (63 FR 46693), and for leatherback sea turtles on Sandy Point on Saint Croix in the US Virgin Islands (44 FR 17710). Therefore, critical habitat for sea turtles will not be discussed further in this document.

Brief species profiles for each of the four ESA listed species are provided below:

2.2.6.1 Green Sea Turtle

Green turtles are found in the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea, primarily in tropical or, to a lesser extent, subtropical waters. Green sea turtles in the Project Area belong to the North Atlantic Distinct Population Segment (DPS) of green sea turtles and listed as threatened (81 FR 20057).

Green sea turtles are generally associated with warmer water masses and appear most frequently in US coastal waters with temperatures exceeding 18°C (Stinson 1984). Because of their association with warm waters, green sea turtles are typically found in New Jersey waters during the summer. Green sea turtles do not nest on beaches in the Project Area, instead they forage on marine algae and marine grasses (Conserve Wildlife Foundation of New Jersey [CWFNJ] 2020).

In the western Atlantic Ocean, green sea turtles are commonly associated with drift lines or surface current convergences which commonly contain floating *Sargassum* capable of providing small sea turtles with shelter and sufficient buoyancy to raft upon (NMFS and USFWS 1991, 1992). These sea turtles rest underwater in coral recesses, the underside of ledges, and sand bottom areas that are relatively free of strong currents and disturbance from natural predators and humans.

The MMSC in New Jersey rescued eight green sea turtles between 1995 and 2005 and another 17 between 2013 and 2018. Of the eight green sea turtles rescued between 1995 and 2005, six had evidence of human interactions including with fishing activities, boat strike, and impingement on a power plant grate (Schoelkopf 2006). In 2017 one green sea turtle had evidence of human interactions.

2.2.6.2 Kemp's Ridley Sea Turtle

Adult Kemp's ridley sea turtles are restricted to the Gulf of Mexico in shallow near shore waters, although adult sized individuals sometimes are found as far north as the Grand Banks and Nova Scotia (Bleakney 1955; Márquez 2001; Watson *et al.* 2004). Adult females rarely leave the Gulf of Mexico and adult males do not migrate. Juveniles feed along the US East oast up to the waters off Cape Cod, Massachusetts (Spotila 2004). A small number of individuals reach European waters (Brongersma 1972; Spotila 2004) and the Mediterranean (Pritchard and Marquez 1973). Kemp's ridley sea turtles were listed as endangered on December 2, 1970 (35 FR 18320). No DPSs or subpopulations are currently recognized.

Juvenile Kemp's ridley sea turtles are the second most abundant sea turtle in the mid-Atlantic region from New England, New York, and the Chesapeake Bay, south to coastal areas off North Carolina. Juvenile Kemp's ridley sea turtles migrate into the North Atlantic from May to June and forage for crabs in submerged aquatic vegetation (Keinath *et al*. 1987; Musick and Limpus 1997). In the fall, they migrate south along the coast, forming one of the densest concentrations of Kemp's ridley sea turtles outside of the Gulf of Mexico (Musick and Limpus 1997).

Kemp's ridley sea turtles forage in a variety of benthic habitat types, including seagrass beds (Byles 1988; Carr and Caldwell 1956), oyster reefs (Schmid 1998), sandy bottoms (Morreale *et al* 1992), mud bottoms (Ogren 1989; Schmid 1998), or complexes of these communities (Ogren 1989; Rudloe *et al*. 1991). In New Jersey, Kemp's ridley sea turtles are typically found in shallow coastal waters in the summer and fall where they forage on mollusks and crustaceans (CWFNJ 2020).

The MMSC in New Jersey rescued 45 Kemp's ridley sea turtles each year between 1995 and 2005 and another 15 between 2013 and 2018. Of the sea turtles rescued between 1995 and 2005, 18 percent had become impinged on power plant grates, 4 percent had been struck by boat propellers, and 20 percent showed signs of other impacts (Schoelkopf 2006).

2.2.6.3 Leatherback Sea Turtle

Leatherback sea turtles are found in the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. Leatherback sea turtles are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Morreale *et al.* 1994; Eckert 1998, 1999). In the North Atlantic Ocean, leatherback sea turtles regularly occur in deep waters (>328 ft), and have been reported in depths ranging from 3 to 13,618 ft, with a median sighting depth of 131.6 ft (Cetacean and Turtle Assessment Program 1982). They occur in waters ranging from 44.6°F to 81°F (7 to 27.2°C) (Cetacean and Turtle Assessment Program 1982) and can be found in the coastal waters of New Jersey throughout the year, but primarily in the summer and fall where they forage on soft bodied animals such as jellyfish and sea squirts (CWFNJ 2020).

Leatherback sea turtles were listed as endangered on December 2, 1970 (35 FR 18320). No DPSs or subpopulations are currently recognized although the Services have been petitioned to list leatherback sea turtles in the Northwest Atlantic as a DPS.

The MMSC in New Jersey rescued 177 leatherback sea turtles between 1995 and 2005 and another 10 between 2013 and 2018. Of the sea turtles rescued in this time interval, 14 percent had been struck by boat propellers, 8 percent had an interaction with fishery equipment, and 2 percent had been struck by a boat (Schoelkopf 2006).

2.2.6.4 Loggerhead Sea Turtle

Loggerhead sea turtles are found in tropical and temperate regions of the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. Loggerhead sea turtles in the Project Area belong to the North Atlantic DPS of loggerhead sea turtles and are listed as threatened (76 FR 58868).

Loggerhead sea turtles commonly occur throughout the inner continental shelf from Florida through Cape Cod (Massachusetts). However, there is a seasonal pattern to their occurrence: they tend to be associated with water masses with surface temperatures between 44.6° and 86°F (7° and 30°C) but were most likely to occur in water temperatures of about 51.8°F (11°C) (Shoop and Kenney 1992; Epperly *et al.* 1995; Braun and Epperly 1996). Aerial surveys conducted over the continental shelf reported loggerhead sea turtles at water depths of 72 to 161 ft (22 to 49 m) (Shoop and Kenney 1992).

Using geostatistical mixed effects models, Winton *et al.* (2018) estimated the distribution and density of satellite tagged loggerhead sea turtles in shelf waters along the US Atlantic coast, and found that predicted spatial distribution of tagged loggerhead sea turtles was concentrated in the region of central Florida to New Jersey. From May to September, predicted densities of tagged turtles were highest in the shelf waters from Maryland to New Jersey, and from November to April, the highest densities occurred on the shelf off of Cape Hatteras, North Carolina.

The MMSC in New Jersey rescued an average of 47 loggerhead sea turtles each year between 1995 and 2005 and another 138 between 2013 and 2018. Of the loggerhead sea turtles rescued between 1995 and 2005, 16 percent had been struck by propellers, 3.9 percent had evidence of boat collisions and 3.7 percent had evidence of fisheries interactions (Schoelkopf 2006).

2.2.7 Terrestrial Habitat and Fauna

2.2.7.1 Terrestrial Habitat Overview

The Project onshore study area is dominated by urban landscapes and includes barren land, small forest areas, industrial development, agriculture, and some residential and commercial use (as described in Section 2.3.4) The Project online study area includes wetlands, primarily associated with rivers, streams, and estuaries (described in Section 2.1.4). [redacted]

[redacted]

2.2.7.2 Wetlands

As the Project is in development, a Project onshore study area was assessed for all potential interconnection points to summarize existing conditions. National Wetlands Inventory and NJDEP data was used to identify wetland areas.

Review of the USFWS Wetland Mapper and NJDEP Bureau of GIS Wetlands of New Jersey data shows a variety of wetlands within the Project onshore study area (NJDEP 2020; USFWS 2020) (see Figure 2.2-11 through Figure 2.2-15). However, much of the Project onshore study area is highly developed. Wetlands within the Project onshore area are generally located in undeveloped park areas and along drainages. Many of the wetlands are dominated by Phragmites or have been created or impacted by human activities.

[redacted]

[redacted]

The flood zone data is derived from the FEMA effective and preliminary FIRMs (FEMA 2019). The effective FIRMs available for the Project onshore study area are dated from 2009 (prior to Hurricane Sandy). Following Sandy, preliminary FIRMs were developed in 2014-2015. According to the preliminary maps, the areas around major watercourses and tributaries fall within Zone A (100-year floodplain), Zone AE (100-year floodplain with base flood elevations and floodways), and Zone X (500-year floodplain). Zone VE (coastal zone subject to wave action) occurs along the shorelines of major river corridors [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.2.7.3 Fauna

Wildlife found in the habitats available in the Project onshore study area include common species found in [redacted]

[redacted]

The USFWS Information, Planning and Consultation (IPaC) system was consulted for the Project onshore study area in November 2020. According to IPaC, six federally listed animal species were identified as potentially occurring near the Project onshore study area:

- Piping Plover (*Charadrius melodus*), listed as federally threatened;
- Red Knot (*Calidris canutus rufa*), listed as federally threatened;
- Roseate Tern (*Sterna dougallii dougallii*), listed as federally endangered;
- Indiana Bat (*Myotis sodalist*), listed as federally endangered;
- Northern Long-eared Bat (*Myotis septentrionalis*) listed as federally threatened; and
- Bog Turtle (*Clemmys muhlenbergii*), listed as federally threatened.

State listed species with the potential to occur within the terrestrial and wetland habitats of the Project onshore study area are identified in Table 2.2-2

Table 2.2 State endangered and threatened pecies with potential to ccur within the terrestrial and wetland habitats of the nshore tudy area.

Common Name	Scientific Name	Status
	Birds	
Piping Plover*	*Charadrius melodus*	SE
Red Knot NB*	*Calidris canutus rufa*	ST
Roseate Tern**	*Sterna dougallii dougallii*	SE
American Bittern BR	*Botaurus lentiginosos*	SE
Bald Eagle BR	*Haliaeetus leucocephalus*	SE
Peregrine Falcon BR	*Falco peregrinus*	SE
Northern Goshawk BR	*Accipiter gentilis*	SE
Pied-billed Grebe BR	*Podilymbus podiceps*	SE
Northern Harrier BR	*Circus cyaneus*	SE
Red-shouldered Hawk BR	*Buteo lineatus*	SE
Short-eared Owl BR	*Asio flammeus*	SE
Black Rail BR	*Laterallus jamaicensis*	SE
Upland Sandpiper	*Batramia longicauda*	SE
Loggerhead Shrike NB	*Lanius ludovicianus*	SE
Black Skimmer	*Rynchops niger*	SE

Common Name	Scientific Name	Status
Henslow's Sparrow	*Ammodramus henslowii*	SE
Vesper Sparrow BR	*Pooecettes gramineus*	SE
Least Tern	*Sternula antillarum*	SE
Golden-winged Warbler BR	*Vermivora chrysoptera*	SE
Sedge Wren	*Cistothorus platensis*	SE
Boblink BR	*Dolichonyx oryzivorous*	ST
Bald Eagle NB	*Haliaeetus leucocephalus*	ST
Cattle Egret BR	*Bubulcus ibis*	ST
American Kestrel	*Falco sparverius*	ST
Horned Lark BR	*Eremophila alpestris*	ST
Black-crowned Night-heron BR	*Nycticorax nycticorax*	ST
Yellow-crowned Night-heron	*Nyctanassa violacea*	ST
Osprey BR	*Pandion haliaetus*	ST
Barred Owl	*Strix varia*	ST
Long-eared Owl	*Asio otus*	ST
Black Rail NB	*Laterallus jamaicensis*	ST
Grasshopper Sparrow BR	*Ammodramus savannarum*	ST
Savannah Sparrow BR	*Passerculus sandwichensis*	ST
Red-headed Woodpecker	*Melanerpes erythrocephalus*	ST
Reptiles		
Timber rattlesnake	*Crotalus h. horridus*	SE
Corn snake	*Elaphe g. guttata*	SE
Queen snake	*Regina septernvittata*	SE
Bog Turtle*	*Glyptemys muhlenberggi*	SE
Northern pine snake	*Pituophis m. melanoleucus*	ST
Wood turtle	*Glyptemys insculpta*	ST
Amphibians		
Blue-spotted salamander	*Ambystoma laterale*	SE
Eastern tiger salamander	*Ambystoma tigrinum*	SE
Southern gray treefrog	*Hyla chrysocelis*	SE
Eastern mud salamander	*Pseudotriton montanus*	ST
Long-tailed salamander	*Eurycea longicauda*	ST
Pine barrens treefrog	*Hyla andersonii*	ST
Invertebrates		
American burying beetle**	*Nicrophorus americanus*	SE
Northeastern beach tiger beetle**	*Cincindela d. dorsalis*	SE
Bronze copper	*Lycaena Hyllus*	SE
Brook floater	*Alasmidonta varicosa*	SE
Green floater	*Lasmigona subviridis*	SE
Gray petaltail	*Tachopteryx thoreyi*	SE
Mitchell's satyr**	*Neonympha m. mitchelli*	SE
Arogos skipper	*Atrytone arogos arogos*	SE
Appalachian grizzled skipper	*Pyrgus Wyandot*	SE
Dwarf wedgemussel**	*Alasmidonta heterodon*	SE
Robust baskettail	*Epitheca spinosa*	ST
Banner clubtail	*Gomphus apomyius*	ST
Harpoon clubtail	*Gomphus descriptus*	ST

Common Name	Scientific Name	Status
Frosted elfin	*Callphrys irus*	ST
Kennedy's emerald	*Somatochlora kennedyi*	ST
Triangle floater	*Alasmidonta undulata*	ST
Silver-bordered fritillary	*Bolaria selene myrina*	ST
Superb jewelwing	*Calopteryx amata*	ST
Eastern lampmussel	*Lampsilus radiata*	ST
Yellow lampmussel	*Lampsilus cariosa*	ST
Tidewater mucket	*Leptodea ochracea*	ST
Eastern pondmussel	*Ligumia nasuta*	ST
Brook snaketail	*Ophogromphus asperses*	ST
Checkered white	*Pontia protodice*	ST
	Mammals	
Indiana bat**	*Myotis solidis*	SE
Bobcat	*Lynx rufus*	SE
Allegheny woodrat	*Neotoma magister*	SE
	Fish	
Atlantic sturgeon**	*Acipenser oxyrinchis oxyrinchus*	SE
Shortnose sturgeon**	*Acipense brevirostrum*	SE

Source: NJDEP 2018.
Notes: ** = Federally Endangered; * = Federally Threatened; SE = State Endangered; ST = State Threatened; BR = Breeding population only; NB = Non-breeding population only.

2.2.8 Avian and Bats

2.2.8.1 Avian

A broad group of avian species may pass through the Lease Area, including terrestrial migrants (such as raptors and songbirds), coastal birds (such as shorebirds, waterfowl, and waders), and marine birds (such as seabirds and seaducks). There is high diversity of marine birds that may use the Lease Area because it is located in the Mid-Atlantic Bight, which overlaps with the ranges of both northern and southern species and falls within the Atlantic Flyway (a major migratory pathway for birds in the eastern US and Canada).

Migrant terrestrial species may follow the coastline on their annual trips or choose more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannets, loons, and seaducks), taking them directly through the mid-Atlantic region in spring and fall. This results in a complex ecosystem where the community composition shifts regularly, and temporal and geographic patterns are highly variable. The mid-Atlantic supports large populations of birds in summer, some of which breed in the area, such as coastal gulls and terns. Other summer residents, such as shearwaters and storm petrels, visit from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer climes, and are replaced by species that breed further north and winter in the mid-Atlantic.

Roseate Terns are federally and State listed marine species (see Table 2.2-2) There are no Roseate Tern breeding colonies in New Jersey, and they may occur at the Lease Area ephemerally during spring and fall migration (Burger *et al.* 2011; BOEM 2014).

Two shorebird species, Piping Plover and Red Knot are federally protected under the ESA (see Table 2.2-2). Piping Plovers nest along New Jersey beaches, and will also migrate (spring and fall) through the area in transit to and from northern breeding sites. Red Knots also fly through the region during migration in transit to northern breeding sites; a critical staging area for the birds is Delaware Bay. A recent nanotag study tracked migrating Piping Plovers captured in Massachusetts and Rhode Island. The study estimated that two of the tracked birds (*n*= 102) would be exposed to the northern portion of the New Jersey WEA and zero birds would be exposed to the southern portion of the New Jersey WEA where the Lease Area is located (Loring *et al.* 2019). A small proportion of the Red Knot migrant population, may pass through the New Jersey WEA, and potentially the Lease Area, during migration (Loring *et al.* 2018).

2.2.8.1.1 Shorebirds

Shorebirds are coastal breeders and foragers and generally avoid straying out over deep waters during breeding. Of the shorebirds, only Red Phalarope (*Phalaropus fulicarius*) and Red necked Phalarope (*P. lobatus*) are generally considered marine species (Rubega *et al.* 2000; Tracy *et al.* 2002). Overall, exposure of shorebirds to the offshore component of the Project will be limited to migration, and, with the exception of phalaropes, the offshore marine environment does not provide habitat for shorebirds.

2.2.8.1.2 Wading birds

Most long legged wading birds breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are coastal breeders and foragers and generally avoid straying out over deep waters (Hafner *et al.* 2000), but may traverse the Lease Area during spring and fall migration periods. The NJDEP EBS surveys detected few heron and egrets offshore.

2.2.8.1.3 Raptors

Except for falcons, most raptors do not fly in the offshore marine environment due to their wing morphology, which requires thermal column formation to support their gliding flight (Kerlinger 1985). Falcons are encountered offshore because they can make large water crossings (Kerlinger 1985). Merlins (*Falco columbarius*) and Peregrine Falcons (*F. peregrinus*) are commonly observed offshore (Cochran 1985; DeSorbo *et al.* 2018), fly offshore during migration (DeSorbo *et al.* 2015), and have been observed on offshore oil platforms (McGrady *et al.* 2006; Johnson *et al.* 2011a). Thus, falcons may pass through the Lease Area during migration. Ospreys (*Pandion haliaetus*) fly over open water crossings (Kerlinger 1985); however, satellite telemetry data from Ospreys in New England and the mid-Atlantic suggest these birds generally follow coastal or inland migration routes. Bald Eagles (*Haliaeetus leucocephalus*) are protected under the Bald and Golden Eagle Protection Act (Eagle Act) The general morphology of both Bald Eagles and Golden Eagles dissuades regular use of offshore habitats (Kerlinger 1985), and they are unlikely to fly through the Lease Area In a study evaluating the space use of Bald Eagles captured in the Chesapeake Bay, the coast of New Jersey was associated with moderate levels of use (Mojica *et al.* 2016), and they were rarely observed in offshore surveys (all observations <3.7 miles (6 km) from shore (Williams *et al.* 2015).

2.2.8.1.4 Songbirds

Songbirds almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Overall, the exposure of songbirds to the Lease Area will be limited to migration.

2.2.8.1.5 Coastal Waterbirds

Coastal waterbirds (including waterfowl) use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. The species in this group are generally restricted to freshwater or use saltmarshes, beaches, and other strictly coastal habitats and are unlikely to pass through the Lease Area.

2.2.8.1.6 Marine Birds

Marine bird distributions are generally more pelagic and widespread than coastal birds. A total of 83 marine bird species are known to regularly occur off the eastern seaboard of the US (Nisbet *et al.* 2013). Many of these marine bird species use the Lease Area during multiple time periods, either seasonally or year-round, including loons, petrels and shearwaters, gannets, gulls and terns, and auks.

The NJDEP EBS surveys and Marine life Data and Analysis Team (MDAT) models show higher use of the Lease Area by loons in the spring than other seasons. The seaducks use the Atlantic Outer Continental Shelf heavily in winter, generally winter in shallower inshore waters or out over large offshore shoals, and xposure to the Lease Area will be primarily limited to migration or travel between wintering sites. Petrels and shearwaters use the US Atlantic Outer Continental Shelf region heavily (Nisbet *et al.* 2013), but mostly concentrate offshore and in the Gulf of Maine (Winship *et al.* 2018) and may pass through the Lease Area The Northern Gannet (*Morus bassanus*) uses the US Atlantic Outer Continental Shelf primarily during winter. They breed in southeastern Canada and winter along the mid-Atlantic region and in the Gulf of Mexico. They are opportunistic foragers, capable of long-distance oceanic movements, and may pass through the Lease Area regularly during the non breeding period (Stenhouse *et al.* 2017). The Double-crested Cormorant (*Phalacrocorax auritus*) is the most likely species of cormorant exposed to the Lease Area, but regional MDAT abundance models show that cormorants are concentrated closer to shore and not commonly encountered well offshore. Nine species of gulls, skuas, and jaegers were observed in the NJDEP EBS surveys and could potentially pass through the Lease Area Seven species of tern are present in New Jersey during the spring, summer, and fall. Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Lease Area infrequently to forage and during migration. The MDAT abundance models show that auks are generally concentrated offshore and south of Nova Scotia (Winship *et al.* 2018), but some individuals may pass through the Lease Area during winter.

2.2.8.2 Project Onshore Study Area Avian Habitat

The Project onshore study area contains a diverse set of habitats including coastal wetlands, forested wetlands, emergent wetlands, forested uplands, and beach habitats that may provide breeding, migratory stopover, and wintering habitat for a variety of birds. However, the Project onshore study area is dominated by [redacted] For proposed onshore xport cable route area, the transmission lines will be co located with existing developed areas (i.e., roads and existing transmission lines) that pass through residential and commercial areas wherever possible, thereby minimizing potential impacts to terrestrial wildlife habitat Bird species occurring along the Project onshore study area is most likely common species associated with developed urban areas, while bird species at the cable landfall sites may include those associated with coastal wetland and beach habitats depending on the landfall locations.

2.2.8.3 Bats

There are nine species of bats present in the State of New Jersey, of which six are year-round residents (see Table 2.2-3) (Maslo and Leu 2013). These species can be broken down into two major groups based on their wintering strategy: cave-hibernating bats and migratory tree bats. Both groups of bats are nocturnal insectivores that use a variety of forested and open habitats for foraging during the summer (Barbour and Davis 1969). Cave hibernating bats are generally not observed offshore (Dowling and O'Dell 2018) and, in the winter, migrate from summer habitat to hibernacula in the mid-Atlantic region (Maslo and Leu 2013). Tree bats fly to southern parts of the US in the winter and are observed offshore during migration (Hatch *et al.* 2013). Given that tree bats were detected in the offshore environment, they may pass through the Project Area during the migration period. Overall, while both cave-hibernating and migratory tree bats may occur in the Project onshore study area, the onshore xport cable areas will be located within existing disturbed areas that are not likely to provide suitable habitat to the text practicable.

Two federally listed bats are present in New Jersey: Indiana bat and northern long-eared bat (see Table 2.2-3). Based on USFWS IPaC (https://ecos.fws.gov/ipac/) results, neither are known to occur in the Project onshore study area.

Table 2.2 3 Bat species present in New Jersey and their conservation status.

Common Name	Scientific Name	Type	State Status	Federal Status
Eastern small-footed bat	*Myotis leibii*	Cave-Hibernating Bat		
Little brown bat	*Myotis lucifugus*	Cave-Hibernating Bat		
Northern long-eared bat	*Myotis septentrionalis*	Cave-Hibernating Bat		T
Indiana bat*	*Myotis sodalist*	Cave-Hibernating Bat	E	E
Tri-colored bat	*Perimyotis subflavus*	Cave-Hibernating Bat		
Big brown bat	*Eptesicus fuscus*	Cave-Hibernating Bat		
Eastern red bat	*Lasiurus borealis*	Migratory Tree Bat		
Hoary bat	*Lasiurus cinereus*	Migratory Tree Bat		
Silver-haired bat	*Lasionycteris noctivigans*	Migratory Tree Bat		

Source: Maslo and Leu 2013.
*Range does not indicate as present in the Project Area
"Type" refers to two major life history strategies among bats in eastern North America; cave-hibernating bats roost in large numbers in caves during the winter, while migratory tree bats do not aggregate in caves and are known to migrate considerable distances. E=endangered; T=threatened.

2.3 Land Use and Socioeconomic Resources

2.3.1 Demographics, Employment, and Environmental Justice

[redacted]

Table 2.3 1 Selected demographic, racial and ethnic characteristics, employment, and Income in the Project nshore tudy area

[redacted]

[redacted]

[redacted]

2.3.1.3 Environmental Justice

Executive Order 12898, Federal Action to Address Environmental Justice in Minority Populations and Low Income Populations, requires federal agencies to consider if impacts on human health or the environment (including social and economic aspects) would be disproportionately high and adverse for minority and low income populations, referred to as environmental justice (EJ) populations, and appreciably exceed impacts on the general population or other comparison group.

In September 2020, the State of New Jersey passed and signed new legislation that requires NJDEP to evaluate the environmental and public health impacts of certain facilities on overburdened communities when reviewing certain permit applications. New Jersey is the first state in the nation to require mandatory permit denials if an EJ analysis determines a new facility will have a disproportionately negative impact on overburdened communities. The legislation defines an overburdened community as any community where 35 percent of the households qualify as low-income according to the US Census, 40 percent of households are minority, or 40 percent of households have limited English proficiency.

The new law requires the NJDEP to evaluate the environmental and public health impacts of the following facilities on overburdened communities when reviewing the following permit applications:

- Major sources of air pollution (i.e., gas fired power plants and cogeneration facilities);
- Resource recovery facilities or incinerators; sludge processing facilities;
- Sewage treatment plants with a capacity of more than 50 million gallons per day;
- Transfer stations or solid waste facilities;
- Recycling facilities that receive at least 100 tons of recyclable material per day;
- Scrap metal facilities;
- Landfills; or
- Medical waste incinerators, except those attendant to hospitals and universities.

The proposed Project facilities do not fall into the categories listed above

2.3.2 Recreation and Tourism

[redacted]

[redacted]

2.3.3 Commercial and For-Hire Recreational Fishing

Commercial and for hire recreational fishing is covered in Section 10 of this Application.

2.3.4 Land Use and Coastal Infrastructure

New Jersey Land Use/Land Cover data and aerial photos were reviewed to determine land use within the Project onshore study area. The Project onshore study area consists of [redacted] potential interconnection points as shown in [redacted]

2.3.4.1 Project Onshore Study Area

[redacted]

More inland, there is less development as compared to the coast and patches of barren land and small agricultural areas. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.3.4.2 Infrastructure

The Onshore E Cable Areas are developed areas within New Jersey and have multiple utilities including electric and gas distribution lines, electric and gas transmission lines, communication cables, and water and sewer pipelines. For the onshore infrastructure crossings, the Applicant will coordinate with owners to identify and better understand crossing agreements, as builts, and recent or planned changes in infrastructure. Underground utility surveys will be conducted to determine existing underground infrastructure along and within routes.

[redacted]

[redacted]

2.3.5 Terrestrial Traffic

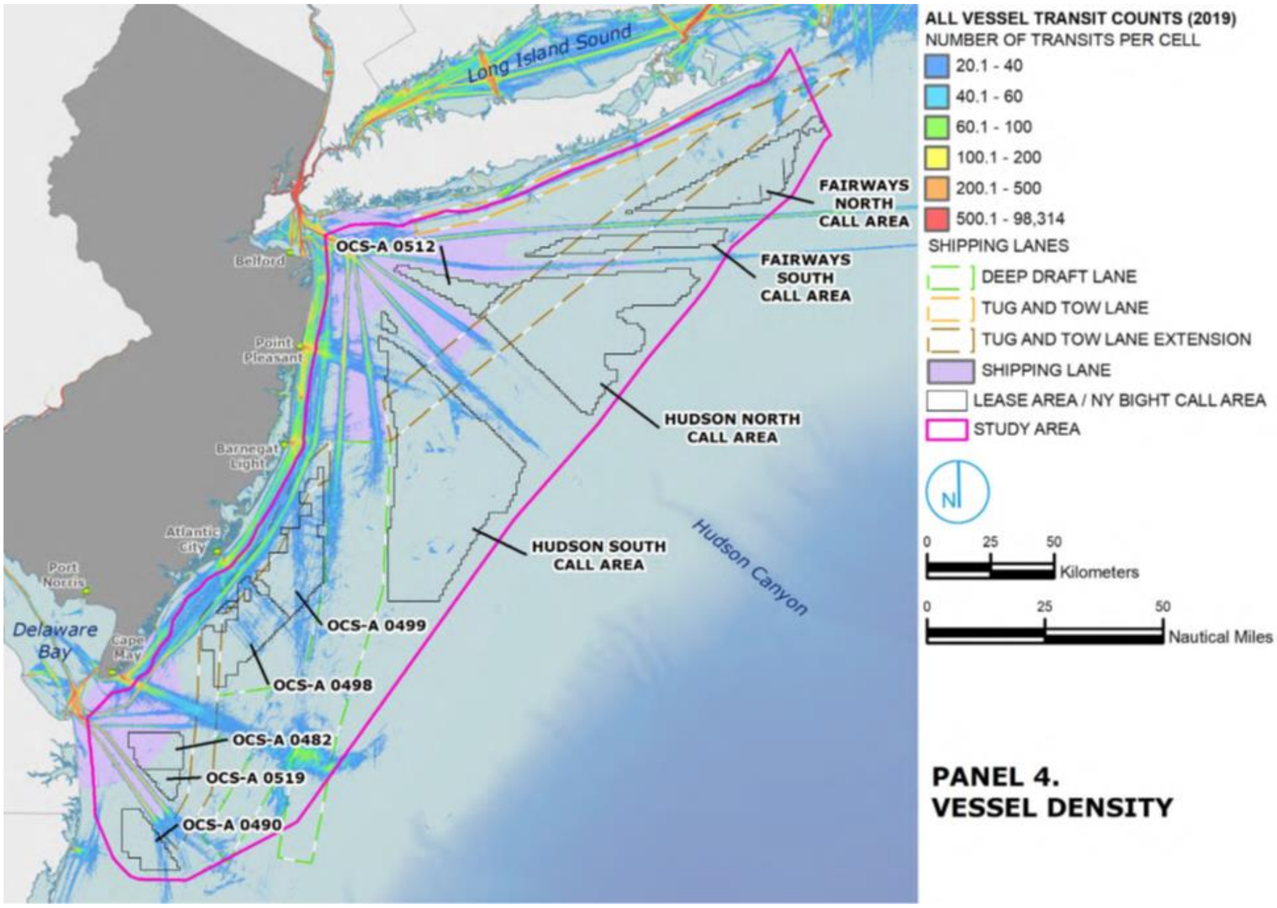
Onshore, a number of toll roads, interstate highways, US highways, State highways, bridges, and railroads may occur within the export cable route areas. The Applicant will coordinate with the owner of each highway, bridge and railroad to determine potential constraints for developing a transmission line project along, within, or across these facilities Any closures or temporary restrictions on these facilities may require permits and approvals from state, county, and local government.

2.3.6 Navigation and Vessel Traffic

A large volume of vessel traffic occurs in the region. Large commercial vessels travel in and out of the Port of New York and New Jersey, the Port of Norfolk, and the Port of Philadelphia. Currently, the United States Coast Guard (USCG) is conducting the Northern New York Bight and Mid-Atlantic Port Access Study (PARS) to evaluate existing vessel routing measures and to determine whether additional ones are necessary. The Applicant is closely coordinating with USCG on this study and on the Navigation Safety Risk Assessment for the Lease Area.

The New Jersey Offshore Wind Strategic Plan includes an analysis of vessel density in the region. The highest levels of vessel traffic are within shipping lanes near the Port of New York and New Jersey and along the coast of New Jersey (see Figure 2.3-7) (NJBPU 2020).

Applicant conducted a Navigation Safety Risk Assessment for the Lease Area which included a comprehensive vessel traffic survey using 2019 Automatic Identification System data. The coastal traffic west of the Lease Area is predominantly comprised of tug transits, while the majority of the coastal traffic further south is predominantly pleasure and fishing vessels. Vessel traffic in the vicinity of the Lease Area is much less dense than near the coast. Traffic east of the Lease Area is predominantly deep draft commercial vessels. There are countless recreational vessels located along the New Jersey Atlantic shore at marinas scattered along numerous inlets with ocean access. The majority of these vessels operate adjacent to the coast with comparatively few tracks in the Lease Area



Source: NJBPU 2020

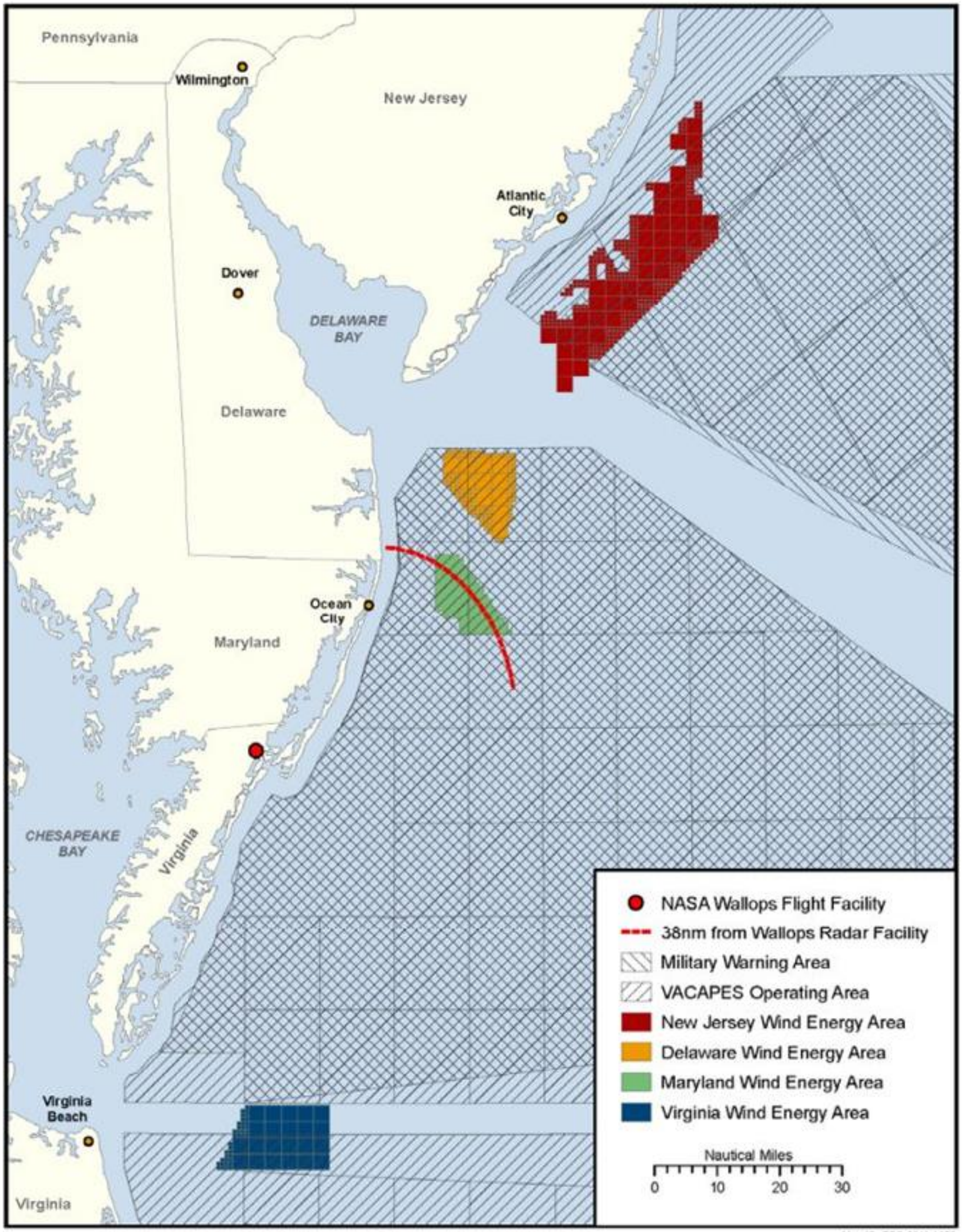
Figure 2.3 7 Vessel density in the Lease A

2.3.7 Other Marine Uses

The Project Area hosts multiple marine uses and activities, including national security and military uses, aviation, marine mineral use, and ocean disposal. When developing new infrastructure, careful planning and consideration of other uses is required to minimize risk to these competing uses.

The Department of Defense operates in the airspace over and adjacent to the Project Area, which are controlled by the Fleet Area Control and Surveillance Facility, Virginia Capes, Virginia Beach, Virginia (Federal Aviation Administration 2014) (see Figure 2.3 8).

Several sand and gravel borrow areas and ocean disposal sites designated and maintained by BOEM, as well as sand and gravel borrow areas designated by USACE in partnership with NJDEP, are mapped in the vicinity of the Lease Area and the Offshore Export Cable Areas (BOEM 2018) (see Figure 2.3 9). The Project has been designed to avoid these sand and gravel borrow areas and ocean disposal sites.



Source: BOEM 2012b

Figure 2.3 8 Military activity areas and uses

[redacted]

2.4 Cultural Resources

Cultural resources include archaeological sites, historic structures, and districts, and traditional cultural properties that represent important aspects of prehistory or history, or that have important and long standing cultural associations with established communities or social groups. The New Jersey State Historic Preservation Office provides listings of New Jersey and National Registers of Historic Places, New Jersey National Historic Landmarks, historic contexts, and the Cultural Resource Geographic Information System. Additional unknown archaeological sites may occur inside these areas.

2.4.1 Project onshore study area

Based on preliminary desktop review of the New Jersey Cultural Resource Geographic Information System:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

2.4.2 Tribal Lands

There are no federally recognized Native American tribes within the State of New Jersey and no tribes hold reservation land within the State; however, the New Jersey Commission on American Indian Affairs has the potential to include members from various tribes that would claim an ancestral connection to the land within the Project Area. The Applicant will coordinate with tribes per lease conditions for HRG&G surveys.

2.4.3 Shipwrecks

Due to continental shelf exposure, post glacial sea level fluctuation, there is potential for locating submerged prehistoric landscapes off New Jersey's coast (Faure *et al.* 2002). The Lease Area was likely an ideal marine and littoral resource for Paleo, Archaic, and Woodland peoples starting approximately 14,000 years ago (Englehart *et al.* 2011). Database review of Outer Continental Shelf wrecks and obstructions data indicates that non dangerous and dangerous submerged obstructions and wrecks, obstructions visible at high water, and awash obstructions, as well as uncharted obstructions and wrecks exist in the vicinity of the Lease Area. Non dangerous dangerous submerged obstructions and wrecks, distributed remains of wrecks, as well as rocks (e.g. awash and covered at low water) and uncharted obstructions have the potential to exist along the xport cable routes. [redacted] The Applicant will coordinate with a Qualified Marine Archeologist during the development of the HRG&G survey plans as well as for the development of the Marine Archeological Resources Assessment Report during the development of the COP.

2.5 Aesthetics

The Project developed preliminary visualizations for this Application. The visualizations were developed to represent a typical beach view from the nearest coastline point, representing clear, partly cloudy and overcast conditions during the early morning, mid afternoon and late day times. Also included is a nighttime visualization which includes the Aircraft Detection Lighting System (ADLS) turned on under clear conditions. The Applicant is planning on implementing ADLS or related means (e.g., dimming or shielding) to limit visual impact, pursuant to regulatory approval and technical feasibility, to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity of wind turbines. This system would reduce the amount of time that the lights are on, thereby minimizing the visibility of the Project from shore as the ADLS is only activated when an aircraft flies within 3 nautical miles of the wind farm area at an altitude less than 2,000 ft. Ocean Wind 1 analyzed Federal Aviation Administration flight data and based on this data, only one flight interacted with the ADLS airspace over a one year period. (Military flights may be more frequent but are not typical overnight.)

The Project is expected to have limited visibility from onshore viewpoints due to distance from shore, curvature of the earth, wave height, and atmospheric conditions. [redacted] A standard camera focal length of 50mm was used for the preliminary visualizations, with a corresponding horizontal field of view of 39.6 degrees. From the nearest coastline point (in Avalon, NJ) looking nominally Southeast, this horizontal field of view sees 78/82 turbines for Ocean Wind 2. This is represented by the plan view graphic on Page 1 of the visualization Attachment 9.2.

Applicant will conduct a visual impact assessment and conduct community outreach to potentially affected stakeholders based on that assessment. Initial visualizations were developed for this Application and can be found in Attachment 9.2 During the development of the COP and coordination with regulatory agencies and stakeholders, the Applicant will develop a visual impact assessment to identify areas of potential Project visibility and describe the potential change to the scenic quality of the seascape/landscape and the potential effect on the viewing public. To achieve this, the overall assessment of visual impacts includes the impact on the landscape and user groups as well as the geographical extent of visual change.

3 Potential Impacts

3.1 Physical Resources

3.1.1 Oceanography, Climate, and Weather

Wind energy is recognized as a major contributor to reducing greenhouse gases and mitigating the effects of climate change (Allison *et al*. 2019) The Project is not expected to have negative impacts on oceanography climate or weather.

3.1.2 Geological Resources

Activities that could cause direct impacts to seabed and bathymetry include construction of foundations, dredging, cable installation, and anchoring of vessels. Foundations and scour protection for wind turbines, OCS would be installed resulting in permanent impacts to the seabed. During construction impacts would result from seabed preparation and installation of facilities. Sediment resuspension and deposition are the primary impacts to the seabed from Project construction.

Sediment resuspension and deposition would be localized and short term due to existing sediment types. Seabed preparations for the installation of monopile or piled jacket foundations may include limited removal of surface features (i.e., sand waves), boulders and obstructions or debris which would cause temporary impacts to the seabed. Removal of obstructions and debris from the seabed surface would result in limited sediment displacement and re suspension. Seabed levelling will include the excavation or dredging of soft seabed material. Disposal of drilling spoils adjacent to pile installations may result in rock and sediment from depth being deposited on the seabed.

Installation of cables below the seabed would cause temporary impacts to the seabed; however the seabed would return to preconstruction conditions quickly following installation in most areas. Vessel anchoring may also temporarily impact the seabed and suspend sediment. In limited areas where cable burial depths cannot be achieved or where cable protection is required, such as where there are other utility crossings, cable protection such as rock or cable mattresses, may permanently change the seabed to hard substrate.

Cable landfall would be by open cut or trenchless methods (bore or horizontal directional drilling [HDD]). Where trenchless technologies are used, an inadvertent release/return plan will be developed and used during construction.

Onshore, cables would be buried below ground to minimize impacts. The substation/converter station facilities, transition joint bays, and splice vaults/grounding link boxes are expected to result in permanent impacts to soils. Temporary impacts would result from sediment and soil removal or displacement and re suspension.

3.1.3 Water Quality

Impacts on water quality may occur during construction, operation and maintenance of facilities, and during decommissioning activities; from activities such as foundation placement and pile driving, placement of scour protection, installation of cables, vessel anchors, jack up spud barges, dredging, and vessel or construction equipment spills. Impacts include increased turbidity due to resuspension of sediments and introduction of contaminants due to spills. Construction of the Project could result in temporary impacts to streams during construction from direct disturbance to stream beds and banks during installation of onshore cables. Indirect impacts could occur due to changes in water quality or sediment deposition associated with stormwater discharges to wetlands and waterbodies.

Offshore, impacts are anticipated to be short term and temporary due to the predominately sandy composition of upper sediments in the Project Area. Potential contamination may occur from unforeseen spills or accidents, and any such occurrence will be reported and addressed in accordance with the local authority. A Project specific spill prevention and countermeasures plan would be implemented to prevent spills and minimize impacts form any inadvertent spills.

Onshore, erosion and sedimentation controls will be employed to minimize the impacts from disturbance to ground and surface water quality If HDD is used at the cable landfall, an inadvertent release/return plan would be developed and implemented The OnSS would be sited within existing commercial or industrial land use to avoid impacts to streams, and cables would be collocated with existing infrastructure (such as roads) to minimize impacts to the extent practicable. By following BMPs for HDD and erosion and sediment control, including a Stormwater Pollution Prevention Plan for the OnSS construction activities for the onshore components of the Project are not anticipated to negatively impact water quality long term.

3.1.4 Air Quality

The Project is anticipated to result in emissions during development, construction, operations/maintenance and decommissioning, primarily due to the combustion of fuel in marine vessels. Emissions are anticipated to be emitted during development as a result of marine vessel usage, primarily marine survey and supply vessels. Emissions are anticipated to occur during construction due to the combustion of fuel in marine engines, helicopters, offshore emergency engines, and onshore construction equipment.

For this Application, air emissions, were calculated for the longest xport cable route and the potential interconnection points. As the Project develops emission estimates and assumptions will be updated. Potential air quality impacts of the Project are a result of air emissions from the following categories of sources:

- Commercial marine vessels;
- Helicopters;
- Generators (backup power/emergency generators);
- Nonroad engines; and
- Mobile engines.

Air pollutants estimated from these sources include the following:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);

- Black carbon (BC);
- Carbon monoxide (CO);
- Particulate matter with a diameter of 10 microns or less (PM_{10});
- Particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$);
- Sulfur dioxide (SO_2);
- Nitrogen oxides (NO_x);
- Lead (Pb); and
- Volatile organic compounds (VOC).

To estimate air emissions from the Project air emission estimates were calculated according to the following Project parameters:

- [redacted]

Because Project planning is under development, some aspects of the Project pertinent to estimating air emissions are under consideration, [redacted]

The Project anticipates refining air emission estimates during Project development. The methodology used to estimate emissions for each category of emission sources is presented here.

3.1.4.1 Marine Vessels

To estimate emissions from marine vessels, the methodology developed by BOEM for Wind Tool was followed. Wind Tool contains various defaults for marine vessels typically used to construct and operate offshore wind energy facilities. Defaults include rated engine capacity (both main and auxiliary), emission factors, load factors, and average speeds of each vessel type. Project specific information (engine power rating) was used in place of Wind Tool defaults where available.

Wind Tool provides default load factors for main and auxiliary marine vessel engines during transit and on site maneuvering. A load factor represents the portion of utilized engine power compared to the maximum rated engine power. Load factors vary from 0 (engine off) to 1 (engine fully utilized) based on a variety of factors.

Wind Tool uses a default load factor of 0.82 for main engines in transit and 0.20 for main engines during maneuvering, which are consistent with other available sources of marine vessel load factors for propulsion engines at cruise speed and during maneuvering. Jack-up vessels use legs to remain in place while on site, so it is assumed that jack up vessels do not use main engines during on site maneuvering. Based on USEPA 2014 National Emissions Inventory technical support documentation (USEPA 2018), it is also assumed that main engines are not engaged during hoteling at port.

Wind Tool provides a single default load factor of 1 for all auxiliary activities. Auxiliary engines will not be engaged at full power at all times; therefore, more representative load factors were selected for auxiliary engines. The 2014 National Emissions Inventory presents load factors for auxiliary engines (in Table 4-120 of that report) in various vessel types during hoteling at port and maneuvering. These load factors were used to estimate emissions from auxiliary engines during hoteling and maneuvering.

The 2014 National Emissions Inventory states that vessels equipped with Category 1 and 2 propulsion engines do not engage main or auxiliary engines while hoteling because it is assumed that these vessels engage in cold ironing to conserve fuel. Category 1, 2 and 3 marine vessel engines are defined in 40 CFR 1042.901 based on engine displacement. Because engine displacement information for the default marine vessels in Wind Tool is unknown, it was assumed that Category 1 and 2 marine vessel engines are typically smaller than 3,000 kilowatts; therefore, it is assumed that vessels with propulsion engines less than 3,000 kilowatts do not engage engines during hoteling.

Marine vessel auxiliary engine load factors during transit are obtained from a 2009 study published by the USEPA that surveyed methodologies in estimating emissions from mobile sources for port related emission inventories. Table 2-7 of the USEPA National Emissions Inventory document contains load factors for marine vessel auxiliary engines while cruising and while operating in the reduced speed zone. Because the vessel types in Table 2-7 do not closely match the vessel types available in Wind Tool, the highest load factor among all load factors for cruise and reduced speed zone, other than the cruise ship load factor, was assumed for all vessels. The cruise ship load factor was removed from consideration because a cruise ship is not representative of Project vessels given its very different function from offshore wind construction.

Another key parameter in estimating emissions using the Wind Tool methodology is duration. Wind Tool assumes that every hour the vessel is not in transit or at port, it is being used for on site maneuvering. Therefore, if an estimated construction duration is months long, the Wind Tool methodology assumes all vessels are emitting 24 hours per day, 7 days per week for the entire duration (either in transit or during on site maneuvering). Because the Applicant has not finalized a detailed construction schedule, the calculations currently assume the worst-case durations for each construction activity, resulting in very conservative emission estimates.

3.1.4.2 Helicopters

Wind Tool includes default values for four typical helicopter types: single engine, twin light, twin medium, and twin heavy. Each type is assigned a typical speed in Wind Tool, which can be adjusted by the user. Helicopter speed was not adjusted in the Project calculations.

Helicopters will use either the Woodbine Municipal Airport or the Atlantic City International Airport, both located in Atlantic City, New Jersey. Although the airports are similar distances to the centroid of the Project Area, the Woodbine Municipal Airport was selected as a worst case assumption because it is a slightly longer route.

3.1.4.3 Offshore Emergency Engines

To estimate emissions from offshore emergency engines during construction, it is assumed up to 24 emergency engines will be used for up to 336 hours each in the commissioning process, which is part of the construction phase. During the operations phase, it is assumed the OCS will have one large emergency engine operating up to 360 hours per year. Additionally, although long term cable failure is not anticipated during the 30-year life of the Project, to account for this possibility, it is conservatively assumed that two emergency generators will run continuously for up to two months.

Emission factors were obtained from USEPA's AP 42 Volume I, Section 3.3 for diesel engines with rated capacities of less than 600 horsepower and from Section 3.4 for diesel engines with rated capacities of 600 horsepower or greater. For the SO_2 emission factor, it was assumed that the sulfur content of diesel fuel used in onshore construction equipment is 0.0015 percent (equivalent to ultra low sulfur diesel fuel).

3.1.4.4 Nonroad and Mobile Engines

Emissions from nonroad engines used at the onshore construction sites to install cabling on land and to construct OnSS were estimated using the latest version of USEPA's Motor Vehicle Emission Simulator (MOVES), version 2014b. This state of the-science program generates emission factors for mobile sources and nonroad equipment for criteria pollutants and greenhouse gases. Load factors were obtained from Appendix A of USEPA Publication EPA 420 R-10 016 (July 2010). Emissions from mobile vehicles, including construction worker commuting and material delivery vehicles, were also estimated using emission factors generated from MOVES. Emission factors for hazardous air pollutants are not generated by MOVES version 2014b; it is assumed that hazardous air pollutants emissions from nonroad and mobile sources are negligible.

3.1.4.5 Greenhouse Gas Emissions

The combustion of fuel in marine vessels, helicopters, offshore emergency engines, and onshore construction equipment generates CO_2, CH_4, and N_2O, which are all greenhouse gas emissions. Each of these pollutants has a different ability to trap heat in the atmosphere; this ability is referred to as a Global Warming Potential (GWP). In order to convert CO_2, CH_4, and N_2O to CO_2 equivalent (CO_2e) values, each pollutant was multiplied by its Global Warming Potential, as defined in 40 CFR Part 98 Table A-1.

3.1.4.6 Avoided Emissions

The Project will replace conventional power generation on the grid, resulting in avoided emissions. Avoided emissions were estimated using emission factors generated by Wind Tool. Wind Tool generates emission factors from the USEPA's Emissions & Generation Resource Integrated Database (eGRID) and the Argonne National Laboratory (ANL). In both sets of emission factors, emissions are corresponded to the point of electricity generation; eGRID uses eGRID subregions and ANL uses North American Electrical Reliability Corporation regions. Wind Tool uses a user supplied zip code of the location where the Project will be connected to the shore based grid. [redacted]

Because Wind Tool relies on eGRID and ANL emission factors, it (conservatively) does not account for future changes to the resource mix of the grid. Wind Tool multiplies the avoided emissions estimated for the first year of operation based on the most recent eGRID and ANL emission factors by the expected life of the Project to estimate the lifetime avoided emissions of the Project.

3.1.4.7 Emission Estimates Results

Project emission estimates are presented for each phase of the Project: development, construction, operations, and decommissioning. Based on the Project schedule, it is assumed that all development emissions occur in Year 1, all onshore construction emissions occur in Year 2, and all offshore construction emissions occur in Year 3. The operations emissions are presented in both annual emissions and Project lifetime emissions. The expected Project lifetime is [redacted] The decommissioning duration is expected to be less than one year. Although marine vessel technology and construction methods are expected to change substantially over the next [redacted] estimated Project emissions during decommissioning are presented here. The estimated decommissioning emissions are anticipated to be very conservative.

Table 3.1 1. Development emissions

[redacted]

Table 3.1 . Construction emissions

[redacted]

[redacted]

Table 3.1 3. Operations emissions

[redacted]

Table 3.1 4. Decommissioning emissions

[redacted]

As a result of the Outer Continental Shelf air permit and potentially also as a result of General Conformity, the Project will obtain emissions offsets for Project emissions of nonattainment pollutants or precursors. The purchase of emissions offsets helps ensure that the Project will not contribute to the nonattainment status of a pollutant in an area currently designated nonattainment or maintenance. As the Project develops, it is expected the air emissions estimates will be reduced as Project assumptions and parameters are refined. The number of emissions offsets to be purchased by the Project will be determined during General Conformity and permitting processes.

3.2 Biological Resources

Installation of the monopiles, scour protection, and vessel operations would result in disturbance to the sea floor, including the temporary disturbance of marine sediments and short-term, localized, and minor amounts of sedimentation Installation of the export and intra array cables would result in temporary disturbance of the marine sediments along the length of the cable. Using trenchless technologies as a method of installation for the cables would result in disturbance and temporary habitat loss where the cable breaks out of the seabed and at facilities associated with the drill rig. The use of open trenching would result in a localized disturbance to benthic habitats the width of the trench (approximately 3-20 ft [1 6 m]). Each installation method would be minor and short term, and it is expected that ocean currents would dissipate any sedimentation enough to result in only minor impacts on any resource.

Bottom perturbations during construction would be positioned to minimize impacts to sensitive habitats.

Implementation of the Project will benefit subsurface habitat by providing habitat structure throughout operation of the Project.

3.2.1 Benthic Invertebrates

Disturbance to benthic habitat during installation activities would impact benthic invertebrates. Cable installation would result in minor, short term increases in sedimentation and temporary habitat loss at the width of the cable Trenching would likely lead to the greatest impacts; however, it is anticipated based on grain size that resuspended sediment would settle quickly. Motile marine fauna would likely relocate from the area of disturbance; however, sessile and other benthic organisms would suffer localized mortality from burial, dislodgement, or other disturbances.

Following the proposed installation activities, benthic macroinvertebrates would likely repopulate disturbed areas over the cable, scour protection, and turbines. Recovery time of macrofaunal communities would be variable, depending on motility, mobility, and larval and juvenile recruitment of a species.

Monopile and scour protection around WTGs and in areas along the export cable route areas where additional cable protection is required would become hard surface habitat for a wide variety of invertebrates, acting as artificial reefs that provide additional surface areas for organisms to attach to, ultimately increasing the number of shellfish present (Bailey *et al.* 2014). Additionally WTG foundations have the potential to provide a sheltering effect or safety buffer zone for organisms from passing ships (Bailey *et al.* 2014).

Potential impacts from the electromagnetic field would be localized to the export cable route area Burial of the cables below the seabed would further reduce electromagnetic field emissions.

Operation activities, including vessel anchoring and cable maintenance, would primarily result in localized and temporary impacts to benthic invertebrates; however, they could result in mortality of sessile or slow-moving benthic organisms. Potential impacts would be minimized by implementing BMPs. The conversion from soft bottom sand to new hard substrate habitat would shift the benthic invertebrate community composition, resulting in more biodiversity in the Project Area Therefore, operation of the Project would have long term, minor positive benefits on marine fauna and flora.

3.2.2 Submerged Aquatic Vegetation

No SAV is expected in the Lease Area; therefore, shading effects from the WTGs and OCS on the surrounding environment would be negligible. SAV are limited to nearshore areas in bays and estuaries. Potential temporary impacts to SAV include increased turbidity from resuspension of sediments. To the extent possible, HDD will be used at landfall locations or work will be conducted during the winter to avoid and minimize potential impacts to SAV.

3.2.3 Phytoplankton

BOEM (2018) noted that impacts could result from the unavoidable entrainment of planktonic larvae during use of a hydraulic jet plow during cable installation; because of the limited time and area of use, this would not cause population level impacts for affected species (BOEM 2018).

3.2.4 Finfish and Essential Fish Habitat

Finfish and essential fish habitat are covered in Section 10 of this Application.

3.2.5 Marine Mammals and Sea Turtles

The marine mammals and sea turtles that occur in the Project Area are highly mobile species. It is anticipated that during installation of the export and array cables, these organisms would relocate and not come into contact with the equipment or Project vessels. Also, during installation activities, trained Protected Species Observers would be stationed on board the Project vessels to lessen the potential for collisions. The Project will lead to an increase in the number of vessels operating in the Project Area.

Upon spotting marine mammals or sea turtles, modification of installation activities would be made to reduce potential impacts to the fauna until it has left the vicinity. Monitoring measures will be implemented along with mitigation measures to avoid and minimize impacts on marine mammals and sea turtles during the Project. To do so, a Protected Species Monitoring and Mitigation Plan (PSMMP) will be developed as the Project is further designed with construction and operational measures. With the implementation of environmental protection measures and Protected Species Monitoring and Mitigation Plan, any adverse impact to marine mammals and sea turtles would be minimal.

The ability to hear and transmit sound (echolocation/vocalization) is vital for marine mammals to perform several life functions. Marine mammals use sound to gather and understand information about their current environment, including detecting prey and predators. They also use sound to communicate with one another. The distance a sound travels through the water depends highly on existing environmental conditions (sea floor topography and ambient noise levels) and characteristics of the sound (sound levels and frequency; Richardson *et al.* 1995). Impacts on marine mammals can vary among species based on their sensitivity to sound and their ability to hear different frequencies. The Project may impact marine mammals behaviorally and physiologically from temporary increases in underwater and airborne noises during construction activities. The level of impact on marine mammals from construction activities will vary depending on the species of marine mammal, the distance between the marine mammal and the construction activity, the intensity and duration of the construction activity, and environmental conditions.

Pile installation, necessary to install the proposed WTG foundations, creates a loud soundwave that spans across many frequencies. Noises, as well as vibrations, associated with construction and operation of offshore wind installations may impact marine mammals and sea turtle. Marine wildlife has been found to be impacted by a variety of anthropogenic noises, often causing changes in behavior among individuals and populations, and in extreme cases, long term physiological impacts, such as cochlear damage (Peng *et al* 2015). This is especially true for marine mammals that depend on echolocation, such as whales, porpoises, and dolphins.

Pile installation can produce noise impacts up to 204 decibels from 500 m away, for large piles 6.5 m (21 ft) in diameter (Nehls *et al* 2007). These noise levels are known to impact marine mammals and federal regulations consider levels exceeding 180-190 decibels damaging to marine mammals (NMFS 2018, 2020). A review of existing literature has found that pile installation noise during construction impacts marine wildlife behavior.

Marine wildlife would likely exhibit avoidance behaviors near the construction area, shifting their habitat away from the source of the noise. While the number of studies focusing on the after effects of construction on marine wildlife is few, most reviewed studies contend that in absence of major effects on wildlife during construction, marine wildlife should return to the site of construction after work has completed. This implies no long-term impacts on the habitat or population of marine wildlife, which in turn would not produce material economic impacts.

It is expected that the impacts to the marine mammals and sea turtles in the vicinity of the Project during installation would be minimal. Temporary avoidance behavior in marine mammals and sea turtles in the Project vicinity would be expected during construction activity. These behavior changes would be short-term and would likely be similar to the avoidance behaviors observed during heavy pleasure boat use, ferry traffic, or heavy fishing activity in the areas used by these species.

As the Project design advances, an underwater noise assessment will be completed to provide Ocean Wind 2 with a noise prognosis report for a better understanding of potential noise impacts to inform Project siting and design. An underwater noise assessment describes the biological exposure assessment for marine mammals, sea turtles, and fish as well as the potential effects for underwater noise generated from pile installation within the Project Area.

The operation of the turbines is not expected to generate substantial sound levels above baseline sound in the area (Minerals Management Service 2008) Increased underwater ambient noise during the operation of the turbines for the life of the Project could cause mild impacts to marine fauna. When the Project is in operation and during periods of high wind, ambient noise will further increase. Some research has been done to suggest that impacts of increased ambient noise levels related to wind turbines drives fish away from the turbines during high wind events (Wahlberg and Westerberg 2005; Thomsen *et al.* 2006). Other studies suggest that during the operational phase, disturbances caused by noise are considered to be of minor importance to the marine environment (Raoux *et al.* 2017).

Accidental discharge of waste materials or fuels is expected to be negligible during installation decommissioning activities. Similar to construction related impacts, underwater noise associated with decommissioning activities would be limited, and would be minor and short term.

For the Fisherman's Atlantic City Environmental Assessment, the United States Department of Energy (USDOE) and USACE had determined that the proposed project may affect but is not likely to adversely affect the marine mammal and sea turtle species (USDOE 2015). Given the similarity of this Project to that project, it is anticipated a similar finding would occur.

3.2.6 Terrestrial Habitat and Fauna

The OnSS would be sited within existing commercial or industrial land use to avoid impacts to terrestrial habitat and fauna.

Onshore, potential temporary construction impacts include onshore habitat modification and disturbance, but these will be limited to small areas Construction of the Project could result in temporary impacts to terrestrial habitat during construction from direct disturbance to vegetation and soils, resulting in displacement of fauna; however, population level impacts are unlikely. Temporary impacts to wetlands during construction could result from direct disturbance to wetland vegetation and soils during installation of onshore cables. The OnSS would be sited within existing commercial or industrial land use to avoid impacts to wetlands, and cables would be collocated with existing infrastructure (such as roads) to minimize impacts to the extent practicable. Long-term onshore habitat loss impacts are expected to be limited, because substation/converter station will be co-located in existing disturbed areas and cables may be buried.

Long term or permanent habitat loss would occur if trees are removed, but this is expected to be very limited if at all due to facilities co-located in existing disturbed areas. Wildlife indigenous to the area are anticipated to return after construction, with species that are habitat generalists (i.e. common raccoon, eastern gray squirrel) most likely to return first. Additionally, BMPs would be used during construction to avoid indirect impacts, such as the spread of invasive species.

3.2.7 Avian and Bats

Construction activities including physical seabed/land disturbance, habitat conversion visible structures/lighting, and traffic may affect birds. Because seabed disturbance, noise, and vessel traffic are expected to be temporary and highly localized, the potential impacts primarily affecting birds are expected to be collision with visible structures and displacement from the Project Area.

During construction, activities offshore will be short term and are unlikely to impact bird populations. Onshore, potential temporary construction impacts include onshore habitat modification and disturbance, but these will be limited to small areas During offshore operations the potential long-term impacts are collision and habitat loss due to displacement, but population level impacts are unlikely Long term onshore habitat loss impacts are expected to be limited, because substations/converter station will be co located in existing disturbed areas and cables may be buried.

Potential temporary construction impacts to bats include short-term disturbance offshore and habitat modification onshore, which are expected to be localized and temporary with the application avoidance and minimization measures.

During operation, the long term potential impacts on bats offshore are collision with visible structures and, onshore, habitat loss due to habitat disturbance, but population level impacts are unlikely. Long term or permanent habitat loss would occur if trees providing bat habitat are removed, but this is expected to be very limited if at all due to facilities being co located in existing disturbed areas.

3.3 Land Use and Socioeconomic Resources

3.3.1 Demographics, Employment, and Environmental Justice

Depending on the size of the Project, between approximately 2,600 and 8,300 direct job-years would be created, increasing employment in the Project onshore study area A temporary decrease in the unemployment rate in the Project onshore study area could occur as a result of hiring of local workers for construction and increased demands on the local economy. The non-local workforce would most likely spend a portion of their pay in local communities on housing, food, transportation, entertainment, and miscellaneous other items. These local communities have tourism related infrastructure including hotels, restaurants, and entertainment facilities that could be used by the non-local workers. Additional temporary jobs would be created in the Project Area as purchases for goods and services increase along with the arrival of the non local construction workforce.

Non local workers would require temporary housing accommodations during the period of construction. [redacted] In addition, numerous hotels, motels, campgrounds, and RV parks are available in the Project Area. Use of this temporary housing by the non local workforce would result in a beneficial economic impact in the vicinity of the Project.

The New Jersey Shore experiences an influx of recreational visitors during the summer months, and these visitors would compete with non-local workers for temporary accommodations. Competition for temporary housing could increase rents. Impacts on temporary housing could be reduced by scheduling construction activities outside of the summer tourist season.

3.3.1.1 Environmental Justice

The potential for impacts on EJ could be introduced during construction, operation and maintenance of facilities, and during decommissioning activities. Increased noise, traffic, impacts to visual resources from new structures or lighting, changes to land use, or economic impacts could affect EJ populations.

There are minority and low income communities in the Project onshore study area as defined in New Jersey legislation and shown in section 2.3.1 Noise generated from construction activities could include trenchless technology operations at landfalls, installation of onshore xport cable area duct bank, and construction of the substation/converter station. Noise and traffic may be notable at times within the immediate construction areas, but is expected to be localized and temporary. Local noise ordinances will be followed during construction.

Potentially adverse environmental impacts associated with construction of the Project would be minimized and/or mitigated, as applicable, and are not characterized as high and adverse. The location of facilities within minority and low income areas are not disproportionate to the project facilities located outside EJ areas. The sites of Project facilities were dictated by a number of engineering factors and screening criteria and were not influenced by demographics. The Project is not one of the types of facilities that require NJDEP review to evaluate environmental and public health impacts The Project would not cause a disproportionate share of high and adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group.

3.3.2 Recreation and Tourism

The New Jersey Shore and coastal areas including [redacted] provide onshore and offshore recreation and tourism opportunities year round. During construction, public access to some areas within the Project onshore study area would be temporarily restricted in the immediate area of construction activities. Noise and traffic associated with construction may reduce access to recreational areas and deter tourist visitation during active construction. However, these impacts would be limited to the construction period. Noise would be generated from such activities as trenchless technologies drilling, installation of onshore xport cable, and construction of the substation/converter station. Construction activities would generate additional vehicular traffic in the area. Noise and traffic may be notable at times within the immediate construction areas, but it is expected to be localized and temporary.

During operation of the Project, the presence of underground cables will not preclude recreational and tourist activities. The substation/converter station has been sited away from recreational and tourist attractions.

3.3.3 Commercial and For-Hire Recreational Fishing

Commercial and for hire recreational fishing is covered in Section 10 of this Application.

3.3.4 Land Use and Coastal Infrastructure

In general, impacts from construction activities to coastal land use will be temporary in nature and consistent with the existing zoning and land use. Onshore Project construction will include landfalls, the onshore xport cable route area substation/converter station and interconnection points within the Project onshore study area. Construction is expected to result in temporary or permanent impacts to local residents, businesses, and the community along the proposed onshore xport cable route area during construction of these Project components. Project activities that are anticipated to result in impacts to land use include construction at landfalls, installation of onshore xport cable area duct bank, and construction of the substation/converter station. These impacts would be minimized through the use of existing rights of-way, co-locating Project components, using land that is zoned for commercial or industrial development, or restoring areas to pre disturbed condition following construction.

Landfall construction methods such as trenchless technologies minimize impacts to land use and the environment. This may result in temporary impacts to land use such as temporary displacement of open lots and roadways. These impacts are anticipated to last for the duration of construction entry pit, landfall transition joint bays, and onshore cable, but following construction, these areas will be returned to their previous condition and use.

Utilities (both onshore and offshore), roadways, bridges, and railroad crossings would be completed per crossing agreements. There may be temporary impacts to the various resources during the construction phase, but they would be completed per the crossing agreement to minimize impacts during construction and avoid permanent impacts.

The construction of the OnSS would include potential temporary and permanent impacts. However, the facilities would be consistent with surrounding land uses and in an industrial setting; therefore potential impacts to land use would be minor. Upgrades to existing facilities may be needed for interconnection, however those upgrades would be consistent with the existing use.

Operations and maintenance is not expected to result in impacts to land use within the Project onshore study area. Decommissioning has the potential to result in similar land use impacts as construction. These impacts would be temporary in duration during the decommissioning phase of the Project.

3.3.5 Terrestrial Traffic

Project construction at the landfall, along the onshore xport cable route, and at the substation/converter station location may result in temporarily increased noise levels, lighting, and traffic in the vicinity of the construction. Duct bank construction within the roadway, railroad, or at bridges could result in temporary traffic impacts such as lane closures, shifted traffic patterns, or closed roadways. BMPs and maintenance of traffic plans would be developed and coordinated with local and State agencies. Any required permits would be obtained prior to construction. These impacts would be limited to the immediate construction area and would be returned to pre-construction conditions and would not result in changes to the existing use.

Utilities, roadways, bridges, and railroad crossings would be completed per crossing agreements. There may be temporary impacts to the various resources during the construction phase, but they would be completed per the crossing agreement to minimize impacts during construction and avoid permanent impacts.

3.3.6 Navigation and Vessel Traffic

Construction activities within the Lease Area and offshore cable area would result in an increase in vessel traffic, which could overlap with existing marine navigation and traffic. A Navigation Safety Risk Assessment will be conducted to determine potential impacts to navigation.

During operation of the Project, impacts include creating obstructions that may impact safe navigation, affecting the traditional uses of the waterway, and impacting USCG search and rescue or otherwise impairing other USCG missions. Applicant will evaluate spacing between WTGs in the layout to determine whether spacing provides sufficient sea room for maneuvering for vessel types expected to transit and fish in the wind farm and will coordinate with USCG. Emergency rescue procedures will likely be adjusted to account for the Project structures once they are in place. Project cables will be buried to avoid conflicts with anchoring and fishing gear.

3.3.7 Other Marine Uses

Construction activities would result in an increase in vessel traffic within the Lease Area and offshore cable area and may involve use of helicopters. The Applicant would coordinate with the Department of Defense to minimize impacts during construction, operation and maintenance and decommissioning. Any impacts to military operations from vessel traffic are expected to be short-term and localized.

As sand, gravel borrow and ocean disposal areas will be avoided, no potential Project impacts associated with construction, operations and maintenance and decommissioning are anticipated.

3.4 Cultural Resources

Installation of export cables and associated offshore and onshore facilities would potentially impact cultural resources through disturbance and/or destruction of culturally significant sites, objects and remains. The Applicant will complete surveys to identify and seek to avoid known cultural resources to the extent possible. Potential impacts would be mitigated through site selection. Impacts to cultural resources are evaluated in accordance with Section 106 of the Historic Preservation Act and various state and local regulations. The Applicant will consult with Federal, State, and local agencies, and with potentially affected Native American Tribes to determine an appropriate scope of investigation and consultation.

3.5 Aesthetics

Aesthetics are discussed in Section 2.5 and Attachment 9.2.

3.6 Noise

Onshore, noise would be generated during construction from activities such as HDD drilling, installation of the onshore export cable, and construction of the substation/converter station (e.g., operation of heavy equipment for clearing, grading, and excavation). At times construction noise may cause disturbance however, disturbances at these sites would be short-term, localized, and temporary. During operational activities, noise would be generated at the OnSS and vehicular traffic would occur. However, due to the urban nature of the Project onshore study area, noise and traffic during operation are expected to be consistent with existing levels Noise during decommissioning would be similar to noise during construction.

Offshore, primary noise impacts would be from pile driving activities. Increased noise from pile driving can cause displacement of or injury to marine fauna (see Section 3.2.4). Vessels used during construction, operation and decommissioning would also generate noise. Vessel noise associated with Project construction (or operations) would be similar to existing conditions, given the high vessel traffic in the region offshore of New York, New Jersey, and Delaware.

Operation of the turbines is not expected to generate substantial sound levels above baseline sound in the area (Minerals Management Service 2008).

3.7 Summary

The Applicant has implemented impact analysis techniques early in the design and planning of the Project to reduce the potential for impact on the environment. Impact analysis is an iterative process throughout the development and operation of any large infrastructure project. The Applicant is applying the mitigation hierarchy to avoid impact where possible through sensitive route planning and site selection to mitigate any adverse impacts that cannot practicably be avoided, and to provide full and fair compensation when necessary.

Based on a preliminary review of environmental resources, it is anticipated that no resource would be significantly negatively impacted because of the methods of installation and operation, avoidance of sensitive receptors where possible, and the flexibility of the Project's disturbance area and timing within the anticipated Project footprint. In particular, the Applicant has targeted areas of existing infrastructure or disturbed ground to identify potential landfall, onshore transmission and converter and substation locations to minimize environmental impacts. The potential impacts during development, construction, O&M and decommissioning are summarized in Section 9, Table 9.1. In addition, Table 9.2 summarized potential mitigation measures by resource.

4 References

Allison, T.D., J.E. Diffendorfer, E.F. Baerwald, J.A. Beston, D. Drake, A.M. Hale, C.D. Hein, M.M. Huso, S.R. Loss, J.E. Lovich, M.D. Strickland, *et al*. 2019. Impacts to wildlife of wind energy siting and operation in the United States. Issues In Ecology 21:24.

Alpine (Alpine Ocean Seismic Survey Inc.). 2017a. Alpine Ocean Seismic Survey, Inc. 2017. OCW01 – Ocean Wind LLC, New Jersey Geophysical 1A Survey (2017) Lot 3: Habitat Characterization Report. 200-15-0981. Volume 10969.5. Prepared for DONG E&P AS. October 17 2017.

Alpine (Alpine Ocean Seismic Survey Inc.). 2017b. Ocean Wind High Resolution Geophysical and Geotechnical Survey, Protected Species Observer Report. Survey Report for Alpine Ocean Seismic Survey Inc. on behalf of Ocean Wind LLC.

American Planning Association– New Jersey Chapter. 2019. Great Places in New Jersey. Accessed 16 November 2020 Retrieved from: https://greatplacesnj.org/map-location/perth-amboy-waterfront/

Anonymous. 1958. The Venice system for the classification of marine waters according to salinity. Limnology and Oceanography 3:346–47.

Asselin, S., M.O. Hammil, and C. Barrette. 1993. Underwater vocalizations of ice breeding grey seals. Canadian Journal of Zoology 71:2211-2219.

Barbour, R.W., and W.H. Davis. 1969. Bats of America: Lexington.

Bleakney, S. 1955. Four records of the Atlantic ridley turtle, *Lepidochelys kempi*, from Nova Scotian waters. Copeia 1955(2):137.

Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in the southern Georgia waters, June, 1991. Gulf of Mexico Science 1996:39 44.

Brongersma, L.D. 1972. European Atlantic Turtles. Zoologische Verhandelingen 121:1-318.

Bureau of Ocean Energy Management (BOEM). 2014. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment.

Bureau of Ocean Energy Management (BOEM). 2018. Summary Report: Best Management Practices Workshop for Atlantic Offshore Wind Facilities and Marine Protected Species (2017). OCS Study BOEM 2018 015. Bureau of Ocean Energy Management, Atlantic OCS Region, Washington, D.C.

Bureau of Ocean Energy Management (BOEM). 2018. Federal OCS Sand and Gravel Borrow (Lease Areas). 16 March. https://gis.boem.gov/arcgis/rest/services/BOEM_BSEE/MMC_Layers/MapServer/14

Burger, J., C. Gordon, J. Lawrence, J. Newman, G. Forcey, and L. Vlietstra. 2011. Risk evaluation for federally listed (roseate tern, piping plover) or candidate (red knot) bird species in offshore waters: A first step for managing the potential impacts of wind facility development on the Atlantic Outer Continental Shelf. Renewable Energy 36:338 351.

Byles, R.A. 1988. The behavior and ecology of sea turtles in Virginia. Unpublished Ph.D. dissertation, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Carr, A., and D. Caldwell. 1956. The ecology and migrations of Sea Turtles, I. Results of field work in Florida, 1955. American Museum Novitates 1793:1-23.

Cetacean Density and Distribution Mapping Working Group (CetMap). 2020. Accessed 11 November 2020, Retrieved from: https://cetsound.noaa.gov/cda index

Cetacean and Turtle Assessment Program. 1982. Characterization of marine mammals and turtles in the Mid and North Atlantic areas of the U.S. Outer Continental Shelf. Prepared for U.S. Bureau of Land Management, Washington, D.C. by Cetacean and Turtle Assessment Program, University of Rhode Island, Graduate School of Oceanography, Kingston, Rhode Island.

Citizens United Maurice River. Undated. Physiographic Provinces and Ecological Communities. Accessed 25 November 2020. Retrieved from: Plants of Southern New Jersey (cumauriceriver.org).

Clarke, R. 1956. Sperm whales of the Azores. Discovery Rep 28:237-298.

Cochran, W.W. 1985. Ocean migration of Peregrine Falcons: is the adult male pelagic? In Proceedings of Hawk Migration Conference IV (M. Harwood, Editor). Hawk Migration Association of North America, Rochester, NY, pp. 223-237.

Cole, T.V.N., D.L. Hartley, and R.L. Merrick. 2005. Mortality and serious injury determinations for large whale stocks along the United States eastern seaboard, 1999 2003. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts.

Connell D.J. (2010). Sustainable livelihoods and ecosystem health: exploring methodological relations as a source of synergy. Ecohealth.

Conserve Wildlife Foundation of New Jersey (CWFNJ). 2020. New Jersey Endangered and Threatened Species Field Guide: Atlantic Loggerhead Sea Turtle. Accessed on 10 November 2020, Retrieved from: http://www.conservewildlifenj.org/species/fieldguide/view/Caretta%20caretta/

Cotter, M.P. 2019. Aerial Surveys for Protected Marine Species in the Norfolk Canyon Region: 2018 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-D 8006 Task Order 18F4019, issued to HDR, Inc., Virginia Beach, Virginia. March 2019.

DeSorbo, C.R., C. Persico, and L. Gilpatrick. 2018. Studying migrant raptors using the Atlantic Flyway. Block Island Raptor Research Station, Block Island, RI: 2017 season.

DeSorbo, C.R., R.B. Gray, J. Tash, C.E. Gray, K.A. Williams, and D. Riordan. 2015 Offshore migration of Peregrine Falcons (*Falco peregrinus*) along the Atlantic Flyway. In Wildlife Densities and Habitat Use Across Temporal and Spatial Scales on the Mid-Atlantic Outer Continental Shelf: Final Report to the Department of Energy EERE Wind.

Dowling, Z.R., and D.I. O'Dell. 2018. Bat Use of an Island off the Coast of Massachusetts. Northeastern Naturalist 25:362-382.

Eckert, K.L., K.A. Bjorndal, F.A. Abreu Grobois, and M. Donnelly (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Eckert, S.A. 1998. Perspectives on the use of satellite telemetry and other electronic technologies for the study of marine turtles, with reference to the first year long tracking of leatherback sea turtles. In: Epperly S.P, Braun J, editors. Proceedings of the 17th Annual Sea Turtle Symposium. NOAA Technical Memorandum NMFS SEFC 415. National Marine Fisheries Service, Southeast Fisheries Science Center Miami, Florida: p. 294.

Engelhart, S.E., B.P. Horton, and A.C. Kemp. 2011. Holocene sea level changes along the United States' Atlantic Coast. Oceanography 24(2):70-79.

Engelhaupt, A., J.M. Aschettino, D. Engelhaupt, A. DiMatteo, M. Richlen, and M. Cotter. 2019. VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2018 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15 8006, Task Order 18F4082, issued to HDR Inc., Virginia Beach, Virginia. July 2019.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995. The winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56:547-568.

Faure, H., R.C. Walter, and D.R. Grant. 2002. The coastal oasis: Ice Age springs on emerged continental shelves. Global and Planetary Change. 33:47-56.

Federal Emergency Management Agency (FEMA). 2019. Flood Map Changes Viewer. Accessed 16 November 2020, Retrieved from: https://fema.maps.arcgis.com/apps/webappviewer/index.html?id=e7a7dc3ebd7f4ad39bb8e485bb64ce44.

Fugro Marine Geoservices, Inc. 2017. Geosciences-focused Desktop Study, Ocean Wind Farm, New Jersey Outer Continental Shelf. Prepared for: DONG Energy Wind Power A/S. May 16, 2017. Fugro Job No. 02.16031031.

Gambell, R. 1985. Sei whale *Balaenoptera borealis* (Lesson 1828). Pages 193-240 in S.H. Ridgway and R.J. Harrison, eds. Handbook of marine mammals. Volume 3: The sirenians and baleen whales. Academic Press, London, United Kingdom.

[redacted]

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. Habitat Mapping and Assessment of Northeast Wind Energy Areas. Sterling, VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017 088, 312.

Hain, J.H.W., M.A.M. Hyman, R.D. Kenney, and H.E. Winn. 1985. The role of cetaceans in the shelf edge region of the northeastern United States. *Marine Fisheries Review* 47:13-17.

Hatch, S.K., E.E. Connelly, T.J. Divoll, I.J. Stenhouse, and K.A. Williams. 2013. Offshore Observations of Eastern Red Bats (*Lasiurus borealis*) in the Mid-Atlantic United States Using Multiple Survey Methods. PLoS ONE 8:e83803.

Hayes, S.A., E. Josephson, K. Maze Foley, and P.E. Rosel. 2020. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019. NOAA Tech Memo NMFS NE 264; 479 pp.

ICF International. (2009). Current Methodologies in Preparing Mobile Source Port Related Emission Inventories. Current Methodologies in Preparing Mobile Source Port Related Emission Inventories. United States Environmental Protection Agency. Retrieved from https://www.epa.gov/sites/production/files/2016 06/documents/2009 port inventory-guidance.pdf

Johnson, J. A., J. Storrer, K. Fahy, and B. Reitherman. 2011a. Determining the potential effects of artificial lighting from Pacific Outer Continental Shelf (POCS) region oil and gas facilities on migrating birds. Prepared by Applied Marine Sciences, Inc. and Storrer Environmental Services for the U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulations and Enforcement. Camarillo, CA. OCS Study BOEMRE 2011 047:29 pp.

Kastelein, R.A., A.D. Goodson, J. Lien, and D. de Haan. 1995. The effects of acoustic alarms on Harbour porpoise (*Phocoena phocoena*) behaviour. Pages 157-167 in Nachtigall, P.E., Lien, J., Au, W.W.L. & Read, A.J., eds. *Harbour porpoises: Laboratory studies to reduce bycatch* Woerden, The Netherlands: De Spil Publishers.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia Journal of Science 38:329-336.

Kerlinger, P. 1985. Water crossing behavior of raptors during migration. Wilson Bulletin 97:109-113.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17:35-75.

iNaturalist. 2020. Available from https://www.inaturalist.org. Accessed 16 November 2020.

Loring, P., J. McLaren, P. Smith, L. Niles, S. Koch, H. Goyert, and H. Bai. 2018. Tracking movements of threatened migratory rufa Red Knots in U.S. Atlantic Outer Continental Shelf Waters. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-046. 145 p.

Márquez, M.R. 2001. Status and distribution of the Kemp's Ridley Turtle, *Lepidochelys kempii*, in the Wider Caribbean Region. In: Eckert, K.L., Abreu Grobois, F.A., Eds, Proceedings of the Regional Meeting: "Marine Turtle Conservation in the Wider Caribbean Region: A dialogue for Effective Regional Management," Santo Domingo, 16-18 November 1999. WIDECAST, IUCN MTSG, WWF & UNEP CEP., pp. 51 46.

Maslo, B., and K. Leu. 2013. The Facts about Bats in New Jersey. Cooperative Extension Fact Sheet FS1207. Retrieved from: https://njaes.rutgers.edu/fs1207/

McGrady, M.J., G.S. Young, and W.S. Seegar. 2006. Migration of a Peregrine Falcon *Falco peregrinus* over water in the vicinity of a hurricane. Ringing and Migration 23:80 84.

Mead, J.G., 1977. Records of sei and Bryde's Whales from the Atlantic coast of the United States, Gulf of Mexico, and the Caribbean. Reports of the International Whaling Commission, Special Issue 1:113 116.

Mid-Atlantic Regional Council on the Ocean (MARCO). Undated. Data Portal. Oceanography. Accessed: December 2020. Retrieved from: http://portal.midatlanticocean.org/data catalog/oceanography/.

Minerals Management Service. 2008. Cape Wind Energy Project Nantucket Sound Biological Assessment (Appendix G). In Cape Wind Energy Project Final EIS. p. 296.

Mojica, E.K., B.D. Watts, and C.L. Turrin. 2016. Utilization Probability Map for Migrating Bald Eagles in Northeastern North America: A Tool for Siting Wind Energy Facilities and Other Flight Hazards. Plos One 11(6):e0157807.

Morreale, S.J., A.B. Meylan, S.S. Sadove, and E.A. Standora. 1992. Annual occurrence and winter mortality of marine turtles in New York waters. Journal of Herpetology 26:301 308.

Morreale, S.J., E.A. Standora, F.V. Paladino, and J.R. Spotila. 1994. Leatherback migrations along deepwater bathymetric contours. Pages 109 110 n B.A. Schroeder and B.E. Witherington (compilers), Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology Conservation. NOAA Technical Memorandum NMFS SEFSC 341. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL.

Musick, J.A., and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles, p. 137-163. In: The biology of sea turtles. P.L. Lutz and J.A. Musick (eds.). CRC Press, Boca Raton, FL.

National Marine Fisheries Service (NMFS). 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS OPR-59.

National Marine Fisheries Service (NMFS). 2020. User Spreadsheet Tool (Version 2.1) for: 2018 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. Silver Spring, Maryland: Office of Protected Resources, National Marine Fisheries Service.

National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS). 1991. Recovery plan for U.S. population of Atlantic green turtle. Washington, D.C.: National Marine Fisheries Service.

National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS). 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. Washington, D.C.: National Marine Fisheries Service.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2020a. 2017-2020 North Atlantic Right Whale Unusual Mortality Event. National Oceanic and Atmospheric Administration. Accessed 10 November 2020 Retrieved from: https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2020-north-atlantic-right-whale-unusual-mortality-event

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2020b. NOAA Right Whale Sighting Advisory System. Accessed 10 November 2020, Retrieved from https://www.nefsc.noaa.gov/psb/surveys/MapperiframeWithText.html

Nehls, G. K. Betke, S. Eckelmann, and M. Ros 2007. Assessment and costs of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore windfarms. BioConsult SH report, Husum, Germany. On behalf of COWRIE Ltd.

Nelson, M., M. Garron, R.L. Merrick, R.M. Pace III, and T. Cole. 2007. Mortality and serious injury determinations for baleen whale stocks along the United States eastern seaboard and adjacent Canadian Maritimes, 2001 2005. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, Massachusetts.

[redacted]

New Jersey Board of Public Utilities (NJBPU). 2020. New Jersey Offshore Wind Strategic Plan Navigating Our Future. Prepared by Ramboll US Corporation. Princeton, New Jersey.

[redacted]

New Jersey Department of Environmental Protection (NJDEP). 2010a. Ocean/Wind Power Ecological Baseline Studies. Final Report. NJDEP Office of Science. July 2010. https://www.nj.gov/dep/dsr/ocean-wind/report.htm

New Jersey Department of Environmental Protection (NJDEP). 2010b. Ocean/Wind Power Ecological Baseline Studies January 2008 December 2009. Final Report. Prepared for New Jersey Department of Environmental Protection Office of Science by Geo-Marine, Inc., Plano, Texas. http://www.nj.gov/dep/dsr/ocean-wind/report.htm. July 2010.

New Jersey Department of Environmental Protection (NJDEP). 2012a. AMBIENT MONITORING NETWORK. Atlantic Water Region. Watershed Management Areas 12, 13, 14, and 15 Round 4 Benthic Macroinvertebrate Data. Volume 1 of 2. December 2012.

New Jersey Department of Environmental Protection (NJDEP). 2012b. AMBIENT MONITORING NETWORK. Raritan Water Region. Watershed Management Areas 7, 8, 9, and 10 Round 4 Benthic Macroinvertebrate Data. Volume 1 of 2. December 2012.

New Jersey Department of Environmental Protection (NJDEP). 2018. New Jersey's Endangered and Threatened Wildlife. Accessed 16 November 2020, Retrieved from: https://www.state.nj.us/dep/fgw/tandespp.htm.

New Jersey Department of Environmental Protection (NJDEP). 2019. Submerged Aquatic Vegetation https://www.nj.gov/dep/landuse/sav.html [Accessed 13 November 2020].

New Jersey Department of Environmental Protection (NJDEP). 2020. Monmouth Battlefield State Park Brochure. Division of Parks and Forestry, State Park Service. Accessed 24 November,

2020. Retrieved from: https://www.state.nj.us/dep/parksandforests/parks/maps/monbat-brochure-map.pdf.

New Jersey Department of Environmental Protection (NJDEP). 2020. Bureau of GIS, NJ GeoWeb. Retrieved from: Bureau of GIS (nj.gov).

New Jersey Department of State, Division of Elections. 2020. 2020 New Jersey Voter Information Portal. Accessed 24 November 2020. Retrieved from: https://www.state.nj.us/state/elections/vote by-mail.shtml.

New Jersey Department of State, Division of Travel and Tourism. 2020. Accessed 16 November 2020, Retrieved from: https://www.visitnj.org/city/asbury-park

Nisbet, I.C.T., R.R. Veit, S.A. Auer, and T.P. White. 2013. Marine Birds of the Eastern United States and the Bay of Fundy: Distribution, Numbers, Trends, Threats, and Management. In. No. 29. Nuttall Ornithological Club, Cambridge, MA.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2011. 2010 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC-11 009.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2012. 2011 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC-11 009.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2013. 2012 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC-11 009.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2014. 2013 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC-11 009.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2015. 2014 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North

Atlantic. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC-11 009.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2016. 2015 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean – AMAPPS II. Prepared by the National Marine Fisheries Service for Bureau of Ocean Energy Management under Interagency Agreement number M10PG00075 and between the U.S. Navy under Interagency Agreement number NEC 11 009.

Ocean Grove Area Chamber of Commerce. 2020. A Brief History of Ocean Grove. Accessed 16 November 2020, Retrieved from: https://www.oceangrovenj.com/about

[redacted]

Ogren, L.H. 1989. Distribution of immature and subadult Kemp's ridley turtles results from the 1984 1987 surveys. In C.W. Caillouet, Jr., and A.M. Landry, Jr. (editors), Proceedings of the First International Symposium of Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A&M University Sea Grant College (TAMU) SG 89 105:116 123.

Palka, D.L., S. Chavez Rosales, E. Josephson, D. Cholewiak, H.L. Haas, L. Garrison, M. Jones, D. Sigourney, G. Waring, (retired), M. Jech, E. Broughton, M. Soldevilla, G. Davis, A. DeAngelis, C.R. Sasso, M.V. Winton, R.J. Smolowitz, G. Fay, E. LaBrecque, J.B. Leiness, D.M. Warden, K. Murray, and C. Orphanides. 2017. Atlantic Marine Assessment Program for Protected Species: 2010 2014. USDOI BOEM, Atlantic OCS Region, Washington, DC. OCS Study BOEM 2017 071. 211 pp.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fishery Bulletin 88:687 696.

Peng, C., X. Zhao, and G. Liu. 2015. Noise in the Sea and Its Impacts on Marine Organisms. Int. J. Environ. Res. Public Health 12:12304 12323.

Pritchard, P.C.H., and R. Marquez. 1973. Kemp's ridley or Atlantic ridley, *Lepidochelys kempi*. IUCN Monograph 2. Morges, Switzerland: International Union for Conservation of Nature and Natural Resources.

Ramey, P.A., M.J. Kennish, and R.M. Petrecca. 2011. Benthic Index Development: Assessment of Ecological Status of Benthic Communities in New Jersey Marine Coastal Waters. Prepared for USEPA. Retrieved from: https://rucore.libraries.rutgers.edu/rutgers lib/44203/PDF/1/

Raoux, A., S. Tecchio, J.P. Pezy, G. Lassalle, S. Degraer, D. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, and K. Grangeré. 2017. Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning? Ecological Indicators 72:33 46.

Rees, D.R., D.V. Jones, and B.A. Bartlett. 2016. Haul-out Counts and Photo Identification of Pinnipeds in Chesapeake Bay, Virginia: 2015/16 Annual Progress Report. Final Report. Prepared for U.S. Fleet Forces Command, Norfolk, Virginia. November 2016.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc., San Diego, CA.

Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V. Cole, C.B. Khan, and W.A. McLellan. 2016. Habitat based cetacean density models for the U.S. Atlantic and Gulf of Mexico. Scientific Reports 6:22615.

Rubega, M.A., D. Schamel, and D.M. Tracy. 2000. Red necked Phalarope (*Phalaropus lobatus*), version 2.0. In The Birds of North America (P. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca.

Rudloe, A., J. Rudloe, and L. Ogren. 1991. Occurrence of immature Kemp's ridley turtles, *Lepidochelys kempi*, in coastal waters of northwest Florida. Northeast Gulf Science 12:49-53.

Ruser, A., M. Dähne, J Sundermeyer, K. Lucke, D.S. Houser, J.J. Finneran, J. Driver, and I. Pawliczka, T. Rosenberger, and U. Siebert. 2014. In air evoked potential audiometry of grey seals (*Halichoerus grypus*) from the North and Baltic Seas. PLos ONE 9(3):e90824.

Schmid, J.R. 1998. Marine turtle populations on the west-central coast of Florida: results of tagging studies at the Cedar Keys, Florida, 1986 1995. Fishery Bulletin 96:589 602.

Schoelkopf, R. 2006. Unpublished stranding data for 1995 2005. Marine Mammal Stranding Center.

Schofield, O., R. Chant, B. Cahill, R. Castelao, D. Gong, A. Kahl, J. Kohut, M. Montes-Hugo, R. Ramadurai, P. Ramey, X. Yi, and S. Glenn. 2008. The decadal view of the mid Atlantic Bight from the COOLroom: is our coastal system changing? Oceanography 21(4):108 117.

Scott, T.M., and S. Sadove. 1997. Sperm whale, *Physeter macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. Marine Mammal Science 13:317 321.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43 67.

Slocum, C.J., A. Ferland, N. Furina, and S. Evert. 2005. What do harbor seals eat in New Jersey? A first report from the Mid-Atlantic region (USA). Page 262 in Abstracts, 16th Biennial Conference on the Biology of Marine Mammals. San Diego, CA, 12 16 December 2005.

Slocum, C.J. and M. Davenport. 2009. Marine conservation: Assessing threats, and characterizing habitats of harbor seals *(Phoca vitulina concolor*; Phocidae) in southern New Jersey (USA). Page 236 in Abstracts, 18th Biennial Conference on the Biology of Marine Mammals. Quebec City, Canada. 12 16 October 2009.

Smultea Environmental Sciences. 2018. Protected Species Observer Technical Report OCW01 Geotechnical Investigation 1A. New Jersey (2017 & 2018). DRAFT. August 9, 2018. Prepared for Fugro USA Marine, Inc., and Offshore Wind, LLC.

Spotila, J.R. 2004. Sea Turtles: A Complete Guide to Their Biology, Behavior, and Conservation. Johns Hopkins University Press, Baltimore, MD.

Stenhouse, I.J., W.A. Montevecchi, C.E. Gray, A.T. Gilbert, C.M. Burke, and A.M. Berlin. 2017. Occurrence and Migration of Northern Gannets Wintering in Offshore Waters of the Mid-Atlantic United States. In Determining Fine scale Use and Movement Patterns of Diving Bird Species in Federal Waters of the Mid- Atlantic United States Using Satellite Telemetry (C. S. Spiegel, Editor). U.S. Department of the Interior, Bureau of Ocean Energy Management, Division of Environmental Sciences, Sterling, Virginia.

Stinson, M.L. 1984. Biology of sea turtles in San Diego Bay, California, and in the northeastern Pacific Ocean. Master's thesis, San Diego State University.

Thomas Edison Center at Menlo Park. 2020. Accessed 24 November 2020, Retrieved from: https://www.menloparkmuseum.org/.

Thomsen, F., K. Lüdemann, R. Kafemann, and W. Piper. 2006. Effects of offshore wind farm noise on marine mammals and fish. Biola, Hamburg, Germany on behalf of COWRIE Ltd, 62.

Tracy, D.M., D. Schamel, and J. Dale. 2002. Red Phalarope (*Phalaropus fulicarius*), version 2.0. In The Birds of North America (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca.

United States Army Corps of Engineers (USACE). 2017. Benthic Recovery Monitoring Report Contract Areas S AK 2 and S AK 3. Final Report. Prepared for the United States Army Corps of Engineers – New York District.

United States Department of Energy (USDOE). 2015. Final Environmental Assessment for the Fishermen's Atlantic City Windfarm.

United States Environmental Protection Agency (USEPA). 2016. Impaired Waters and TMDLs. New Jersey Impaired Waters List Documents 2016 Final New Jersey Integrated Report. Accessed 24 November 2020, Retrieved from https://www.epa.gov/tmdl/new jersey-impaired-waters list documents

United States Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards. (2018). 2014 National Emissions Inventory, version 2 Technical Support Document. 2014 National Emissions Inventory, version 2 Technical Support Document. Retrieved from https://www.epa.gov/sites/production/files/2018-07/documents/nei2014v2_tsd _05jul2018.pdf

United States Environmental Protection Agency (USEPA) Office of Transportation and Air Quality. 2000. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data.

Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi/P1009Z2K.PDF?Dockey=P1009Z2K.PDF

United States Fish and Wildlife Service (USFWS). 2020. National Wetlands Inventory, Wetland Mapper. Retrieved from: Wetlands Mapper (fws.gov).

US Census. 2019. American Community Survey 2019, Table DP-04, Selected Housing Characteristics. Accessed 16 November 2020, Retrieved from: https://data.census.gov/cedsci/table?q=Housing&g=0400000US34_0500000US34023,34025&tid=ACSDP1Y2019.DP04&moe=false&hidePreview=true.

US Census. 2020. Quick Facts. Accessed 16 November 2020 and 24 November 2020 at https://www.census.gov/quickfacts/fact/table/US/PST045219

Wahlberg, M. and H. Westerberg. 2005. Hearing in fish and their reactions to sounds from offshore wind farms. Marine Ecology Progress Series 288:295 309.

Watson, J.D. Foster, S. Epperly, and A. Shah. 2004. Experiments in the Western Atlantic Northeast Distant Waters to Evaluate Sea Turtle Migration in the Pelagic Longline Fishery. Report on Experiments Conducted in 2001 2003. U.S National Marine Fisheries Service, Pascagoula, MS.

Whitt, A., K. Dudzinski, and J. Laliberté. 2013. North Atlantic right whale distribution and seasonal occurrence in nearshore waters off New Jersey, USA, and implications for management. Endangered Species Research 20:59 69.

Williams, K.A., E.E. Connelly, S.M. Johnson, and I.J. Stenhouse. 2015. Wildlife Densities and Habitat Use Across Temporal and Spatial Scales on the Mid Atlantic Outer Continental Shelf: Final Report to the Department of Energy EERE Wind & Water Power Technologies Office, Award Number: DE EE0005362. Report BRI 2015 11. In. Biodiversity Research Institute, Portland, Maine.

Winship, A.J., B.P. Kinlan, T.P. White, J.B. Leirness, and J. Christensen. 2018. Modeling At Sea Density of Marine Birds to Support Atlantic Marine Renewable Energy Planning: Final Report. OCS Study BOEM 2018-010. Sterling, VA. 67 pp.

Winton, M.V., G. Fay, H.L. Haas, M. Arendt, S. Barco, M.C. James, C. Sasso and R. Smolowitz. 2018. Estimating the distribution and relative density of satellite tagged loggerhead sea turtles using geostatistical mixed effects models. Marine Ecology Progress Series 586:17 232.

Wood, S.A., T.R. Frasier, B.A. McLeod, J.R. Gilbert, B.N. White, W.D. Bowen, M.O. Hammill, G.T. Waring, and S. Brault. 2011. The genetics of recolonization: an analysis of the stock structure of grey seals (*Halichoerus grypus*) in the northwest Atlantic. Canadian Journal of Zoology 89:490 497.

Attachment 9.2 – Visualizations

December 2020

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