Appendix I. Environmental and Physical Settings

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

I.1. General Regional Setting

I.2. Climate and Meteorology

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

I.2.1 Regional Climate Overview

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

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

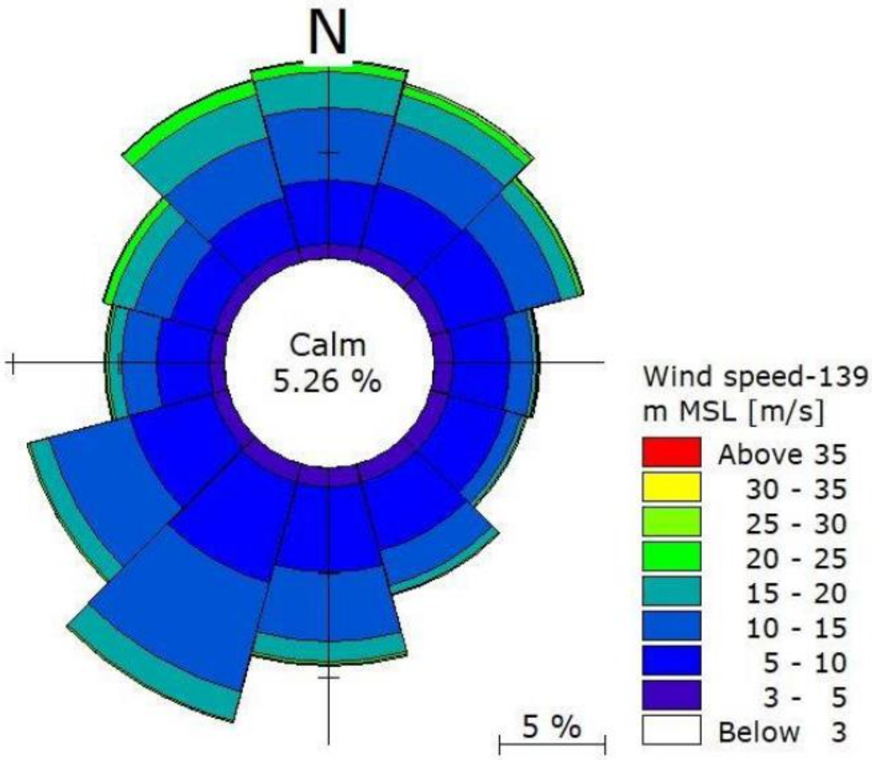
The North Atlantic Oscillation (NAO) also affects climate in the Northwest Atlantic on the scale of decades (Townsend et al. 2004). The NAO is calculated as the wintertime pressure difference between the high-pressure system over the Azores Islands and the low-pressure system over Iceland (Townsend et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

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

I.2.2 Winds

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

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



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

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

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

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

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

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

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

Table I-1 Representative Wind Speed Data

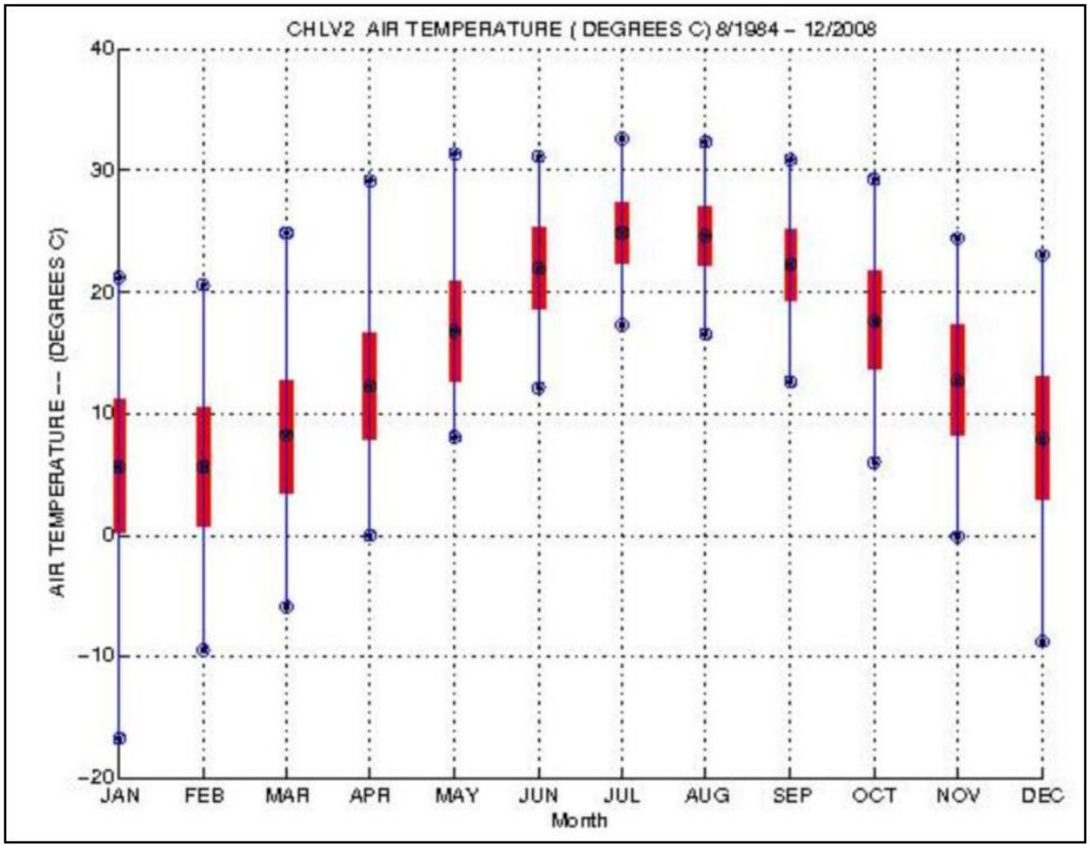
Month	Monthly Average Wind Speed (1984–2008)		Monthly Average of Hourly Peak Gust (1990–2005)		Monthly Maximum Hourly Peak Gust (1990–2005)	
	mph	m/s	mph	m/s	mph	m/s
January	19.1	8.5	23.8	10.6	79.2	35.4
February	18.6	8.3	23.1	10.3	75.1	33.6
March	18.8	8.4	23.2	10.4	83.0	37.1
April	18.5	8.3	23.4	10.5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

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

I.2.3 Air Temperature and Precipitation

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

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



Source: NOAA 2020 as cited in BOEM 2021b.

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

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

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

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

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

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

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

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

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

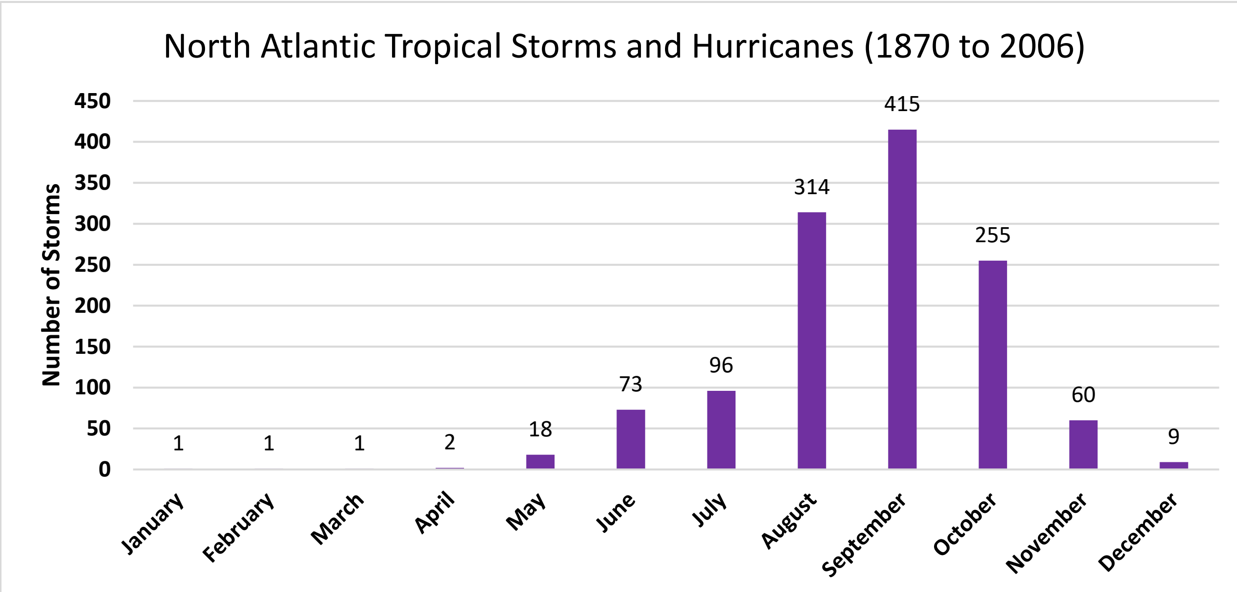
I.2.4 Extreme Storm Events

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

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

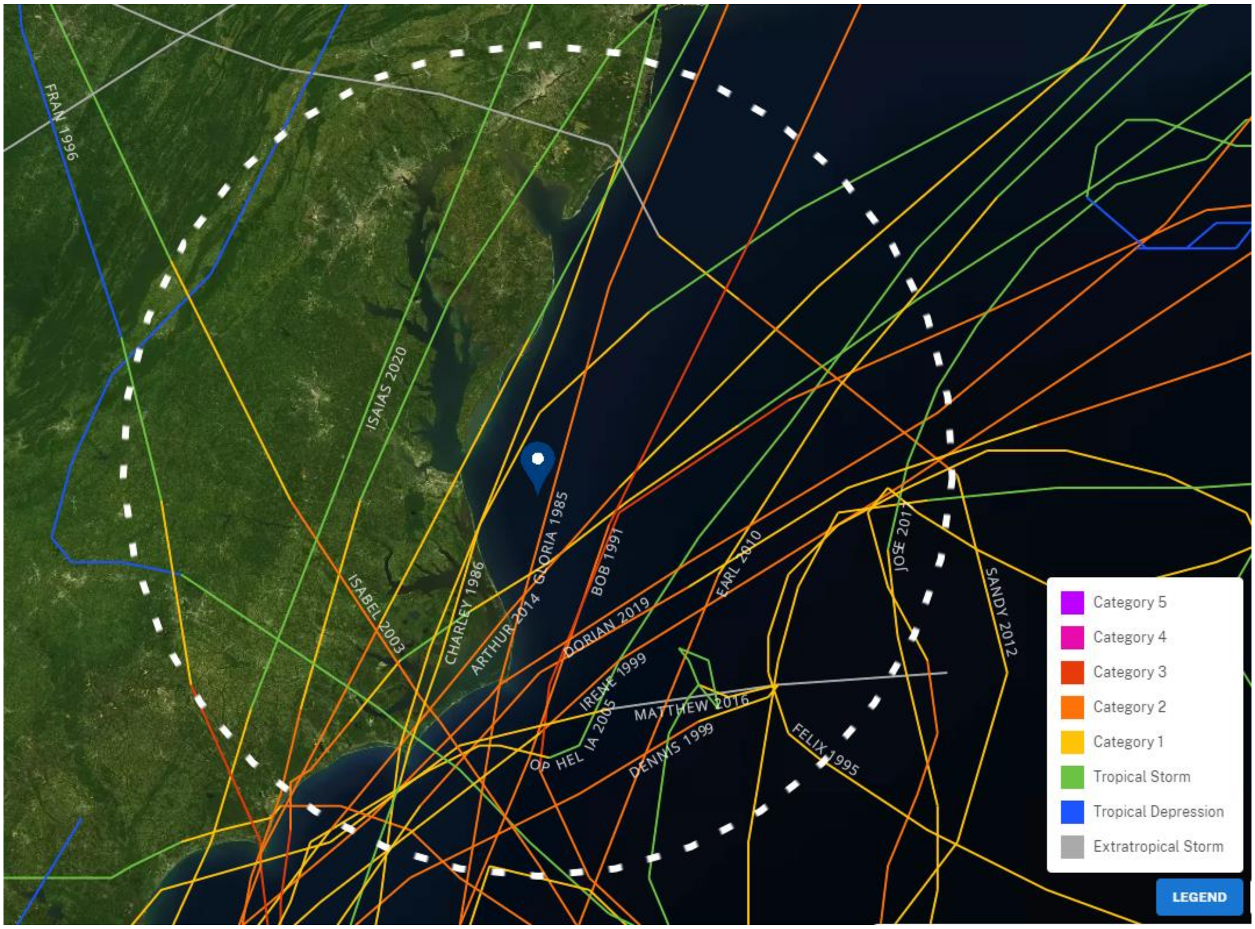
Figure I-4 identifies the hurricane tracks surrounding the Lease Area between 1984 and 2020 (NOAA 2021). Though data on tropical systems go back to 1851, the quality and consistency of the data are lacking the further back one looks. The analyzed storm period was selected based on the availability of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

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



Source: McAdie et al. 2009

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



Source: NOAA 2021

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

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

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

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

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

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

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

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

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

Table I-5 Representative Seasonal Mixing Height Data

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

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

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

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

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

I.3. Water Quality

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

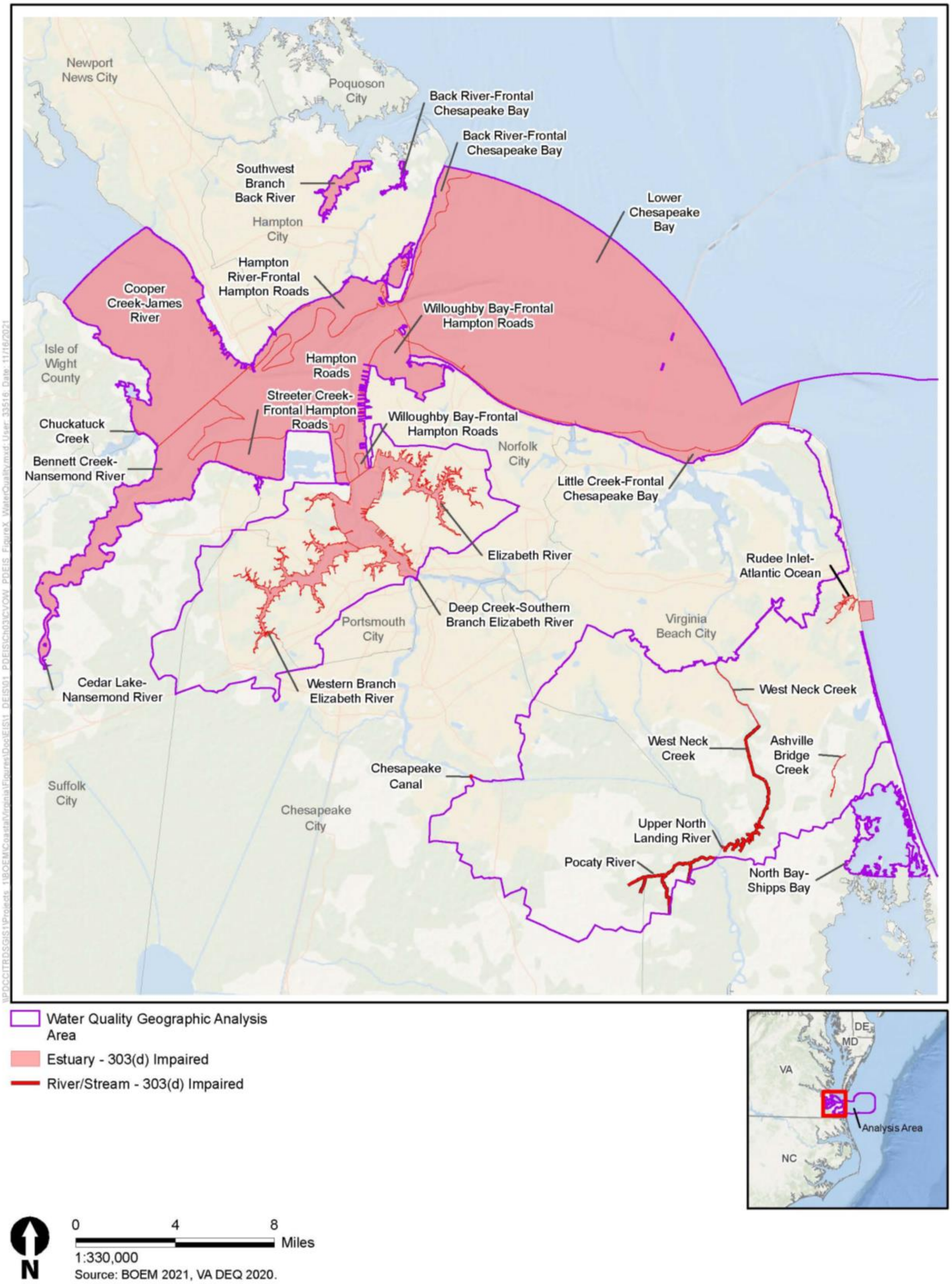


Figure I-5 303(d) Impaired Surface Waters in the Water Quality Geographic Analysis Area

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

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

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

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

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

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

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

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

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

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

Source: VDEQ 2020.

I.4. Wetlands

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

I.4.1 North Landing River

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

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

I.4.2 Gum Swamp

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

I.4.3 West Neck Creek (Upper and Lower)

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

I.4.4 Pocaty River

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

I.5. Navigation and Vessel Traffic

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

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

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

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

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

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

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

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

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

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

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

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

I.6. References Cited

I.6.1 Wetlands

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