CUMULATIVE HISTORIC RESOURCES VISUAL EFFECTS ANALYSIS – EMPIRE WIND OFFSHORE WIND FARM PROJECT

Prepared for

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Abstract

The Bureau of Ocean Energy Management (BOEM) requested that ICF prepare a cumulative historic resources visual effects analysis (CHRVEA) for the Empire Wind Projects (Projects). The Projects have the potential to contribute to the cumulative visual effects on historic properties in combination with the potential effects of other proposed actions, most specifically other offshore wind energy development activities proposed in lease areas adjacent to the Projects. Where BOEM has determined that the Projects have the potential to result in adverse visual effects on historic properties, this CHRVEA analyzes further where the effects of other reasonably foreseeable development activities may be additive to those of the Projects, resulting in cumulative effects. In considering the potential for cumulative visual effects of the Projects on historic properties, the CHRVEA assists BOEM in complying with Section 106 of the National Historic Preservation Act (NHPA), as amended (at 54 United States Code 306108), and its implementing regulations (36 Code of Federal Regulations [CFR] 800). This includes meeting the requirements of NHPA Section 110(f) for protecting National Historic Landmarks (NHL), pursuant to 36 CFR 800.10.

The Analysis of Visual Effects to Historic and Architectural Properties (AVEHAP) report prepared specific to the Projects and updated in May 2022 identified historic properties within the Area of Potential Effects (APE) for visual effects analysis, the area within which adverse visual effects could result from wind turbine generator (WTG) installation. The AVEHAP recommended potential adverse effects on historic properties resulting from the proposed Projects (Construction and Operations Plan [COP] Volume 3, Appendix Z; Empire 2022).

In addition to the AVEHAP, the *Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) EW 2 Onshore Substation C Characterization Report* evaluated visual impacts on historic properties resulting from addition of an Empire Wind 2 Project (EW 2) Substation C optional location and recommended no additional adverse effects on historic properties (Tetra Tech 2021).

BOEM, in review of the AVEHAP and information and comments received from consulting parties, determined the Projects would result in adverse effects on 16 historic properties in New York and New Jersey that were either previously determined eligible or recommended eligible for the National Register of Historic Places (NRHP):

1. West Bank Light Station in Staten Island, New York
2. Breezy Point Surf Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
3. Silver Gull Beach Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
4. Jacob Riis Park Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
5. Jones Beach State Park, Parkway and Causeway System, Hempstead/Oyster Bay, New York
6. Robert Moses State Park in Babylon/Islip, New York
7. Fire Island Lighthouse in Fire Island National Seashore, Islip, New York (National Park Service)
8. Fire Island Light Station Historic District in Fire Island National Seashore, Islip, New York (National Park Service)
9. Carrington House in Fire Island National Seashore, Brook Haven, New York (National Park Service)
10. Point O'Woods Historic District in Islip, New York
11. Romer Shoal Light Station in Lower New York Bay, New Jersey

12. Sandy Hook Light in Gateway National Recreation Area, Middleton, New Jersey (National Park Service)
13. Fort Hancock, U.S. Life Saving Station in Gateway National Recreation Area, Highlands, New Jersey (National Park Service)
14. Allenhurst Residential Historic District in Allenhurst, New Jersey
15. Ocean Grove Camp Meeting Association District in Ocean Grove, New Jersey
16. Water Witch (Monmouth Hills) Historic District in Middleton, New Jersey

For each of the 16 historic properties clear ocean views are considered a character-defining feature of each property's significance (COP Volume 3, Appendix Z; Empire 2022).

Where BOEM has determined that the Projects would result in adverse visual effects on historic properties, this CHRVEA further analyzes where the effects from other offshore wind energy development activities may be additive to the adverse visual effects from the Projects, resulting in cumulative effects. Cumulative visibility of the WTGs and other offshore wind energy development activities is anticipated to intensify the level of adverse effect on the 16 historic properties. WTGs associated with the Projects would represent 57 to 100 percent of the total WTGs visible from each property, and WTGs associated with other offshore wind energy development activities would represent 0 to 43 percent of the total WTGs visible from each property. For six of the historic properties, WTGs associated with the Projects would represent 100 percent of the total WTGs visible.

The conclusions herein are ICF's recommendations regarding the Projects' WTGs' incremental contribution to cumulative visual effects (daytime and nighttime) on historic properties when combined with past, present, and reasonably foreseeable offshore wind energy development activities in the APE for the Projects. These recommendations are provided to inform BOEM's determination of Project effects on historic properties and consultation on any effects found. Where BOEM has made its determination in the *Finding of Adverse Effect for the Empire Wind Construction and Operations Plan*, this determination is expressed consistently in the CHRVEA. While Section 106 consultation is ongoing among BOEM, State Historic Preservation Officers, and other identified consulting parties on the Projects, final determinations remain with BOEM in accordance with 36 CFR 800. This includes ongoing consultation with Native American tribes that may identify properties of traditional cultural and religious significance in the APE.

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1 INTRODUCTION

This cumulative historic resources visual effects analysis (CHRVEA) assesses the contribution of the Empire Wind Projects (the Projects) to cumulative visual effects on historic properties. Cumulative effects on historic properties are the incremental effects that the Projects could have when added to other past, present, or reasonably foreseeable future actions, regardless of which agency or person undertakes the actions (40 Code of Federal Regulations [CFR] 1508.7). Where the Bureau of Ocean Energy Management (BOEM) has determined that the Projects have the potential to result in adverse visual effects on historic properties, this CHRVEA analyzes further where the effects of other reasonably foreseeable development activities may be additive to those of the Projects, resulting in cumulative effects. The CHRVEA focuses on cumulative visual effects on historic properties.

1.1 Project Background

BOEM is the lead federal agency responsible for the decision on whether to approve, approve with modifications, or disapprove the Projects' construction and operations plan (COP) pursuant to 43 United States Code 1332(3). To further inform that decision, BOEM requested that ICF prepare a CHRVEA to assist in BOEM's compliance with Section 106 of the National Historic Preservation Act (NHPA), as amended (54 United States Code 306108), and its implementing regulations (36 CFR 800).

In the COP, Empire Offshore Wind, LLC (Empire) proposes to develop a commercial-scale offshore wind energy facility in BOEM Lease Area OCS-A 0512 (Lease Area) with up to 147 wind turbine generators (WTG) (57 in EW 1 and 90 in EW 2), up to two offshore substations, interarray cables linking the individual turbines to the offshore substations, substation interconnector cables linking the substations to each other, offshore export cables, an onshore export cable system, two onshore substations to be located in Brooklyn and Oceanside or Island Park, New York, and connections to the existing electrical grid in New Jersey and New York. Empire plans to install the Projects by 2027.

In addition to the proposed Projects, BOEM has identified 10 types of actions that could result in cumulative effects on the human environment, including historic properties: (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) marine minerals use and ocean-dredged material disposal; (5) military use; (6) marine transportation; (7) fisheries use and management; (8) global climate change; (9) oil and gas activities; and (10) onshore development activities, such as onshore wind turbines, telecommunications towers, planned projects in town master plans, and railroad/railroad station improvements.

Of the above actions, the visual effects from other offshore wind energy development activities in BOEM lease areas adjacent to the Projects (Figure 1) pose the greatest potential for cumulative effects on historic onshore properties when combined with those identified for the Projects (Figure 2). The following discussion presents the reasonably foreseeable cumulative visual effects associated with other offshore wind energy development activities and the Projects.

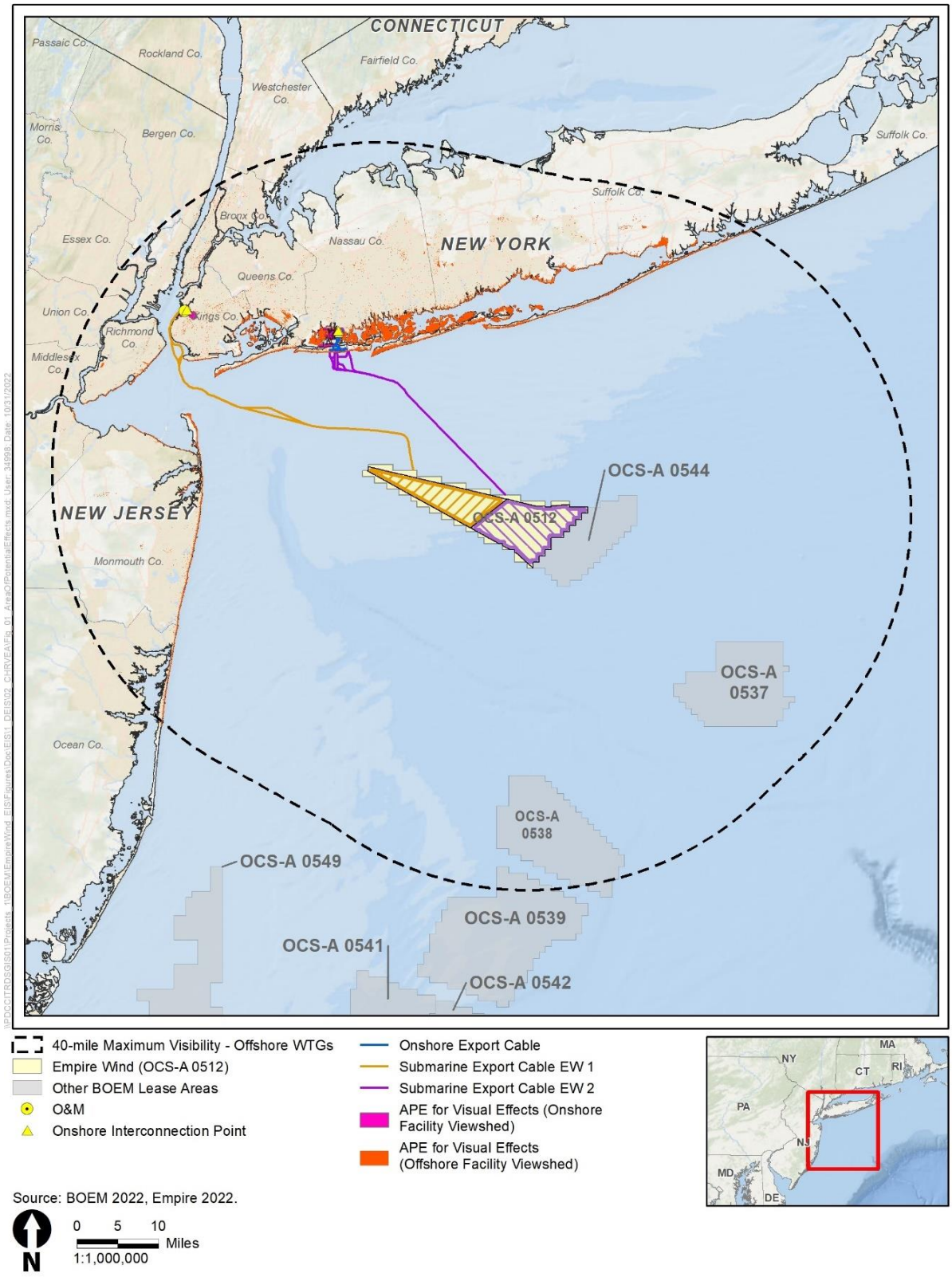

Figure 1 **Area of Potential Effects for Visual Effects Analysis within the Maximum Distance for Potential Visibility of Project Facilities**

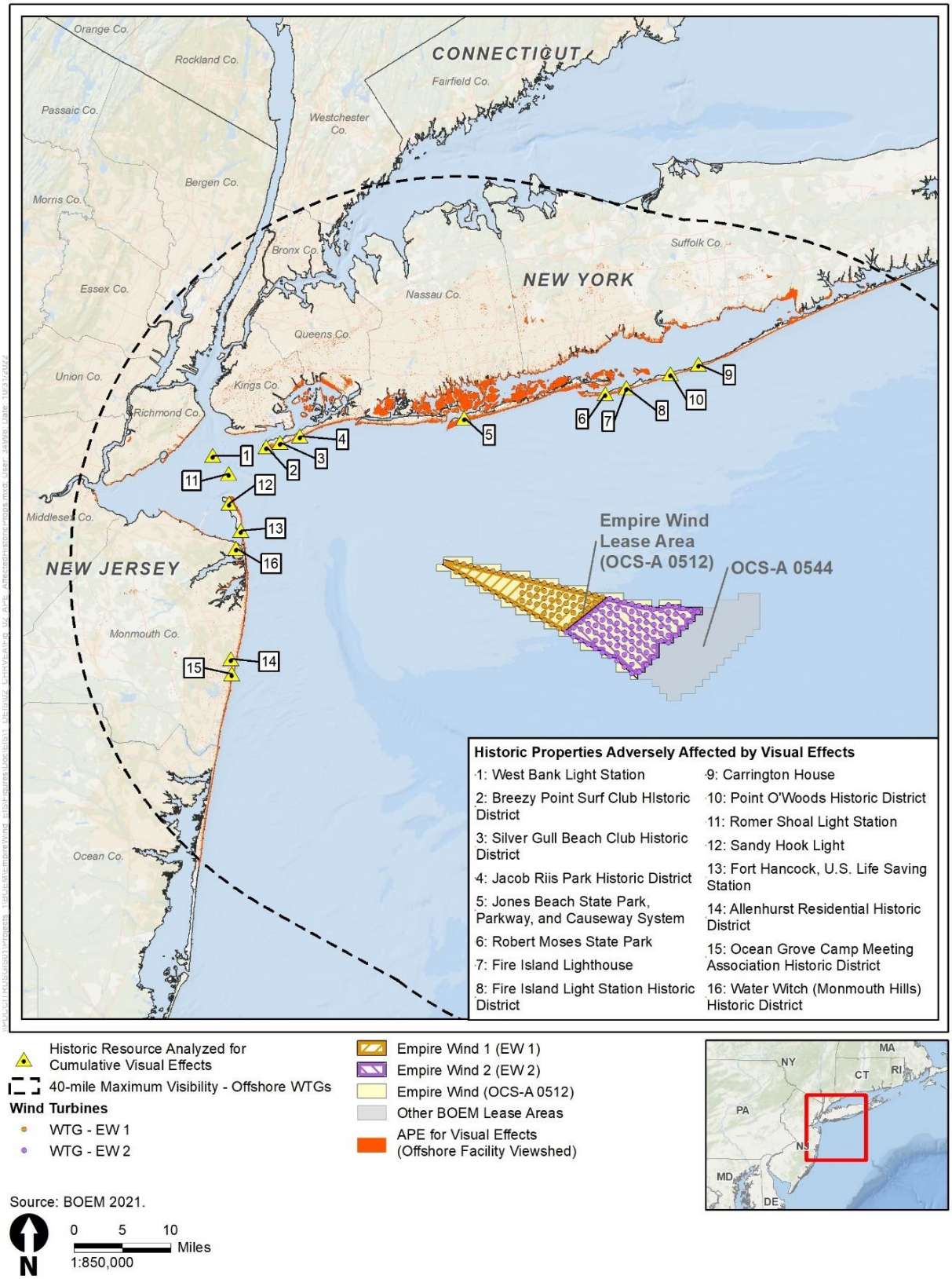

Figure 2 **Area of Potential Effects with Affected Historic Properties in New York and New Jersey**

1.2 Area of Potential Effects and Historic Properties Identified

Visual effects from the Projects have the potential to adversely affect historic properties within the Area of Potential Effects (APE) that BOEM has defined for the Projects. The APE encompasses the viewshed from which renewable energy structures would be visible, whether offshore or onshore (see Figure 1 and Figure 2). The APE for visual effects analysis for the Projects includes onshore coastal areas of New York and New Jersey. Geographic information system analysis and subsequent field investigation delineated the viewshed APE methodically through a series of steps, beginning with the maximum theoretical distance that WTGs could be visible (COP Volume 3, Appendix Z; Empire 2022). This was determined by first taking into account the visibility of a WTG from the water level to the tip of an upright rotor blade at a height of 951 feet. This analysis next accounted for how distance and curvature of the Earth impede visibility as space increases between the viewing point and WTGs (i.e., by a 40-mile distance, even blade tips would be below the sea level horizon line). The mapping effort then removed all areas analyzed with obstructed views toward the Projects' WTGs, such as those impeded by intervening topography, vegetation, and structures. Areas with unobstructed views of offshore Project elements then composed the APE (see shaded APE areas for the Project viewshed on Figure 2).

BOEM reviewed and confirmed that the visual Preliminary APE presented in the Analysis of Visual Effects to Historic and Architectural Properties (AVEHAP) (COP Volume 3, Appendix F-3; Empire 2022) accurately delineated the visual APE. Therefore, the visual APE is the same as the Preliminary APE identified in the AVEHAP. BOEM provided notification of its determination of the APE to consulting parties on November 18, 2022. BOEM's determination of the APE was documented in the *Area of Potential Effects Delineation Memorandum for Empire Wind Offshore Wind Farm Project*. The visual APE is also described in the *Finding of Adverse Effect for the Empire Wind Construction and Operations Plan,* which was also provided as Appendix N of the Draft EIS.

Generally, the offshore visual APE in New York extends from Fire Island in Suffolk County, New York in the east to the southeastern coastline of Richmond County, New York in the west and includes the various Long Island barrier islands (Jones Beach Island, Long Beach, Rockaway Beach) and select inland areas in Kings County and Richmond County with views across the Lower New York Bay opening to the Atlantic Ocean. In New Jersey the offshore visual APE extends from the Lower New York Bay in the north to the mouth of the Manasquan River in the south and includes the Sandy Hook Peninsula and eastern coastline of Monmouth County, New Jersey. The onshore visual APEs in New York include a 2-mile boundary around the Brooklyn, New York substation location (Empire Wind 1 Project [EW 1] onshore substation and O&M facility) and the Nassau County substation locations (Empire Wind 2 Project [EW 2] onshore substation location A in Oceanside, New York, or location C in Island Park, New York). Cumulative visual effects associated with the Projects in combination with other planned offshore wind energy development activities in adjacent BOEM offshore wind lease areas were assessed within the APE. Effects on historic properties outside the APE were not assessed.

The APE for visual effects for the Projects was previously analyzed for Project-specific effects in the AVEHAP) (COP Volume 3, Appendix F-3; Empire 2022), which included onshore and offshore Project elements. Beyond visual effects from WTGs, the AVEHAP study did not identify adverse visual effects on historic properties from other Project facilities, such as the onshore substation locations or associated overhead grid connections. The AVEHAP recommended potential adverse effects on historic properties resulting from the proposed Projects (COP Volume 3, Appendix F-3; Empire 2022). In addition to the AVEHAP, the *Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) EW 2 Onshore Substation C Characterization Report* evaluated visual impacts on historic properties resulting from the addition of an EW 2 Substation C optional location and recommended no additional adverse effects on historic properties (Tetra Tech 2021).

BOEM reviewed the AVEHAP and the *Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) EW 2 Onshore Substation C Characterization Report*, as well as information and comments received from consulting parties and meetings, in determining effects on all historic properties identified in the APE. This cumulative effects analysis addresses those historic properties BOEM found to be adversely affected by visual effects from the Projects.

Visual effects on historic properties tend to especially risk the alteration of characteristics that qualify a property for inclusion in the National Register of Historic Places (NRHP) when these effects diminish integrity of setting, feeling, or association of that property. The National Park Service (NPS) defines *setting, feeling,* and *association* as follows (NPS 1997):

1. Setting is the physical environment of a historic property and refers to the character of the place in which the property played its historical role. The physical features that constitute the setting of a historic property can be either natural or human made, including such elements as topographic features, vegetation, human-made features/landscape structures, and relationships between buildings and other features or open space. These features and their relationships are considered between the property and its outside surroundings as well as inside the boundaries of the property.
2. Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character. A historic property retaining original design, materials, workmanship, and setting might relate the feeling of its historic period of significance—its historic feel.
3. Association is the direct link between an important historic event or person and a historic property. A property retains association if it is the place where the event or activity occurred and is sufficiently intact to convey that relationship to an observer. Like feeling, association requires the presence of physical features that convey a property's historic character.

The AVEHAP analyzed 49 historic properties in the offshore visual APE for effects. Of these, 16 were identified as having a maritime setting that directly contributes to the property's NRHP eligibility, including significant open seaward views that support the integrity of the maritime setting, which are oriented toward the Project WTGs. As such, BOEM, in its review of the AVEHAP, determined adverse effects from visual impacts on 16 historic properties:

1. West Bank Light Station in Staten Island, New York
2. Breezy Point Surf Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
3. Silver Gull Beach Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
4. Jacob Riis Park Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
5. Jones Beach State Park, Parkway and Causeway System, Hempstead/Oyster Bay, New York
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9. Carrington House, Fire Island National Seashore, Brook Haven, New York (National Park Service)
10. Point O'Woods Historic District in Islip, New York
11. Romer Shoal Light Station in Lower New York Bay, New Jersey
12. Sandy Hook Light in Gateway National Recreation Area, Middleton, New Jersey (National Park Service)

13. Fort Hancock, U.S. Life Saving Station in Gateway National Recreation Area, Highlands, New Jersey (National Park Service)
14. Allenhurst Residential Historic District in Allenhurst, New Jersey
15. Ocean Grove Camp Meeting Association District in Ocean Grove, New Jersey
16. Water Witch (Monmouth Hills) Historic District in Middleton, New Jersey

Appendix A provides a description, historic character, and basis for NRHP eligibility of the 16 historic properties with adverse effects from the Projects. Figure 2 shows the locations of each property within the APE.

This CHRVEA specifically analyzes cumulative adverse effects on historic properties where BOEM has determined adverse visual effects could result from the Projects. In addition to the proposed Project WTGs, this CHRVEA assesses where the WTGs proposed for other planned offshore wind energy development activities may combine with the Projects to produce cumulative visual effects on historic properties in the APE.

1.3 Cumulative Visual Effects Analysis

Modeling for the AVEHAP mapped the maximum area of potential onshore visibility to the Project WTGs within which historic properties may occur (COP Volume 3, Appendix Z; Empire 2022). Modeling for the CHRVEA next established the maximum potential number and positioning of the Project WTGs and other actions' WTGs cumulatively visible from the historic properties.

1.3.1 Modeling Viewshed and Cumulative Wind Turbine Generator Visibility

Modeling viewshed and WTG visibility is a multi-step process. The method applied for initial Project-level viewshed modeling is as described in the following summary from the AVEHAP (COP Volume 3, Appendix Z; Empire 2022:14, 11):

> An initial analysis was conducted using ESRI ArcGIS Pro 2.2.0 software with the Spatial Analyst extension to process 10-meter Digital Elevation Models based on the National Elevation Dataset and height zones of visible components of the wind turbines (foundation, entire rotor swept area, hub, and maximum blade tip). The initial topographic viewshed assumed "bare earth" conditions and was developed from wind turbine locations looking out to determine areas with potential visibility. The initial viewshed accounted for both curvature of the earth and refraction, using the default values identified in the software. Figure Z-5 is a scaled graphic, showing the wind turbines at varying distances based on a photograph from a coastal beach location. A 40-mi (64 km) AVEHAP Offshore Study Area around the Lease Area was used as a conservative estimate of minimal visibility as a starting point for identifying the Offshore AVEHAP PAPE. The location and extent of the AVEHAP Offshore Study Area is illustrated in Figure Z-6.

Additional desktop analysis applied in the AVEHAP analysis included (COP Volume 3, Appendix Z; Empire 2022:14, 11–12):

> The viewshed model represents a best management practices approach to delineating the PAPE. The computer-generated viewshed is a close approximation of zones of Project visibility and is considered to conservatively define the PAPE. However, the viewshed model inherently displays some misrepresentation of actual Project views due to an imperfect rendering of existing conditions on the ground. To better understand this gap between modeled views and actual views, and to delineate areas of the PAPE that would be most likely to contain historic properties vulnerable to visual adverse effects, the AVEHAP team conducted additional analysis. This additional analysis consisted of desktop Google Earth Street View examination of Project-facing views along regularly spaced transects. These transects followed streets, in New Jersey moving

> westward from the shoreline and in New York, generally moving northward from the shoreline. NRHP-listed, eligible and unevaluated properties were used as station points along each transect, with the objective of determining the most inland point along a transect that would have an ocean view, and thus a possible Project view.

Based on this analysis, the AVEHAP concluded (COP Volume 3, Appendix Z; Empire 2022:12):

> As distance from the shoreline increases, the predominant Project view becomes those from rooftops or upper stories in tall buildings. Increased distance also lessens direct associations with maritime settings and introduces previously altered foreground viewsheds that represent only small, incremental change compared with existing conditions. The ground-truthing indicated that the portion of the PAPE with the clearest views of the ocean in the direction of the Project tends to extend from the shoreline inland a distance of approximately 0.3 to 0.5 mi (0.5 to 0.8 km), depending on location. Elevated terrain in New Jersey occurs in the Atlantic (Navesink) Highlands in New Jersey within a zone extending inland from approximately 0.45 mi (0.7 km) to 0.7 mi (1.1 km). Sections of the Ronkonkoma and Harbor Hill terminal moraines on Long Island, and the bedrock-cored hills of Washington Heights in Manhattan and High Bridge section in the Bronx, have been identified as containing historic and architectural properties with attenuated, or partial Project views.

The AVEHAP also reviewed field photographs and visual simulations (COP Volume 3, Appendix Z; Empire 2022:13):

> Photographic simulations (simulations) were created to depict the Project components and their potential changes to the existing landscape. The simulations were used to determine the level of contrast between the existing landscape and the expected landscape after the Project is implemented. Four Key Observational Points (KOPs) were selected for development of simulations to demonstrate how the constructed Project will appear to future viewers; Sandy Hook–North Beach, Ocean Grove Beach, Jacob Riis Park, and Fire Island. A simulation was created for each selected KOP depicting the representative wind turbines. A nighttime simulation was also completed for the KOPs.

Cumulative effects modeling was based on technical specifications and Project layouts or layout criteria provided by BOEM for potential locations where WTGs for the Projects and all other offshore wind lease areas (within 40 miles around the Projects) could be visible from historic properties (Figure 3). The cumulative WTG visibility assessment considered the combined, simultaneous visibility from the APE of potentially visible WTG locations on offshore wind lease area grids associated with Empire Wind (Lease Area OCS-A 0512), Vineyard Mid-Atlantic LLC (OCS-A 0544), OW Ocean Winds East LLC (OCS-A 0537), and Atlantic Shores North (OCS-A 0549). Turbines are counted as "visible" if the computer model determines a single point on the component would be seen from the eye level of a window, observation deck, or ground location. In addition to height of the viewer at each of the 16 historic properties, the analysis also considered height of the WTGs, earth curvature, and distance between the historic properties and WTGs. WTG height varied among the Projects, which propose WTGs with a blade tip height of 951 feet, and the other offshore wind energy development activities, which propose WTGs with blade tip heights ranging from 853 feet (260 meters) to 1,049 feet (319 meters) (maximum blade tip elevation above flat sea surface) (Figure 4). This maintains consistency with the "reasonably foreseeable future offshore WTGs" analyzed in the Draft Environmental Impact Statement (BOEM 2022).

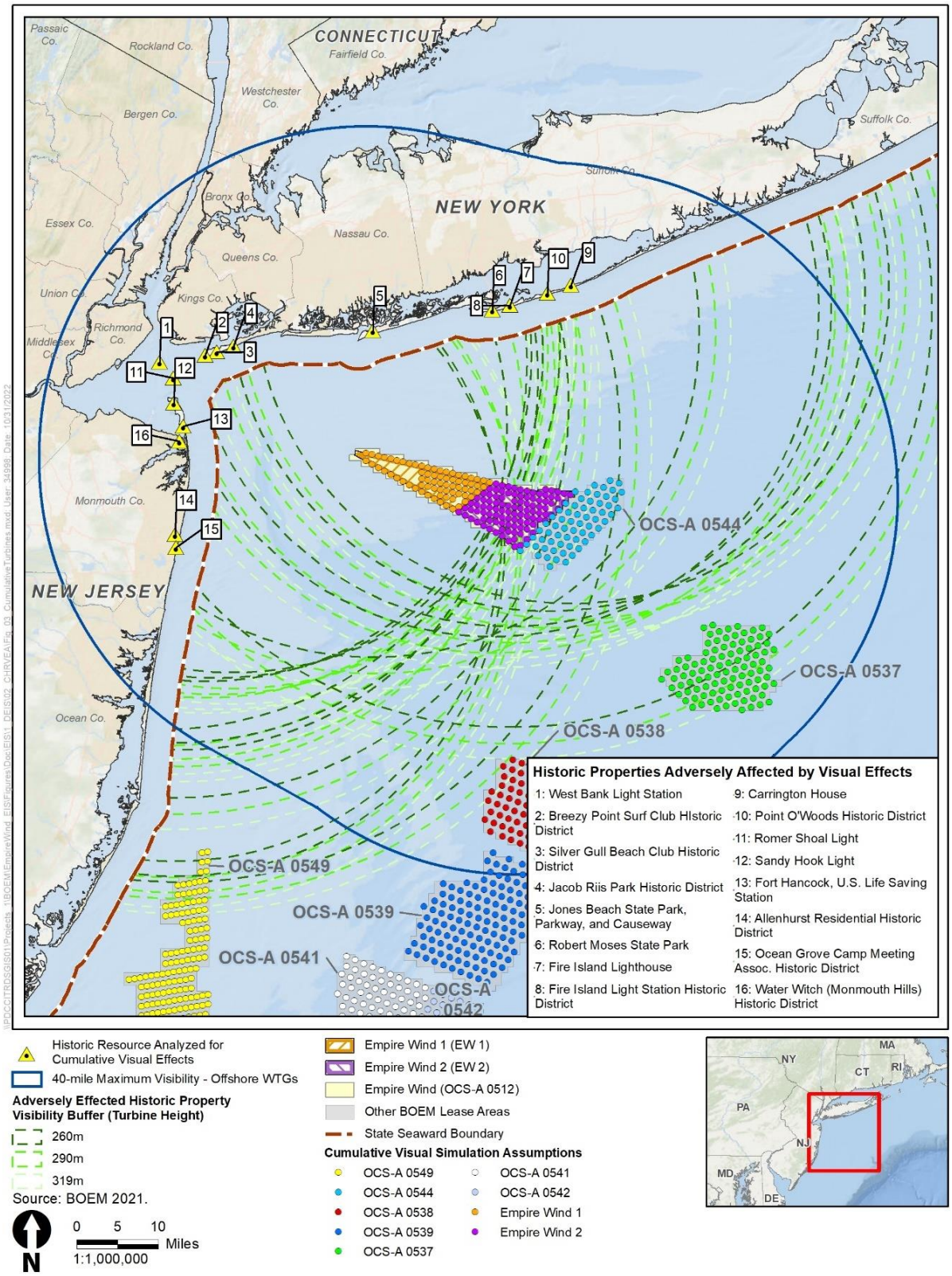

Figure 3 Wind Turbine Generator Locations for Cumulative Visual Simulations Across the Adjacent Bureau of Ocean Energy Management Lease Areas, Including the Proposed OCS-A 0544, OCS-A 0537, and OCS-A 0549 that Would Surround the Empire Wind Lease Area

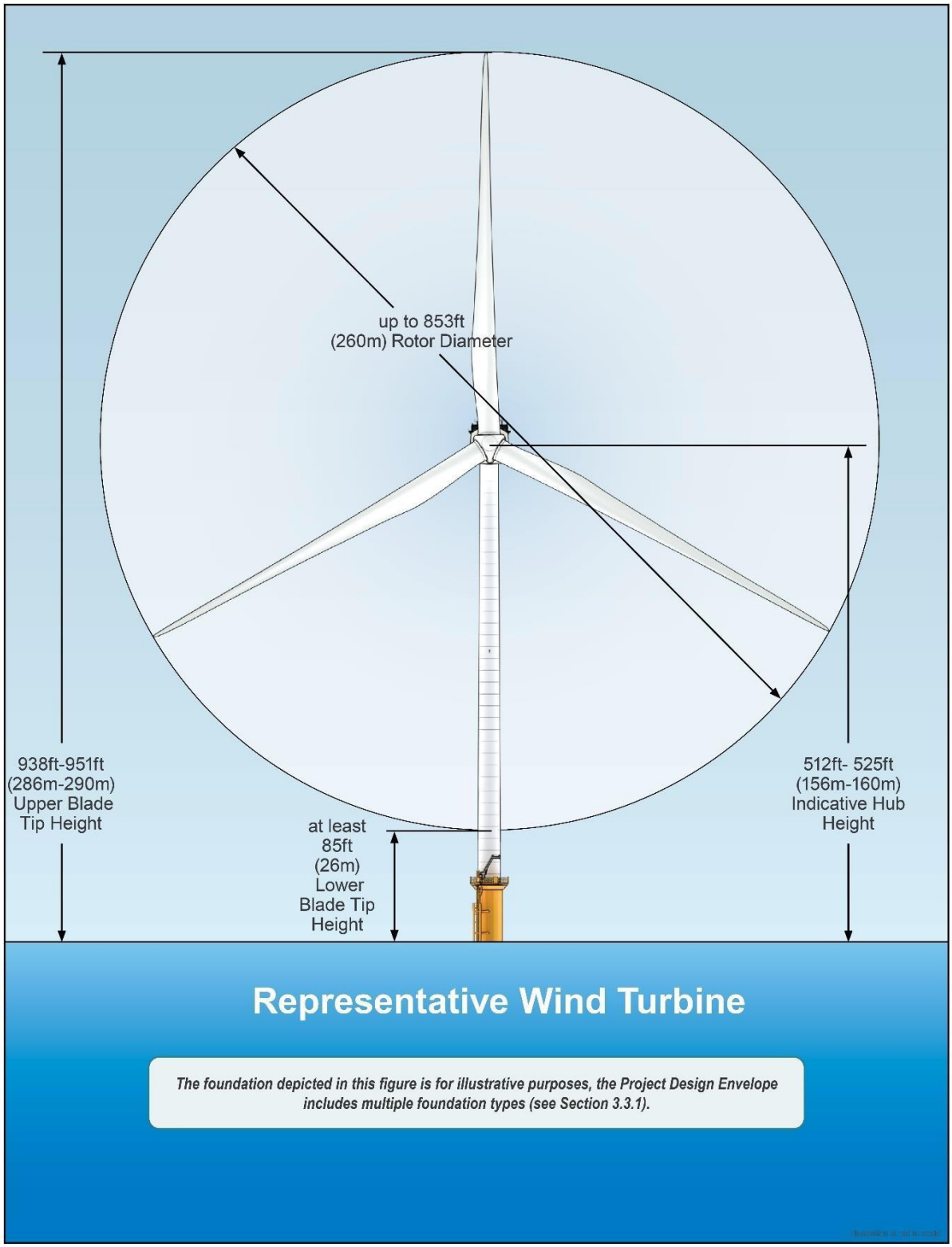

Figure 4 Dimensions for Wind Turbine Generators Proposed for the Projects (951 Feet)

1.3.2 Visual Effects

This CHRVEA analyzes how the adverse visual effects from the Projects, which BOEM has determined for the 16 historic properties, have the potential to result in additive cumulative visual effects in combination with the other reasonably foreseeable offshore wind energy development activities.

This CHRVEA uses the modeling of the Project viewshed and cumulative WTG visibility within that viewshed to inform this analysis. The analysis considers the importance of maritime setting to the integrity of the 16 historic properties from the vantage of significant seaward views that could include the WTGs and the WTGs of other planned offshore wind energy development activities. The modeling quantifies the total number of WTGs that are theoretically visible from the historic properties and the distance at which they may be visible. Based on these factors, this CHRVEA analyzes the level of effect on the integrity of the 16 historic properties.

Table 1 provides the maximum number of potentially visible WTG locations for each of the 16 historic properties based on reasonably foreseeable offshore wind energy development activities. Although all planned Project WTGs would be visible, not all potential WTGs from other reasonably foreseeable offshore wind energy development activities would be visible from the 16 historic properties. WTGs would begin to disappear from view at locations with increased distance, where potential development locations within the offshore wind lease areas extend south-southeastward and north-northeastward. Table 2 summarizes the number of theoretically visible WTGs by project.

Appendix C presents cumulative visual simulations that illustrate theoretical visibility of WTGs associated with the Projects in combination with those of other foreseeable projects. These visual simulations are modeled based on KOPs positioned at locations with representative views. These representative views are not intended to be located at all elements of historic properties, or even directly at historic properties, but are rather situated at approximate locations to provide open views toward WTGs, considering the distance of historic properties from the maximum possible build-out of all WTG locations modeled in the offshore wind lease areas for the Projects and other offshore wind energy development activities (Appendix B). KOPs were placed where seaward views and potentially visible historic properties could be maximized and are considered important. The KOP closest to each historic property is identified in Table 1.

The standards for selecting these viewpoints were defined as follows (Appendix B):

- The representative viewpoints and existing (i.e., previously prepared for the Projects) visualizations should represent a full range of possible visibility of other projects.
- The Projects should be readily noticeable under ideal viewing conditions, which may exceed 25 miles from the viewer during daylight hours.
- The location and photographic quality should show meteorological and lighting conditions to enable BOEM to assess the worst-case visibility and potential cumulative effects on the seascape.

Table 1 Historic Properties and Wind Turbine Generator Visibility

Historic Property	Name of KOP Closest to the Historic Property	Total Number of Potentially Visible WTGs (blade tips) from the Historic Property (including the Project WTGs)	Distance from the Historic Property to the Nearest Potentially Visible WTG for Other Proposed and Built Wind Farms and Empire Wind
West Bank Light Station	14 Sandy Hook-North Beach	105 WTGs (54 percent are EW 1 and 46 percent are EW 2)	27.6 miles to nearest EW 1 WTG, 41.0 miles to nearest EW 2 WTG, and 49.8 miles to the nearest potential WTG location for other wind energy development activities.
Breezy Point Surf Club Historic District	06 Jacob Riis State Park	102 WTGs (ground-level Historic District) (56 percent are EW 1 and 44 percent are EW 2)	23.1 miles to nearest EW 1 WTG, 36.5 miles to nearest EW 2 WTG, and 45.4 miles to the nearest potential WTG location for other wind energy development activities.
Silver Gull Beach Club Historic District	06 Jacob Riis State Park	114 WTGs (50 percent are EW 1 and 50 percent are EW 2)	22.1 miles to nearest EW 1 WTG, 35.6 miles to nearest EW 2 WTG, and 44.4 miles to the nearest potential WTG location for other wind energy development activities.
Jacob Riis Park Historic District	06 Jacob Riis State Park	131 WTGs (44 percent are EW 1 and 56 percent are EW 2)	20.8 miles to nearest EW 1 WTG, 34.3 miles to nearest EW 2 WTG, and 43.1 miles to the nearest potential WTG location for other wind energy development activities.
Jones Beach State Park	07 Jones Beach State Park	211 WTGs (27 percent are EW 1, 43 percent are EW 2, and 30 percent are OCS-A 0544)	15.0 miles to nearest EW 1 WTG, 24.0 miles to nearest EW 2 WTG, and 31.7 miles to the nearest potential WTG location for other wind energy development activities.
Robert Moses State Park	10 Sunken Forest	211 WTGs (27 percent are EW 1, 43 percent are EW 2, and 30 percent are OCS-A 0544)	20.6 miles to nearest EW 1 WTG, 21.3 miles to nearest EW 2 WTG, and 24.4 miles to the nearest potential WTG location for other wind energy development activities.
Fire Island Lighthouse	03 Fire Island Lighthouse	258 WTGs (elevated 160 feet) (22 percent are EW 1, 35 percent are EW 2, 18 percent are OCS-A 0537, and 25 percent are OCS-A 0544)	21.7 miles to nearest EW 1 WTG, 21.9 miles to nearest EW 2 WTG, and 24.2 miles to the nearest potential WTG location for other wind energy development activities.

Historic Property	Name of KOP Closest to the Historic Property	Total Number of Potentially Visible WTGs (blade tips) from the Historic Property (including the Project WTGs)	Distance from the Historic Property to the Nearest Potentially Visible WTG for Other Proposed and Built Wind Farms and Empire Wind
Fire Island Light Station Historic District	03 Fire Island Lighthouse	211 WTGs (ground-level Historic District) (27 percent are EW 1, 43 percent are EW 2, and 30 percent are OCS-A 0544)	21.7 miles to nearest EW 1 WTG, 21.9 miles to nearest EW 2 WTG, and 24.2 miles to the nearest potential WTG location for other wind energy development activities.
Carrington House	10 Sunken Forest	211 WTGs (ground-level Historic District) 27 percent are EW 1, 43 percent are EW 2, and 30 percent are OCS-A 0544)	26.1 miles to nearest EW 1 WTG, 25.2 miles to nearest EW 2 WTG, and 24.4 miles to the nearest potential WTG location for other wind energy development activities.
Point O'Woods Historic District	10 Sunken Forest	211 WTGs (27 percent are EW 1, 43 percent are EW 2, and 30 percent are OCS-A 0544)	24.2 miles to nearest EW 1 WTG, 24.0 miles to nearest EW 2 WTG, and 24.2 miles to the nearest potential WTG location for other wind energy development activities.
Romer Shoal Light	14 Sandy Hook-North Beach	130 WTGs (44 percent are EW 1 and 56 percent are EW 2)	25.3 miles to nearest EW 1 WTG, 38.6 miles to nearest EW 2 WTG, and 47.4 miles to the nearest potential WTG location for other wind energy development activities.
Sandy Hook Light	14 Sandy Hook-North Beach	154 WTGs (elevated 108 feet) (37 percent are EW 1, 58 percent are EW 2, and 5 percent are OCS-A 0544)	24.3 miles to nearest EW 1 WTG, 37.4 miles to nearest EW 2 WTG, and 46.1 miles to the nearest potential WTG location for other wind energy development activities.
Fort Hancock, U.S. Life Saving Station	11 Harshorne Woods Park	106 WTGs (ground-level Historic District) (54 percent are EW 1 and 46 percent are EW 2)	22.6 miles to nearest EW 1 WTG, 35.3 miles to nearest EW 2 WTG, and 44.0 miles to the nearest potential WTG location for other wind energy development activities.
Allenhurst Residential Historic District	12 Ocean Grove Beach	128 WTGs (45 percent are EW 1, 45 percent are EW 2, and 10 percent are OCS-A 0549)	25.0 miles to nearest EW 1 WTG, 34.8 miles to nearest EW 2 WTG, and 39.0 miles to the nearest potential WTG location for other wind energy development activities.

Historic Property	Name of KOP Closest to the Historic Property	Total Number of Potentially Visible WTGs (blade tips) from the Historic Property (including the Project WTGs)	Distance from the Historic Property to the Nearest Potentially Visible WTG for Other Proposed and Built Wind Farms and Empire Wind
Ocean Grove Camp Meeting Association Historic District	12 Ocean Grove Beach	141 WTGs (41 percent are EW 1, 41 percent are EW 2, and 18 percent are OCS-A 0549)	25.5 miles to nearest EW 1 WTG, 34.9 miles to nearest EW 2 WTG, and 37.4 miles to the nearest potential WTG location for other wind energy development activities.
Water Witch Historic District	11 Hartshorne Woods	239 WTGs (24 percent are EW 1, 38 percent are EW 2, 25 percent are OCS-A 0544, and 13 percent are OCS-A 0549)	22.9 miles to nearest EW 1 WTG, 35.3 miles to nearest EW 2 WTG, and 43.8 miles to the nearest potential WTG location for other wind energy development activities.

Table 2 Summary of Number of Theoretically Visible Wind Turbines by Project

Historic Property	Number of Theoretically Visible Wind Turbines (Based on WTG Blade Tip Visibility)					
	EW 1	EW 2	OCS-A 0544	OCS-A 0537	OCS-A 0549	Total
West Bank Light Station	57	48	0	0	0	105
Breezy Point Surf Club Historic District	57	45	0	0	0	102
Silver Gull Beach Club Historic District	57	57	0	0	0	114
Jacob Riis Park Historic District	57	74	0	0	0	131
Jones Beach State Park	57	90	64	0	0	211
Robert Moses State Park	57	90	64	0	0	211
Fire Island Lighthouse (elevated 160 feet)	57	90	64	47	0	258
Fire Island Light Station Historic District (ground)	57	90	64	0	0	238
Carrington House	57	90	64	0	0	211
Point O'Woods Historic District	57	90	64	0	0	211
Romer Shoal Light	57	73	0	0	0	130
Sandy Hook Light (elevated 108 feet)	57	90	7	0	0	154
Fort Hancock, U.S. Life Saving Station	57	49	0	0	0	106
Allenhurst Residential Historic District	57	57	0	0	14	128
Ocean Grove Camp Meeting Association Historic District	57	58	0	0	26	141
Water Witch Historic District	57	90	61	9	31	239

The Projects would incrementally add to the cumulative visual effects on the 16 historic properties identified within the APE for visual effects analysis, when combined with the effects of other past, present, or reasonably foreseeable future actions. This may occur where there is intervisibility between the Project viewshed and the viewshed of other actions, the area of intervisibility being the geographic extent of the intersection of Project visibility with the visibility of another action. The potential Project WTG locations within the Lease Area (OCS-A 0512) have the potential for intervisibility with other WTG locations within the BOEM offshore wind lease areas of Vineyard Mid-Atlantic LLC (OCS-A 0544), OW Ocean Winds East LLC (OCS-A 0537), and Atlantic Shores North (OCS-A 0549).

This intervisibility and related adverse effects would apply for daytime visibility. Nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a contributing element to their historic integrity. A dark nighttime sky is not an explicitly defined character-defining feature of any of the 16 historic properties assessed in the CHRVEA. However, the National Park Service has indicated during consultation that a dark nighttime sky should be assumed to be a character-defining features of certain resource types, such as lighthouses, or resources associated with historic events that may have occurred at night, such as battlefields. Given this assumption, a dark nighttime sky is considered a character-defining feature of the West Bank Light Station, Fire Island Lighthouse, Romer Shoal Light, and Sandy Hook Light. As such, there would be cumulative visual effects from nighttime visibility of aviation obstruction lights on the WTG nacelles associated with the Projects and other

proposed offshore wind development projects; from use of an Aircraft Detection Lighting System to reduce the period and intensity of effects from aviation obstruction lights on the Projects; and from other short-term lighting visibility from vessels during construction or decommissioning, area lighting during construction, or other activities that could arise cumulatively during construction and decommissioning, should they occur after dark (COP Volume 3, Appendix Z; Empire 2022). Visual effects resulting from nighttime construction activities would be limited to select locations within the Lease Area and along the submarine export cable routes. These visual effects would also be short term because large vessels and lights necessary to perform construction activities would not be present overnight once construction is complete (COP Volume 3, Appendix Z; Empire 2022). Furthermore, with implementation of the Aircraft Detection Lighting System or similar system to turn aviation obstruction lights on and off in response to detection of aircraft near the wind farm, it is estimated that the amount of "lights on" time would be approximately 2 percent of the night, with most of that concentrated in the hours between sunset and midnight when airport traffic is high (COP Volume 3, Appendix Z; Empire 2022). For visual simulations of nighttime lighting from the Projects and other offshore wind energy development activity WTGs, see Appendix C.

As presented in Table 1, the Project WTG locations represent 57 to 100 percent of the total WTGs that are potentially visible from the 16 historic properties in the cumulative build-out scenario of wind energy developments in the area. WTGs associated with other offshore wind energy development activities would represent 0 to 43 percent of the total WTGs potentially visible from the 16 historic properties. For six of the historic properties, WTGs associated with the Projects would represent 100 percent of the total WTGs visible.

WTGs associated with the Projects would be the most prominently visible development compared to other developments planned nearby, including Vineyard Mid-Atlantic LLC (OCS-A 0544), OW Ocean Winds East LLC (OCS-A 0537), and Atlantic Shores North (OCS-A 0549), as the other activities reach build out.

Sullivan et al. (2013) found in general that offshore wind facilities tend to be a major focus of visual attention at distances up to 10 miles and were only noticeable to casual observers at distances of up to almost 18 miles. While Sullivan et al. (2013) analyzed wind turbines shorter in height than those proposed for the Projects, findings from the study remain relevant for the purpose of guiding cumulative effects analysis for offshore wind development because they demonstrate that degree of visibility varies across a cumulative scenario based on distance from observer, assuming turbine heights are the same across the scenario. A more recent study undertaken by the New York State Energy Research and Development Authority suggests offshore wind energy projects of typical magnitude would have minimal visual effects at a distance of 20 miles and negligible effects beyond 25 miles (EDR 2017). Jones Beach State Park is the only historic property where the nearest WTG associated with the Projects is less than 20 miles; the closest WTG from the Projects is 15 miles away. For the other 15 historic properties, the nearest WTG associated with the Projects is 20 or more miles away. For five of the other properties, the nearest WTG associated with the Projects is 25 or more miles away. Other wind development activities are more than 20 miles away from all of the 16 historic properties.

To inform determinations of adverse and cumulative visual effects, BOEM reviewed the AVEHAP's list of historic properties assessed as likely to be adversely affected by the Projects. In making these determinations, BOEM further reviewed all information and comments provided by consulting parties in correspondence and at meetings. The 16 historic properties determined to be adversely affected represent all of the properties identified within the APE that retain a maritime setting and where the maritime setting contributes to the property's NRHP eligibility. These historic properties are in areas that offer significant seaward views that support the integrity of the maritime setting and vantage points with the potential for open views from each property toward the WTGs (COP Volume 3, Appendix Z; Empire 2022).

BOEM has determined the Projects would have visual adverse effect on these 16 historic properties with direct views to WTGs. Cumulative visibility of the Projects and other offshore wind energy development activities is anticipated to intensify the level of adverse effects on the 16 historic properties. Specifically, the Projects would contribute between approximately 57 and 100 percent of the cumulative adverse effect, and WTGs associated with other offshore wind energy development activities would represent 0 to 43 percent of the total WTGs potentially visible from the 16 historic properties. WTGs associated with the Projects would be the most prominently visible development compared to other developments planned nearby, including Vineyard Mid-Atlantic LLC (OCS-A 0544), OW Ocean Winds East LLC (OCS-A 0537), and Atlantic Shores North (OCS-A 0549), as the other activities reach build-out.

The AVEHAP found that the Projects would not adversely affect the remaining 23 historic properties identified in the offshore viewshed APE (COP Volume 3, Appendix Z; Empire 2022). BOEM agrees with this assessment, finding no adverse effects on any historic properties identified in the viewshed APE beyond the 16 historic properties identified as adversely affected above.

2 CONCLUSION

This CHRVEA concludes that the Projects would have a cumulative adverse effect on the 16 historic properties identified. These historic properties are as follows:

1. West Bank Light Station in Staten Island, New York
2. Breezy Point Surf Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
3. Silver Gull Beach Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
4. Jacob Riis Park Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)
5. Jones Beach State Park, Parkway and Causeway System, Hempstead/Oyster Bay, New York
6. Robert Moses State Park in Babylon/Islip, New York
7. Fire Island Lighthouse in Islip, New York
8. Fire Island Light Station Historic District in Islip, New York
9. Carrington House in Brook Haven, New York
10. Point O'Woods Historic District in Islip, New York
11. Romer Shoal Light Station in Lower New York Bay, New Jersey
12. Sandy Hook Light in Gateway National Recreation Area, Middleton, New Jersey (National Park Service)
13. Fort Hancock, U.S. Life Saving Station in Gateway National Recreation Area, Highlands, New Jersey (National Park Service)
14. Allenhurst Residential Historic District in Allenhurst, New Jersey
15. Ocean Grove Camp Meeting Association District in Ocean Grove, New Jersey
16. Water Witch (Monmouth Hills) Historic District in Middleton, New Jersey

For the 16 historic properties noted above, each would retain its maritime setting, and that maritime setting contributes to the property's NRHP eligibility and continues to offer significant seaward views that support the integrity of the maritime setting; those seaward views include vantage points with the potential for an open view from each property toward the WTGs (COP Volume 3, Appendix Z; Empire 2022).

Cumulative visibility of the WTGs and other offshore wind energy development activities is anticipated to intensify the level of adverse effect on the 16 historic properties. The Projects would contribute between 57 and 100 percent of the cumulative adverse effect on individual historic properties, depending on the location and intensity of the foreseeable build-out attributable to other offshore wind energy development activities visible from each historic property. WTGs associated with the Projects would be the most prominently visible development compared to other developments planned nearby, including OCS-A 0544, OCS-A 0537, and OCS-A 0549, as the other activities reach build out. WTGs from EW 1 and EW 2 would be most visible to the affected historic properties, relative to WTGs from the other projects in the cumulative scenario, because they would be built closest to the shore.

The conclusions here are recommendations by ICF regarding the WTGs' incremental contribution to cumulative visual effects (daytime and nighttime) on historic properties when combined with past, present, and reasonably foreseeable offshore wind energy development activities in the APE for the Projects. These recommendations are provided to inform BOEM's determination of Project effects on historic properties and consultation on any effects found. Where BOEM has made its determination in the *Finding of Adverse Effect for the Empire Wind Construction and Operations Plan*, this determination is expressed consistently in the CHRVEA. While Section 106 consultation is ongoing among BOEM, State Historic Preservation Officers, and other identified consulting parties on the Projects, final determinations remain with BOEM in accordance with 36 CFR 800. This includes ongoing consultation with Native American tribes that may identify properties of traditional cultural and religious significance in the APE.

2.1 National Historic Landmarks and the National Historic Preservation Act Section 106 Process

The NPS, which administers the National Historic Landmark (NHL) program for the Secretary of the Interior (Secretary), describes NHLs and requirements for NHLs as follows:

> National Historic Landmarks (NHL) are designated by the Secretary under the authority of the Historic Sites Act of 1935, which authorizes the Secretary to identify historic and archaeological sites, buildings, and objects which "possess exceptional value as commemorating or illustrating the history of the United States." Section 110(f) of the NHPA requires that Federal agencies exercise a higher standard of care when considering undertakings that may directly and adversely affect NHLs. The law requires that agencies, "to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark." In those cases when an agency's undertaking directly and adversely affects an NHL, or when Federal permits, licenses, grants, and other programs and projects under its jurisdiction or carried out by a state or local government pursuant to a Federal delegation or approval so affect an NHL, the agency should consider all prudent and feasible alternatives to avoid an adverse effect on the NHL. (NPS 2021)

NHPA Section 110(f) applies specifically to NHLs. BOEM is implementing the special set of requirements for protecting NHLs and for compliance with NHPA Section 110(f) at 36 CFR 800.10, which, in summary:

1. Requires the agency official, to the maximum extent possible, to undertake such planning and actions as may be necessary to minimize harm to any NHL that may be directly and adversely affected by an undertaking;
1. Requires the agency official to request the participation of the Advisory Council on Historic Preservation in any consultation conducted under 36 CFR 800.6 to resolve adverse effects on NHLs; and
2. Further directs the agency to notify the Secretary of any consultation involving an NHL and to invite the Secretary to participate in consultation where there may be an adverse effect.

In transmittal of the separate Finding of Effects documentation on the Projects to the NPS, BOEM will specifically request to consult with NPS's NHL Program pursuant to 36 CFR 800.10(c), to which the Secretary of the Interior has delegated consultation authority, and will address this request to the NHL program lead for the region. BOEM will continue to involve the Advisory Council on Historic Preservation and all participating consulting parties in consultation on special requirements for minimizing harm to and protecting Sandy Hook Light NHL. The measures for the avoidance, minimization, or mitigation of adverse effects on this NHL as required by 36 CFR 800.6 will be included in the memorandum of agreement.

2.2 Cumulative Adverse Effects Assessment at National Historic Landmarks

The AVEHAP identified four NHLs in the visual APE for the Projects: Green-Wood Cemetery, Cyclone Roller Coaster, Fort Hancock and Sandy Hook Proving Ground Historic District, and Sandy Hook Light (COP Volume 3, Appendix Z; Empire 2022). BOEM has determined that one NHL, Sandy Hook Light, would be adversely affected by the Projects.

2.2.1 Sandy Hook Light National Historic Landmark

Among the identified lighthouses and navigational aids, the Sandy Hook Light in the Gateway National Recreation Area (a unit of the National Park Service) was recognized for its importance to U.S. history as an NHL in 1964. As noted previously, the HRVEA describes this historic property as follows:

> The Sandy Hook Light, built in 1764, is the oldest extant lighthouse in the United States. Standing 103 ft tall, the octagonal brick structure tapers upward from a base diameter of 29 ft to 15 ft at the top. The lantern and catwalk are accessible by a spiral, cast iron staircase. The property's period of significance is 1764 -1799. The lighthouse largely has been unaltered in appearance and materials since its construction, and accurately reflects the character of the property during its period of significance. Areas of significance include commerce and transportation. (COP Volume 3, Appendix Z; Empire 2022)

Sandy Hook Light NHL was listed on the NRHP in 1966 under Criterion A for association with the colonial program to promote maritime safety along the eastern seaboard (COP Volume 3, Appendix Z; Empire 2022). Although the NRHP nomination does not explicitly note the significance of the view to the ocean, the setting of this historic aid to navigation is important to understanding its significance. Criterion A is readily interpreted to mean that an expansive, unimpeded ocean view is integral to the light station's character, setting, feeling, and association. The HRVEA found Sandy Hook Light NHL in particular to have high visual sensitivity within the viewshed APE due to its historic location, setting, and feeling being primarily associated with clear views of the sea and for which public use enhances appreciation of the property's historic use and association with the sea (COP Volume 3, Appendix Z; Empire 2022).

The Projects would diminish the characteristic setting of the Sandy Hook Light NHL that helps qualify this historic property for inclusion in the NRHP but would not diminish other aspects of integrity. The historic use and association of the Sandy Hook Light NHL and similar lighthouses, lights, or light stations are connected to the sea and their integrity of location, setting, and feeling are primarily associated with open views of the sea, resulting in a high sensitivity to visual effects. The visibility of WTG structures and lighting has the greatest potential to affect the integrity of setting of this historic property at sea views from elevated viewing points on the structure. At a distance of approximately 34.0 miles between the nearest Project WTG and the Sandy Hook Light NHL, the views would be unobstructed and visual effects on the Sandy Hook Light NHL would be adverse.

Cumulatively, 16 WTGs would be visible from the Sandy Hook Light NHL at distances between 24 miles and 30 miles (16 EW 1 WTGs) (see Table 2). Another 145 WTGs would be fading into the background from the Sandy Hook Light NHL at distances of 30 miles to 49 miles (133 Project WTGs and 12 WTGs from other future offshore wind projects) (see Table 2). Most, 145 WTGs, would be at distances of over 30 miles. WTGs (portions of up to 161 in the modeled scenario) would appear clustered across the sea and horizon from the Sandy Hook Light NHL in the daytime and with nighttime lighting. The cumulative visual simulations for Sandy Hook Light NHL are those for Simulation Location 3, Port Pleasant Beach, in Appendix C.

Like the Project-specific visual impacts, the cumulative visual impacts would result in adverse effects from the Projects on Sandy Hook Light NHL.

3 PERSONNEL

This study was co-authored by key personnel: Secretary of the Interior–qualified professional architectural historian, January Tavel, MHP; and historic preservation specialist, Corey Lentz, MHP. Resumes of the report co-authors can be found in Appendix D, *Key Personnel Resumes*.

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Appendix A

Description, Historic Character, and Basis for National Register of Historic Places Eligibility of the Sixteen Historic Properties with Adverse Effects from the Projects

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The AVEHAP (COP Volume 3, Appendix Z; Empire 2022) provides a description, historic character, and basis for the NRHP eligibility of each of the 16 historic properties that could be adversely affected by the Projects, as summarized below from the historic resources visual effects analysis.

West Bank Light Station in Staten Island, New York

The West Bank Light Station is in Lower New York Bay, approximately 3 nm (5.6 kilometers) east of New Dorp Beach, Staten Island, New York. The light station, constructed in 1901, consists of a cast iron caisson expanding in a trumpet shape to form a gallery, which supports an iron conical tower surmounted by a black lantern. The West Bank Light Station (NR No. 06001230) was listed in the NRHP in 2006 under Criterion A for its association with the federal program of coastal maritime history, and Criterion C as an excellent example of maritime-related architecture. The property is listed as part of the Light Stations of the United States multiple property submission. The property's period of significance is 1901–1971. The West Bank Light Station is near the entrance to New York Harbor with a relatively unobstructed view toward the Projects between Sandy Hook and Rockaway Point. The light station's significance as historic aid to navigation is tied substantially to its setting, and the introduction of the Projects will likely affect this setting. An expansive and unimpeded ocean view is considered a character-defining feature of the property's significance under Criteria A and C. The Wind Farm Development Area is approximately 27.8 miles (44.7 kilometers) southeast from the property. (COP Volume 3, Appendix Z; Empire 2022:27.)

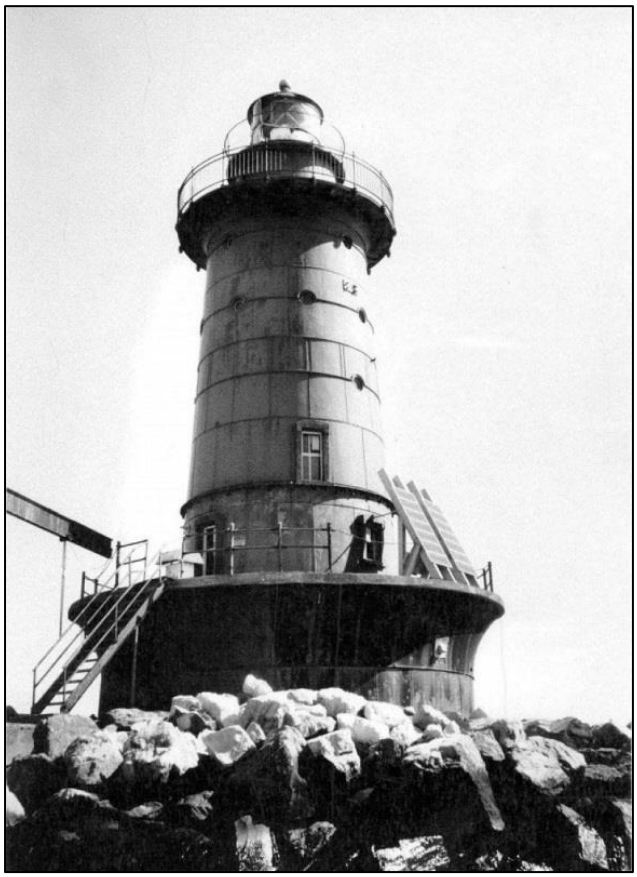

Figure A-1 West Bank Light Station in Staten Island, New York

Breezy Point Surf Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)

The property is in Rockaway, Queens, New York and is approximately 22.0 miles (35.4 kilometers) from the Wind Farm Development Area. The Breezy Point Surf Club was initially constructed in 1937 with additional facilities constructed during the 1950s. The property consists of two sets of cabanas—the original set of small plain 1937 structures and the 1950s set close to the ocean—pool and sports facilities, a restaurant, and ocean beach near the western tip of the Rockaway Peninsula within the Gateway National Recreation Area. Owned by the National Park Service, the Breezy Point Surf Club Historic District (CRIS No. 08101.011499) is NRHP-eligible under Criterion A for its association with the development of seaside recreation and entertainment during the Great Depression, and under Criterion C as a nearly intact example of mid-twentieth century beach club and cabana complex. The property's period of significance is 1937–1963. This property is on the Rockaway Peninsula and has had clear ocean views since it was constructed. The beach club's facilities provide expansive views of the Atlantic Ocean in one of New York City's last undeveloped locations. As an unimpeded ocean view and recreational use are considered character-defining features of the property's significance, it was assessed that the Projects would diminish the significant characteristics of the property and result in an adverse effect on the Breezy Point Surf Club Historic District. (COP Volume 3, Appendix Z; Empire 2022:30, 49.)

Silver Gull Beach Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)

The Silver Gull Beach Club Historic District (CRIS No. 08101.012423) is in the Gateway National Recreation Area (a unit of the National Park Service) in Rockaway, Queens, New York. The Silver Gull Beach Club was constructed in 1962 and consists of adjoining rows of cabanas, a club house, pool, athletic facilities, and ocean beach on the Rockaway Peninsula within the Gateway National Recreation Area. The Silver Gull Beach Club Historic District is NRHP-eligible under Criterion A for its association with the development of seaside recreation and entertainment in the post-Second World War period, and under Criterion C as a nearly intact example of oceanfront recreation architecture. The property's period of significance is 1962–1963. This property is on the Rockaway Peninsula and has had clear ocean views since it was constructed. The beach club's facilities provide expansive views of the Atlantic Ocean in one of New York City's last undeveloped locations. As an unimpeded ocean view is considered a character-defining feature of the property's significance, it was assessed that the Projects would diminish the significant characteristics of the property and result in an Adverse Effect on the Silver Gull Beach Club Historic District. The Wind Farm Development Area is approximately 22.0 miles (35.4 kilometers) south-southeast from the property. (COP Volume 3, Appendix Z; Empire 2022:33.)

Figure A-2 Silver Gull Beach Club Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)

Jacob Riis Park Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)

Jacob Riis Park (NR No. 81000081) is located in the Gateway National Recreation Area (a unit of the National Park Service) on the Rockaway Peninsula. Jacob Riis Park was established in 1932, with the project led by New York City Park Commissioner Robert Moses. The park features a beachfront and parklands for recreational activities and includes several buildings, such as the prominent main bathhouse, that feature Art Deco designs. Jacob Riis Park was listed in the NRHP in 1981 under Criterion C as an excellent example of Work Progress Administration park design during the 1930s. The district's period of significance is 1932–1937. The park's focus, both in terms of purpose and orientation, is the unobstructed ocean access and views. The Wind Farm Development Area is approximately 20.7 miles (33.2 kilometers) south-southeast from the property. (COP Volume 3, Appendix Z; Empire 2022:34.)

Figure A-3 Jacob Riis Park Historic District in Gateway National Recreation Area, Rockaway, Queens, New York (National Park Service)

Jones Beach State Park, Parkway and Causeway System, Hempstead/Oyster Bay, New York

The Jones Beach State Park/Jones Beach State Park, Parkway and Causeway System (NR No. 81000081) is at 1 Ocean Parkway in Hempstead/Oyster Bay, New York. Construction of the Jones Beach State Park began in 1925 under the leadership of New York City Parks Commissioner Robert Moses and continued through the mid-1950s. The park includes ocean and bay fronts, landscaped roads and paths, a boardwalk, a building complex consisting of bathhouses, and service and recreational facilities. Moses envisioned the park as a combination of natural landscapes and the oceanside transportation network. The Jones Beach State Park/Jones Beach State Park, Parkway and Causeway System was listed in the NRHP in 2005 under Criterion A for its association with the development of public oceanside recreation facilities on Long Island, and under Criterion C for the Beaux Arts design and Art Deco motifs of its buildings and the overall design of the park as a beach-oriented development. The property's period of significance is 1925–1955. The focus of the park, both in terms of purpose and orientation, is the ocean access and views it offers. The Wind Farm Development Area is approximately 12.8 miles (20.6 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:35.)

Figure A-4 Jones Beach State Park, Parkway and Causeway System in Hempstead/Oyster Bay, New York

Robert Moses State Park in Babylon/Islip, New York

Robert Moses State Park (CRIS No. 10305.001592) is at 600 Robert Moses State Parkway at the western end of Fire Island in New York. Robert Moses State Park (originally named Fire Island State Park) was established in 1908 as the first state park on Long Island. The park originally featured several bathhouses, beachfront, and open parkland. Robert Moses State Park was accessible only by ferry or private boat until construction of the Robert Moses Causeway in 1964. Robert Moses State Park is NRHP-eligible as a Building District under Criterion A for its association with the development of Long Island's south shore as a recreation destination for urban and suburban residents, and under Criterion C for its recreation architecture. Robert Moses State Park's period of significance is 1908–1964. The focus of the park, both in terms of purpose and orientation, is the ocean access and views it provides. The Wind Farm Development Area is approximately 20.6 miles (34.8 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:36.)

Figure A-5 Robert Moses State Park in Babylon/Islip, New York

Fire Island Lighthouse in Islip, New York

The Fire Island Lighthouse (NR No. 81000082) is on Fire Island. The extant lighthouse was constructed in 1858, replacing the first lighthouse at the site that had been constructed in 1826. The lighthouse is 150 feet in height and features a hollow central column of cast iron clad in brick and covered with a cement wash. The original lamp was a first-order Fresnel lens, which was lit by a succession of various fuels until the light was electrified in 1939. The Fire Island Lighthouse was listed in the NRHP in 1981. The lighthouse is listed under Criterion A for its association with the early federally sponsored program of maritime navigational aids and is significant in the areas of maritime history, transportation, communication, commerce, and military. The property is also listed under Criterion C as an excellent example of mid-nineteenth century maritime engineering and architecture, and under Criterion D for its potential to contain significant post-contact archaeological deposits. The district's period of significance is 1825–1960. Unobstructed sightlines out to the Atlantic Ocean are an important characteristic of the lighthouse's setting and purpose as an aid to maritime navigation. The Wind Farm Development Area is approximately 21.7 miles (36.0 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:36.)

Figure A-6 Fire Island Lighthouse in Islip, New York

Fire Island Light Station Historic District in Islip, New York

The Fire Island Light Station Historic District (NR No. 09001288) is on Fire Island. The extant lighthouse was constructed in 1858, replacing the first lighthouse at the site that had been constructed in 1826. In addition to the lighthouse and Keeper's House, the Fire Island Light Station Historic District is composed of 14 other contributing buildings, sites, and structures. The Fire Island Light Station Historic District was listed in the NRHP in 2009. The district is listed under Criterion A for its association with the early federally sponsored program of maritime navigational aids and is significant in the areas of maritime history, transportation, communication, commerce, and military. The property is also listed under Criterion C as an excellent example of mid-nineteenth century maritime engineering and architecture and under Criterion D for its potential to contain significant post-contact archaeological deposits. The district's period of significance is 1825–1960. Unobstructed sightlines out to the Atlantic Ocean are an important characteristic of the lighthouse's setting and purpose as an aid to maritime navigation. The Wind Farm Development Area is approximately 21.7 miles (36.0 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:36.)

Figure A-7 Fire Island Light Station Historic District in Islip, New York

Carrington House in Brook Haven, New York

The property is on Fire Island within the Fire Island National Seashore and is approximately 24.9 miles (40.1 kilometers) from the Wind Farm Development Area. Carrington House was constructed in circa 1912. The Craftsman-style influenced bungalow is an early, intact example of resort community residences on Fire Island. Its Craftsman-style elements include its wood-shingle cladding and exposed rafter ends. Carrington House (NR No. 13001057) was listed in the NRHP in 2014. The property is listed under Criterion A for its association with its owner's, theater director Frank Carrington, use of the residence as a salon for gay artists, actors, and writers during the mid-twentieth century. Carrington House is also listed under Criterion C as an intact example of beach bungalow architecture. The property's period of significance is 1912–1969, the period from its construction to the year Carrington deeded the property to the National Park Service. The property is on Fire Island and has had unimpeded ocean views since it was constructed. As an unimpeded ocean view is considered a character-defining feature of the property's significance, it was assessed that the Projects would diminish the significant characteristics of the property and result in an adverse effect on the Carrington House. (COP Volume 3, Appendix Z; Empire 2022:37, 50.)

Figure A-8 Carrington House in Brook Haven, New York

Point O'Woods Historic District in Islip, New York

The Point O'Woods Historic District (CRIS No. 10302.003470) is located centrally on Fire Island. Point O'Woods was established in 1894 as a Methodist community by the Long Island Chautauqua Assembly Association. Point O'Woods includes 133 residential buildings, as well as additional community structures and maintenance facilities. Nearly all the buildings within the district feature Shingle-style designs, popular among residents of shore communities in the late nineteenth and early twentieth centuries. It differs from other shore communities of the period in its overall design, which used curved roads and paths, rather than the more common rectangular grid plan. The Point O'Woods Historic District is NRHP-eligible under Criterion A for its association with the Chautauqua movement and development of private Methodist beach communities in the early twentieth century and under Criterion C for its comprehensive and innovative design as a beach community. The district's period of significance is 1894 to circa 1962. Ocean access and views were an important consideration in the siting and establishment of the Point O'Woods community. The Wind Farm Development Area is approximately 24.0 miles (38.6 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:37.)

Figure A-9 Point O'Woods Historic District in Islip, New York

Romer Shoal Light Station in Lower New York Bay, New Jersey

Romer Shoal Light Station (NR No. 06001304) is offshore within Lower New York Bay. Romer Shoal Light Station was built in 1898 as a maritime navigational aid at the entry to New York Harbor. The light station consists of a 30-foot-diameter cast iron cylindrical caisson filled with rock and concrete that supports a four-story cast iron tower. A circular watch room surrounded by a galley and surmounted by a lantern sits atop the tower. The Romer Shoal Light Station was originally lit by a fourth-order Fresnel lens but has been automated since 1966. Romer Shoal Light Station was listed in the NRHP in 2006 under Criterion A for its association with the late nineteenth century federal program to provide maritime navigational aids in the United States and locally to provide safe access to New York Harbor, and under Criterion C as an intact example of maritime engineering and architecture at the turn of the twentieth century. The light station's period of significance is 1898–1966. Unobstructed sightlines out to the Atlantic Ocean are an important characteristic of the light station's setting and purpose as an aid to maritime navigation. The Wind Farm Development Area is approximately 25.7 miles (41.3 kilometers) south from the property. (COP Volume 3, Appendix Z; Empire 2022:37.)

Figure A-10 Romer Shoal Light Station in Lower New York Bay, New Jersey

Sandy Hook Light in Gateway National Recreation Area, Middleton, New Jersey (National Park Service)

Sandy Hook Light (NR No. 66000468) is in the Gateway National Recreation Area (a unit of the National Park Service) on the Sandy Hook peninsula in Middletown Township in New Jersey. Constructed in 1764, the Sandy Hook Light is the oldest extant lighthouse in in the United States. The lighthouse's tower is 103 feet in height and consists of an octagonal brick structure that tapers from a base diameter of 29 feet to 15 feet at the top. The lantern and catwalk are accessed by an interior cast iron staircase. Sandy Hook Light was listed in the NRHP in 1966 under Criterion A for its association with the colonial program to construct maritime navigational aids along the eastern seaboard. The lighthouse's period of significance is 1764–1799. The property was designated as an NHL in 1964. Clear sightlines out to the Atlantic Ocean are an important characteristic of Sandy Hook Light's setting and purpose as an aid to maritime navigation. The Wind Farm Development Area is approximately 24.0 miles (38.6 kilometers) east from the property. (COP Volume 3, Appendix Z; Empire 2022:38.)

Figure A-11 Sandy Hook Light in Gateway National Recreation Area, Middleton, New Jersey (National Park Service)

Fort Hancock, U.S. Life Saving Station in Gateway National Recreation Area, Highlands, New Jersey (National Park Service)

The property is on the Sandy Hook peninsula and is approximately 22.4 miles (36.3 kilometers) from the Wind Farm Development Area. Constructed in 1894, the station was one of the six original U.S. Life Saving Service stations in New Jersey. The property was designed in the Shingle style, but its railings and framing principals exhibit Craftsman-style influences. The Life Saving Station was deactivated in 1949 and has served as a visitor center for the Gateway National Recreation Area since 1974. Owned by the National Park Service, Fort Hancock, U.S. Life Saving Station (NR No. 81000080), which is in the Gateway National Recreation Area, was listed in the NRHP in 1981 under Criterion A for its association with the earliest federally sponsored efforts to save life and property from coastal shipwrecks, and under Criterion C as an example of late-nineteenth century New Jersey coastal utilitarian architecture. The property's period of significance is 1894–1949. The property is on the Sandy Hook peninsula and has had unobstructed ocean views since it was constructed. Clear sightlines out to the Atlantic Ocean are an important characteristic of Fort Hancock, U.S. Life Saving Station's setting and purpose as life-saving station. It was assessed that the Projects would diminish this significant characteristic of the property and result in an adverse effect on Fort Hancock, U.S. Life Saving Station. (COP Volume 3, Appendix Z; Empire 2022:35, 50.)

Figure A-12 Fort Hancock, U.S. Life Saving Station in Gateway National Recreation Area, Highlands, New Jersey (National Park Service)

Allenhurst Residential Historic District in Allenhurst, New Jersey

The Allenhurst Residential Historic District (NR No. 10000353) is in eastern Monmouth County, New Jersey. The Allenhurst Residential Historic District is composed of 290 residences, 202 outbuildings, a municipal building, a church, a restaurant, and the Allenhurst Beach Complex. Most of the buildings within the district were constructed around the turn of the twentieth century by the Coast Land Improvement Company. Architectural styles including Tudor Revival, Gothic Revival, Queen Anne, Prairie, Mission, Shingle, and Craftsman are exhibited within the district. The Allenhurst Residential Historic District is listed in the NRHP under Criterion C an example of late nineteenth and early twentieth century community development that employs a number of the popular architectural styles of this period. The district's period of significance is 1895–1930. The introduction of the Projects within the ocean viewshed of the district will likely alter this relationship between the Atlantic Ocean and the planned community and diminish the characteristics for which the historic district is significant. The Wind Farm Development Area is approximately 24.3 miles (39.1 kilometers) east from the property. (COP Volume 3, Appendix Z; Empire 2022:40.)

Figure A-13 Allenhurst Residential Historic District in Allenhurst, New Jersey

Ocean Grove Camp Meeting Association District in Ocean Grove, New Jersey

The Ocean Grove Camp Meeting Association Historic District (NR No. 76001170) is in Ocean Grove in western Monmouth County, New Jersey and is approximately 25.4 miles (40.9 kilometers) from the Wind Farm Development Area. The community of Ocean Grove was established in 1870 by the Methodist Church as a seaside resort, religious assembly, and spiritual haven for congregants. The Ocean Grove Camp Meeting Association Historic District is composed of almost 1,000 buildings, with nearly three-quarters designed in the Stick style. The Ocean Grove Camp Meeting Association Historic District was listed in the NRHP in 1976 under Criterion A for its association with the religious camp meeting as a planned community and under Criterion C for its Stick-style architecture and the nineteenth century acoustical science and ventilation system in its Great Auditorium. The district's period of significance is 1870–1894. The introduction of the Projects within the ocean viewshed of the district will likely alter this relationship between the Atlantic Ocean and the planned community and diminish the characteristics for which the historic district is significant. The Wind Farm Development Area is approximately 24.3 miles (39.1 kilometers) east from the property. (COP Volume 3, Appendix Z; Empire 2022:41–42.)

Figure A-14 Ocean Grove Camp Meeting Association District in Ocean Grove, New Jersey

Water Witch (Monmouth Hills) Historic District in Middleton, New Jersey

The Water Witch (Monmouth Hills) Historic District (NR No. 04000147) is inland on the Atlantic Highlands in Monmouth County, New Jersey and is approximately 22.8 miles (36.6 kilometers) from the Wind Farm Development Area. The Water Witch Club Historic District comprises what was known historically as the Water Witch Club, a late nineteenth century and early twentieth century romantically design summer community. The district consists of a clubhouse/casino, 21 summer cottages, all constructed between 1896 and 1909, and 28 contributing structures. These 28 contributing structures consist of the narrow gravel roadway system and a series of peanut stone (a distinctive local sandstone composite) structures including gateposts, retaining walls, walks, gutters, and staircases. The Water Witch (Monmouth Hills) Historic District was listed in the NRHP in 2004 under Criterion A for its association with the development of the Atlantic Highlands as a professional-class summer community during the late nineteenth and early twentieth century; under Criterion B for its association with the life of Frederick P. Hill, a significant architect who designed and resided in Monmouth Hills; and under Criterion C for its contributions to community planning, construction techniques, and architecture as a designed community featuring winding gravel roads, vegetated lots, and hills offering scenic views of the ocean. The district's period of significance is 1895–1930. The introduction of the Projects within the ocean viewshed of the district will likely alter this relationship between the Atlantic Ocean and the planned community and diminish the characteristics for which the historic district is significant. The Wind Farm Development Area is approximately 22.8 miles (36.6 kilometers) east from the property. (COP Volume 3, Appendix Z; Empire 2022:42; Tomkins 2004:3, 26.)

Figure A-15 Water Witch Club in Water Witch (Monmouth Hills) Historic District in Middleton, New Jersey

Appendix B

Memorandum: Empire Wind Cumulative Visual Effects Approach, November 17, 2021

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Memorandum

To: John McCarty, BOEM

From: Jenn Chester, Nathalie Schils, Tetra Tech, Inc.
Laura Morales, Equinor

Date: Revised November 17, 2021

Project: Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)

Subject: Cumulative Visual Effects Approach

Attachments:

A. Request letter from BOEM dated September 21, 2021
B. Detailed Visibility Analysis for Proposed Wind Projects
C. Cumulative Simulation Layout Template Sheets

Background and Purpose

In 2019, Empire Offshore Wind LLC (Empire) contracted with Tetra Tech, Inc. (Tetra Tech) to conduct a visual impact assessment (VIA) for the Empire Offshore Wind Project (Project). The Empire Project (Lease Area OCS-A 0512) is located within one of the Bureau of Ocean Energy Management (BOEM) designated Renewable Energy Lease Areas off the southern coast of Long Island New York/eastern coast of New Jersey. BOEM released its Notice of Intent to prepare an Environmental Impact Statement for the Empire Project in June 2021.

In September 2021, BOEM requested Empire develop photographic simulations to support an analysis of potential cumulative visual effects (BOEM's request is included in Attachment A). Per BOEM's request:

> *Cumulative effects (CE) simulations should portray the foreseeable future condition (BOEM authorized development as well as other forms of development approved by other jurisdictions) as accurate[ly] as possible illustrating how individual projects contribute to the incremental changes to the viewshed that may occur over a defined timeframe.*

The cumulative effects simulations would depict the offshore components (i.e., wind turbine generators and offshore substations) proposed for the Project and wind turbine generators and offshore substation(s) substituted with a wind turbine generator for other BOEM-identified proximate planned projects or lease areas planned for auction: Atlantic Shores Offshore Wind (two lease areas), and New York Bight (multiple lease areas). The simulations will be developed based upon information and requirements in Attachment A, including:

- Simulation sequencing and relevant information provided for lease areas and foreseeable projects
- Monopile substructure for all projects
- Simulation field of view and required views (stationary, left, right)

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The purpose of this memorandum is to describe Tetra Tech's proposed approach for selecting and preparing the cumulative effects simulations for BOEM's review and comment before work begins to produce the simulations. Following BOEM's review, a work session with BOEM is expected to confirm the approach and refine next steps.

Potentially Contributing Offshore Wind Projects Analyzed

Two potentially contributing offshore wind planned projects are included in this analysis: Atlantic Shores Offshore Wind (including Atlantic Shores North and South), and New York Bight (including eight separate lease areas: Central Bight, Hudson North, and Hudson South areas A through F).

Atlantic Shores Offshore Wind is the only other project which has submitted a Construction and Operations Plan (COP) to BOEM that is publicly available. Atlantic Shores Offshore Wind LLC (Atlantic Shores) is proposing an approximately 1,510-megawatt (MW) wind energy facility within the lease area (OCS-A 0499) located 45.8 nautical miles (nm) south-southwest of the Empire Project.

In addition to Atlantic Shores, the New York Bight wind energy areas (WEA) are a grouping of eight lease areas located at various distances from the Empire Project, from immediately adjacent (Hudson North) to as much as 47.5 nm (Hudson South F). The New York Bight WEAs are not yet leased but are scheduled for auction in early 2022. Offshore wind facility specifications for New York Bight were based upon non-public information provided by BOEM (see Table 1).

Table 1. Contributing Project Specifications

	Atlantic Shores*		New York Bight*		
	Atlantic Shores North	Atlantic Shores	Central Bight	Hudson North	Hudson South A-F
Lease Area Number	OCS-A 0499		OCS-A 0537	OCS-A 0544	OCS-A 0538 to OCS -A 543
Wind turbine dimensions					
Max. tip height	1,046.6 feet (ft)		853 ft		
Hub height	574.2 ft		492 ft		
Rotor diameter	918.6 ft		722 ft		
Wind turbine spacing	1 nm rows, 0.6 nm apart		1 nm rows, 1 nm apart		

Note:
* Wind turbine dimensions based on information provided by BOEM noting that the COP for Atlantic Shores indicates a max. tip height of 1,048.8 ft.

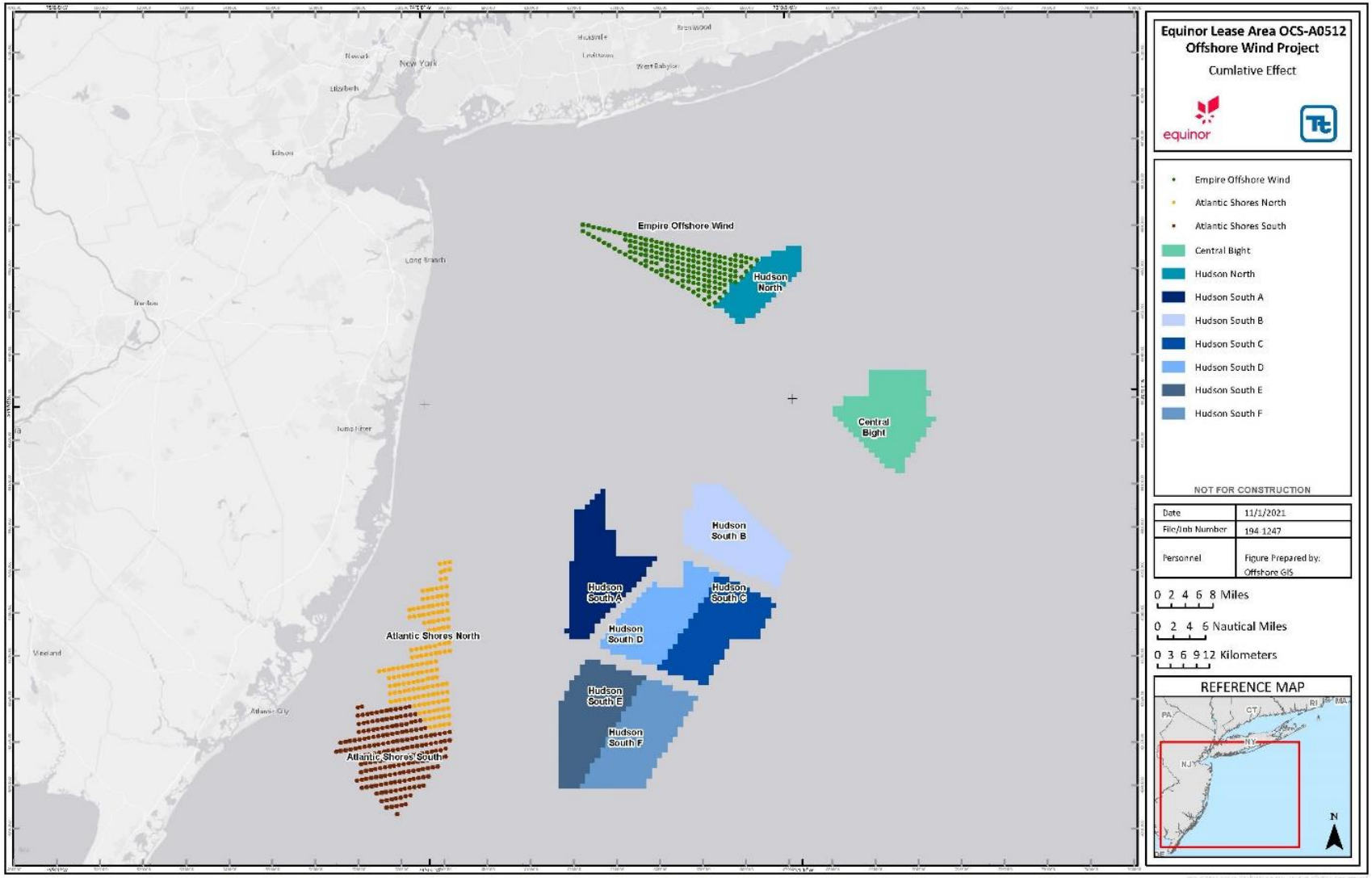


Figure 1. Offshore Wind Projects Analyzed for Potential Cumulative Visual Effects

Atlantic Shores Offshore Wind LLC (Atlantic Shores) is proposing an approximately 1,510-megawatt offshore wind project.

Intervisibility Assessment

To support the assessment of potential cumulative visual effects (CE), Tetra Tech first conducted an intervisibility assessment in ArcGIS to understand the identified contributing wind projects' lease area locations relative to one another and the technical parameters of each project. Tetra Tech then analyzed several key observation point (KOP) locations from the Empire Project Visual Impact Assessment (VIA) in relation to each project's proposed wind turbine configuration, while factoring in the limitations of visibility due to earth curvature. The results of this analysis are detailed in Table B-1 in Attachment B, and summarized in Table 2, below.

Tetra Tech then determined which KOP locations studied for the Empire Project VIA potentially included views of a combination of the contributing projects.

Table 2. Distance from KOPs Considered to Nearest Wind Turbine, by Project

	Empire Offshore Wind (mi)	Atlantic Shores North (mi)	Atlantic Shores South (mi)	NY Bight (Central) (mi)	NY Hudson North (mi)	NY Hudson South A (mi)
New York						
Fire Island Lighthouse	21.7	76.3	100.7	45.6	23.9	58.2
Jones Beach State Park	14.3	65.8	91.5	54.2	30.9	52.5
Jacob Riis Park	21.0	61.7	87.8	65.6	43	54.5
New Jersey						
Point Pleasant Beach	31.0	29.6	55.2	61.6	44.2	31.9
Ocean Grove Beach	25.0	29.6	55.2	60.9	41.9	36.8
Hartshorne Woods Park	21.0	49.3	75.3	64.1	42.8	45.9
Seven Presidents Oceanfront Park	21.0	44.3	70.3	61.8	41.3	41.6

Notes:

1. Hudson South B-F lease areas are excluded from Table 2 because they were found not visible from the analyzed KOPs, due to earth curvature. Refer to the detailed distance table in Attachment B.
2. Grey shaded rows indicate the KOPs selected for further cumulative viewshed analysis.

After distance and earth curvature visibility factors were considered, specific viewshed 'cones' were applied to the selected KOPs, to determine how a person's field of view would perceive the different projects across the horizon. The field of view cones as applied to the selected KOPs are shown in Figure 2.

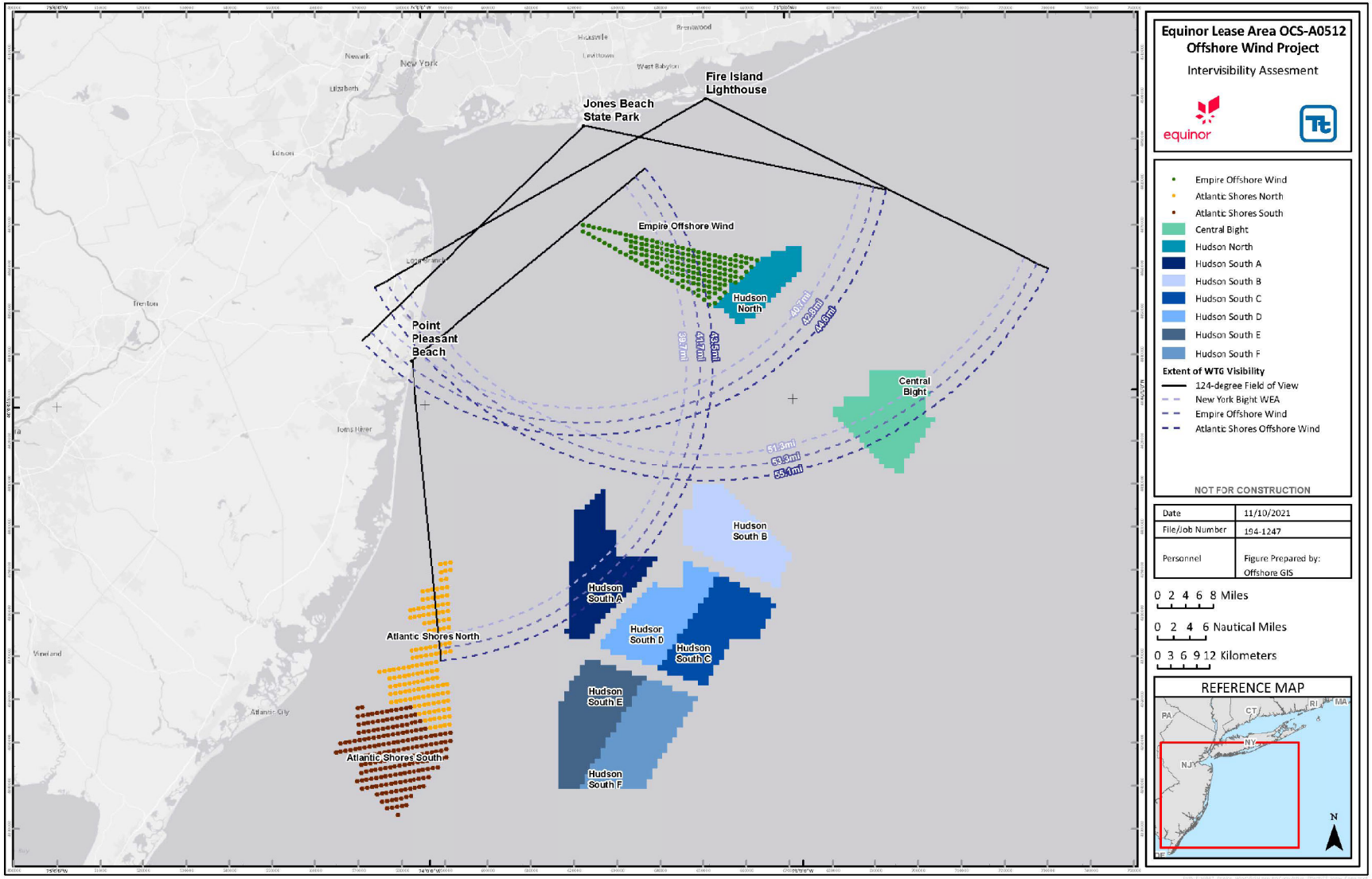


Figure 2. Selected Empire KOPs with prescribed 124-degree fields of view applied.

Recommended Key Observation Points

Based on the analysis described above, Tetra Tech recommends the following KOPs be carried forward for development of cumulative effects photo simulations:

- Fire Island Lighthouse, New York
- Jones Beach State Park, New York
- Point Pleasant Beach, New Jersey

The selected KOPs potentially have views of the following combinations of projects/lease areas, as shown in Table 3. In addition to the Empire Project being visible, Fire Island Lighthouse and Jones Beach State Park in New York would likely have views of two New York Bight lease areas: Hudson North and Central Bight. Point Pleasant Beach, New Jersey could have views of the Empire Project, Atlantic Shores Offshore Wind North, and the Hudson South A lease area.

Table 3. Results of Intervisibility Assessment for Selected Empire Project KOPs

	Empire Offshore Wind	Atlantic Shores	New York Bight
Fire Island Lighthouse	X		X (Hudson North, Central Bight)
Jones Beach State Park	X		X (Hudson North)
Point Pleasant Beach	X	X (ASOW North)	X (Hudson South A)

During its analysis, Tetra Tech found that the field photography captured for the Empire Project VIA does not include photos framed and oriented to capture potential cumulative effects from the contributing projects described above. Therefore, additional field work at the three KOPs would be required to collect photos oriented to capture potential cumulative effects. Figure 3 illustrates an example site photo from Point Pleasant Beach.

Figure 3. Site photo from Point Pleasant Beach, New Jersey. The Empire Project would be visible at the horizon to the left, but potential views of Atlantic Shores are obscured by the pier structure to the right.

Cumulative Photo Simulation Layout Template

CE simulation layout templates are provided in Attachment C, for review and discussion. Simulations would be developed following discussion with BOEM. The cumulative effects simulation layout templates for each KOP include the following:

- Inset map depicting the KOP location, offshore wind energy project lease areas, project wind turbine layout configuration (if known), and the prescribed 124-degree cone of vision.
- Existing and Simulated images formatted as directed by BOEM to capture a 124-degree (h) by 55 degree (v) field of view (FOV).
- Location geographic details
- Photograph details
- Identification of the wind turbine (or other element) that would be in the center of the cone of vision's view
- Graphic comparison of wind turbine dimensions for each offshore project analyzed

Attachment A. Request letter from BOEM dated September 21, 2021

Empire Wind
Recommendations for Cumulative Effects Simulations
Prepared by John McCarty, Ian Slayton
September 9, 2021

Empire Wind Cumulative Effects Simulation Recommendations

Cumulative effects (CE) simulations should portray the foreseeable future condition (BOEM authorized development as well as other forms of development approved by other jurisdictions) as accurate as possible illustrating how individual projects contribute to the incremental changes to the viewshed that may occur over a defined timeframe. In addition to cumulative visual effects assessment to seascapes, landscapes, and the public, this approach also supports the methodology used for assessing cumulative effects to historic properties. The information is also instrumental during Tribal consultations when explaining incremental changes to the viewshed and how a particular project fits into the overall context of the leasing area.

1. Conduct an intervisibility assessment to determine those projects that may contribute to the changes to the offshore ocean character within the viewshed study area associated with the Empire Wind project.
   - Potential contributors include:
     - Atlantic Shores
     - Atlantic Shores North
     - New York Bight Lease Areas *(including the following will depend on the timing of BOEM's internal decision on the final configurations of these lease areas)*
       - 0CS-A 0544
       - OCS-A 0543

2. Simulation sequencing and relevant information: The goal for CE simulations is to illustrate incremental change using the most accurate information available for wind turbine generators (WTG) and offshore substations (OSS) sizing and layout configurations. The following summarizes the information to use for projects depending on the project's status or phase of project development, and a list of those projects thought to fit the description.

   - BOEM authorized projects: simulate decision in the ROD
     - Model of WTG
     - Maximum height and width of WTGs and OSSs
     - Final WTG and OSS layout configuration

     NO PROJECTS OF THIS TYPE IN THIS GEOGRAPHIC AREA

   - Projects under BOEM review where project information has been disclosed to the public, or is scheduled for disclosure before the planned date for releasing the Empire Wind Draft EIS:
     - Model of WTG proposed in the COP VIA
     - Proposed maximum height and width of WTGs and OSSs (use the taller WTG scenario for those projects that simulate multiple WTG alternatives)
     - Proposed WTG and OSS layout configuration

     NO PROJECTS OF THIS TYPE IN THIS GEOGRAPHIC AREA

   - Lease areas where project information is not yet submitted or released to the public:
     - 853 feet height at tip of blade
     - 492 feet hub height

- 722 feet rotor diameter
- Maximum buildout configuration scenario on a 1 nm x 1 nm spacing
- Substitute OSS with a WTG

New York Bight Lease Areas listed above

(Adding the New York Bight leases to the simulations is dependent on the timing of BOEM's internal decision on the final configurations of the lease areas)

3. Assume monopile substructure for all projects.
4. Simulations should be a 124° horizontal by 55° vertical field of view. If the project occupies an area that exceeds the 124° x 55° field-of-view, then more than one simulation may be needed to capture the sequence of successive viewing from left to right.
5. Simulations would include three views that characterize the stationary view (person viewing with turning his/her head) and successive viewing (viewer standing in the same location turning his/her head from left to right).
6. In addition to the customary information (e.g., location name and coordinates, weather conditions, direction of view, camera elevation, distance to the nearest and farthest WTG with a graphic illustrating feet and percent visible of each, etc.), please include the following for each lease covered within the simulations:
   - Identify the WTG that will be in the center of the photo simulation's field of view. Face this WTG's rotor and blades toward the key observation point (KOP). Determine the compass direction of the center WTG is facing and orient the other WTGs in the same direction.
   - Locator-map insert illustrating:
     - the viewer orientation at each KOP,
     - cone of view from the KOP,
     - number and configuration of WTGs and OSSs (color-coded) within the different leases
     - color code the individual projects represented in the simulation with a unique color signature,
     - delineate the WTGs seen from the KOP apart from those unseen using an arc that separates the two, and screen back those that are unseen.
7. Prepare a total of four CE simulation series per KOP in the sequence described below to illustrate incremental effects:
   1) Simulation illustrating Empire Wind without other foreseeable future changes
   2) Simulation illustrating full lease buildout showing foreseeable projects in leased areas with Empire Wind
      a. Atlantic Shores
         i. WTG dimensions
            1. 1,046.6 feet high (MSL)
            2. 32.8 feet diameter at the base and 27.9 feet at the top
            3. hub height 574.2 ft (MSL)
            4. nacelle dimensions 82.0 ft x 52.5 ft x 39.4 ft
            5. rotor diameter 918.6 ft

6. blade length 452.8 ft
7. maximum blade width 32.8 ft

ii. Spacing: WTGs at 1 nm apart in rows spaced 0.6 nm
iii. Use WTGs in place of unknown OSS locations.

b. Atlantic Shores North
   i. WTG Dimensions:
      1. 1,046.6 ft high (MSL),
      2. 32.8 feet diameter at the base and 27.9 feet at the top;
      3. hub height 574.2 ft (MSL);
      4. nacelle dimensions 82.0 ft x 52.5 ft x 39.4 ft;
      5. rotor diameter 918.6 ft;
      6. blade length 452.8 ft and maximum blade width 32.8 ft;
   ii. Spacing: assume maximum buildout at 1 nm rows spaced 0.6 nm apart
   iii. Use WTGs in place of unknown OSS locations

3) Simulation illustrating full lease buildout showing foreseeable projects located in leased area and those lease areas scheduled for auction with Empire Wind *(producing this simulation is dependent on the timing of BOEM's internal decision on the final configurations of these lease areas).*
   a. New York Bight Lease Areas
      i. WTG Dimensions:
         1. 853 ft height (MSL)
         2. hub height 492 ft (MSL)
         3. rotor diameter 722 ft
      i. Spacing, assume maximum buildout at 1 nm x 1 nm between WTGs and rows.
      ii. Use WTGs in place of unknown OSS locations.

4) Simulation illustrating full lease buildout (leased and leases pending auction) not including Empire Wind.

8. Include a brief narrative on the simulation that explains the assumptions used for producing each simulation.

9. The developer should submit a written description for developing the simulations that incorporates the above information, identifies proposed KOPs, and provides sample simulation templates for BOEM to review for completeness and readability.

10. BOEM will review the developer's recommendation and schedule a work session with the developer to finalize the cumulative effect simulation strategy before the developer produces the simulations.

BOEM CE Simulation KOPs considered:

- KOP 3: Fire Island Lighthouse
- KOP 13: Point Pleasant Beach (If photography is available, if not then KOP 12: Ocean Grove Beach as the alternative)

- KOP 7: Jones Beach State Park (Need to confirm that the 40 mile viewshed extends beyond Empire Wind into the other NY Bight leases).

Attachment B. Detailed Visibility Analysis for Proposed Wind Projects

KOP from Empire Wind	Camera Elevation (ft)	Distance Empire WTG Obscured (mi)	Empire	Distance NY Bight Areas Obscured (mi)	Hudson North	Central Bight	Hudson A	Hudson B	Hudson C	Hudson D	Hudson E	Hudson F	Distance ASOW Obscured (mi)	Atlantic Shores North	Atlantic Shores South
Point Pleasant Beach*	10	41.7	31	39.7	44.2	61.1	31.9	44.3	54.7	47.1	49.9	56.8	43.5	29.6	55.2
Ocean Grove Beach*	**15**	**42.6**	25.4	40.5	41.9	60.9	36.8	46.8	58.5	52.7	56.3	63	44.4	29.6	55.2
Hartshorne Woods Park	**164**	**53.5**	22.3	51.5	42.8	64.1	45.9	53.8	66.3	61.3	67.2	73.4	55.3	49.3	75.3
Seven Presidents Oceanfront Park	10	41.7	22.1	39.7	41.3	61.8	41.6	50.1	62.2	57.1	62.4	68.7	43.5	44.3	70.3
Jacob Riis Park	**15**	**42.6**	21	40.5	43	65.6	54.5	59.9	73	68.9	77.6	82.8	44.4	61.7	87.8
Jones Beach State Park*	**16**	**42.8**	14.25	40.7	30.9	54.2	52.5	54	69.1	64.4	77	80.6	44.6	65.8	91.5
Fire Island Lighthouse*	**160**	**53.3**	21.7	51.3	23.9	45.6	58.2	55.6	67.2	64.5	82.5	84.2	55.1	76.3	100.7

Turbines not visible due to earth curvature

Some portion of turbines visible above the horizon

Turbine visibility determined based on Turbine specifications provided by BOEM and accounting for Earth curvature calculation to determine distance at which turbines are obscured.

New York Bight Max Rotor Tip	853ft
Atlantic Shores Max Rotor Tip	1046ft

* Indicates Empire Wind KOPs suggested by BOEM in their request dated September 2021.

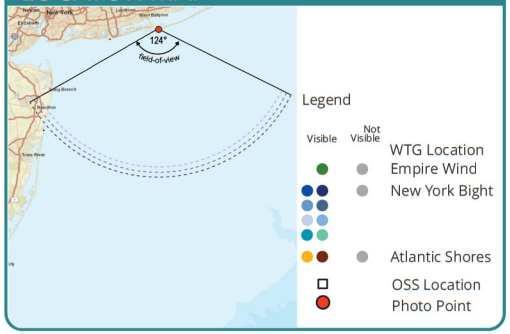
Bold text KOP indicates that simulations were prepared for that KOP as part of the Empire Wind VIA.

Attachment C. Cumulative Simulation Layout Template Sheets

EXISTING CONDITION

View of the existing condition at Fire Island Lighthouse

LOCATOR MAP



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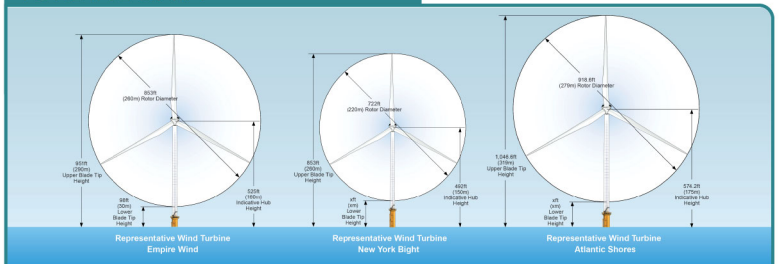


Viewpoint Visibility (Empire Wind)

Closest Visible Turbine 21.7 miles Farthest Visible 29.6 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Fire Island Lighthouse
Date of Photograph:	September 9, 2019
Time of Photograph:	1:50 PM (EDT)
Weather Condition:	Hazy
Latitude:	40.632216° N
Longitude:	-73.218455° W
Viewing Direction:	South
Ground Elevation + Tripod Height:	160 feet

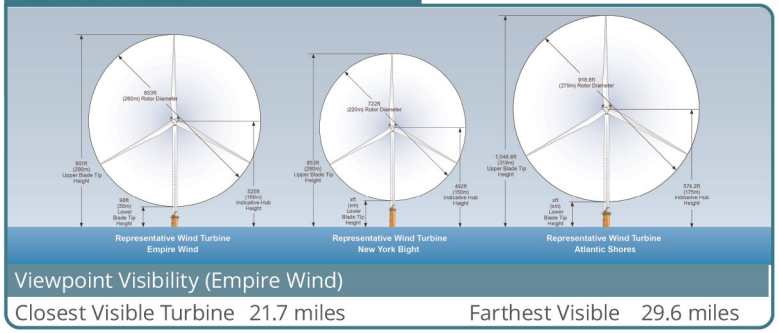
*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION

Simulation illustrating Empire Wind without other foreseeable future changes

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine 21.7 miles Farthest Visible 29.6 miles

PHOTOGRAPH INFORMATION

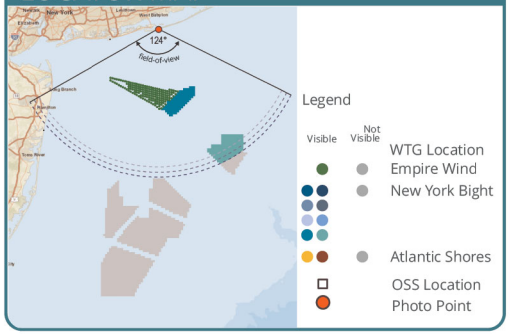
Viewpoint Location:	Fire Island Lighthouse
Date of Photograph:	September 9, 2019
Time of Photograph:	1:50 PM (EDT)
Weather Condition:	Hazy
Latitude:	40.632216° N
Longitude:	-73.218455° W
Viewing Direction:	South
Ground Elevation + Tripod Height:	160 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

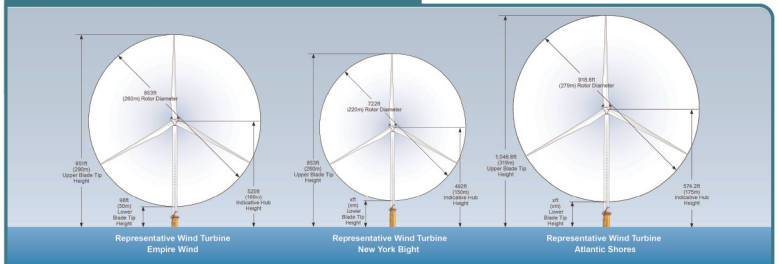
SIMULATION

Simulation illustrating full lease buildout showing foreseeable projects located in leased area and those lease areas scheduled for auction with Empire Wind

LOCATOR MAP



TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine 21.7 miles Farthest Visible 29.6 miles

PHOTOGRAPH INFORMATION

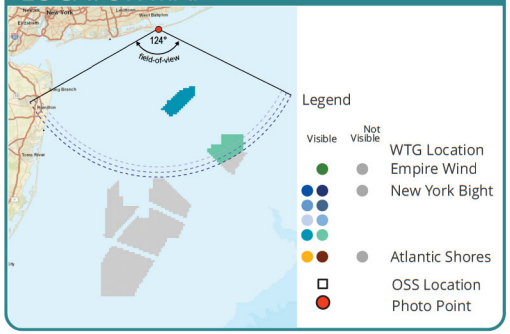
Viewpoint Location:	Fire Island Lighthouse
Date of Photograph:	September 9, 2019
Time of Photograph:	1:50 PM (EDT)
Weather Condition:	Hazy
Latitude:	40.632216° N
Longitude:	-73.218455° W
Viewing Direction:	South
Ground Elevation + Tripod Height:	160 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

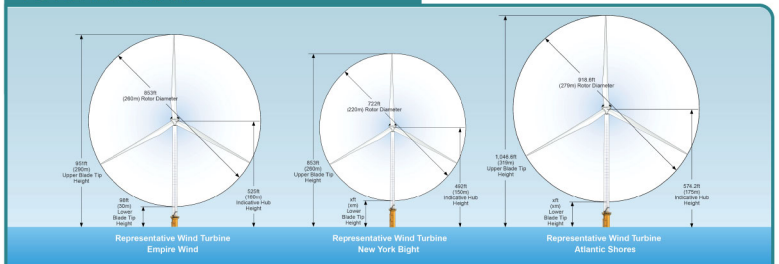
SIMULATION

Simulation illustrating full lease buildout (leased and leases pending auction) not including Empire Wind

LOCATOR MAP



TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine 21.7 miles Farthest Visible 29.6 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Fire Island Lighthouse
Date of Photograph:	September 9, 2019
Time of Photograph:	1:50 PM (EDT)
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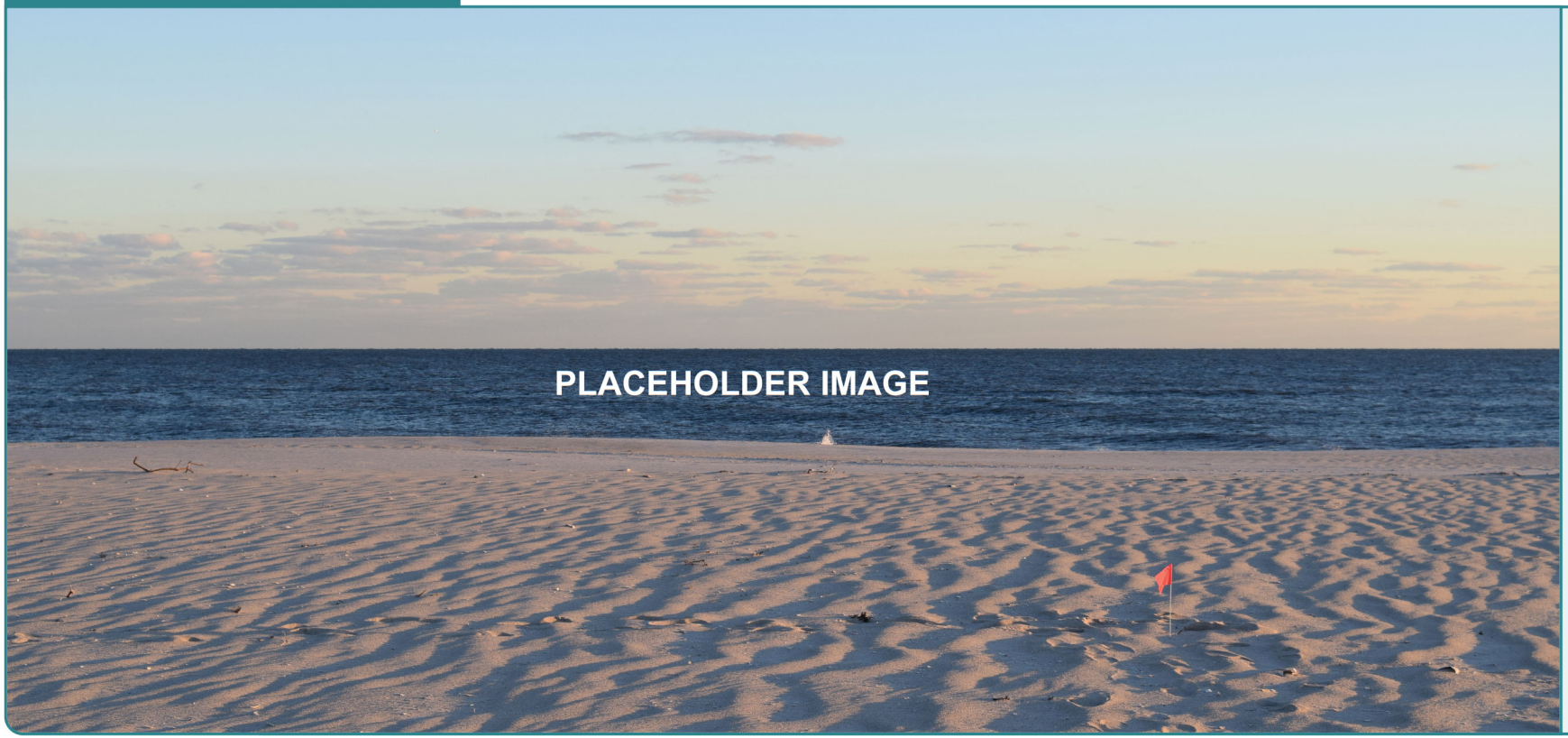
Viewing Direction:	South
Ground Elevation + Tripod Height:	160 feet

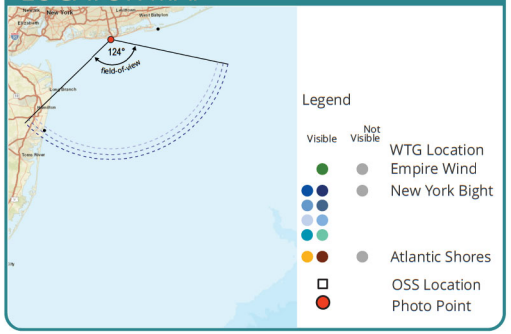
*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

EXISTING CONDITION

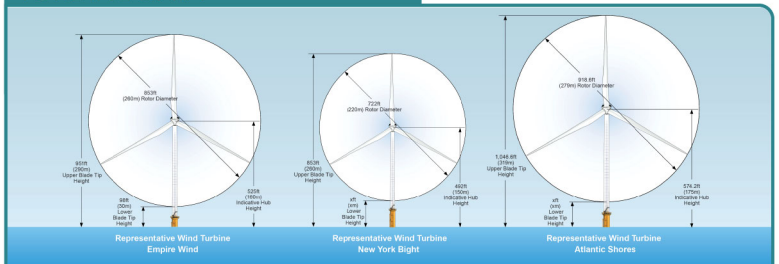


View of the existing condition at Jones Beach State Park

LOCATOR MAP



TURBINE DATA



Viewpoint Visibility (Empire Wind)

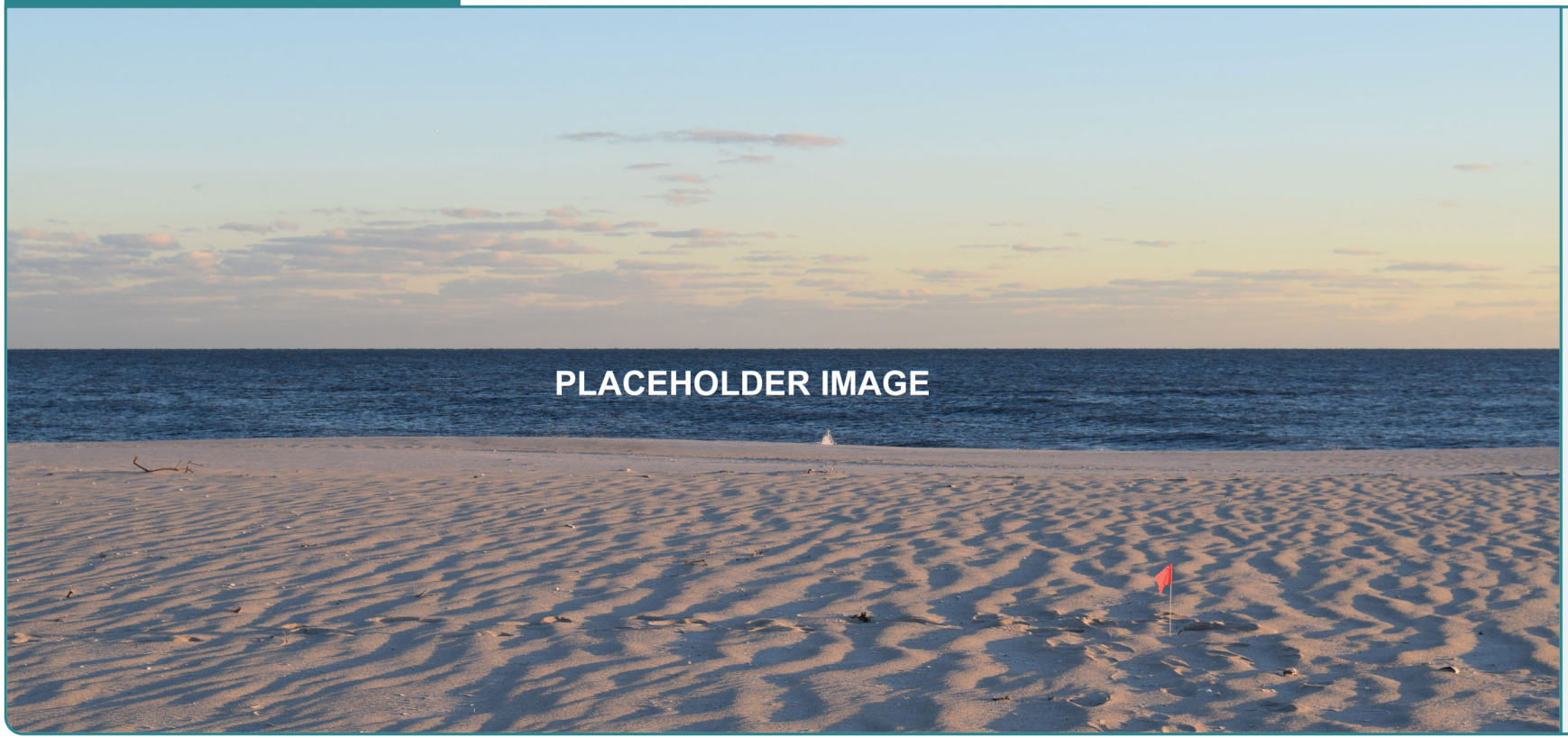
Closest Visible Turbine 14.2 miles Farthest Visible 31.8 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Jones Beach State Park
Date of Photograph:	December 7, 2018
Time of	3:30 PM (EDT)
Weather Condition:	Clear
Latitude:	40.580436° N
Longitude:	-73.55644° W
Viewing Direction:	Southeast
Ground Elevation + Tripod	16 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

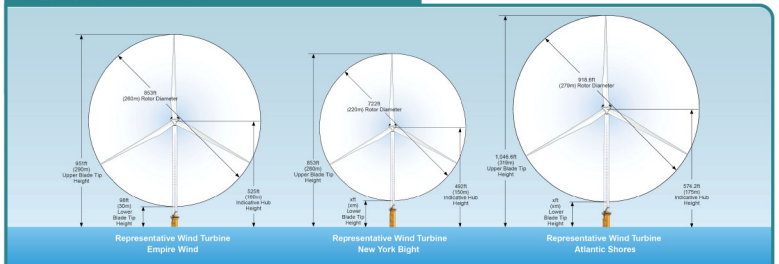
SIMULATION



Simulation illustrating Empire Wind without other foreseeable future changes

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

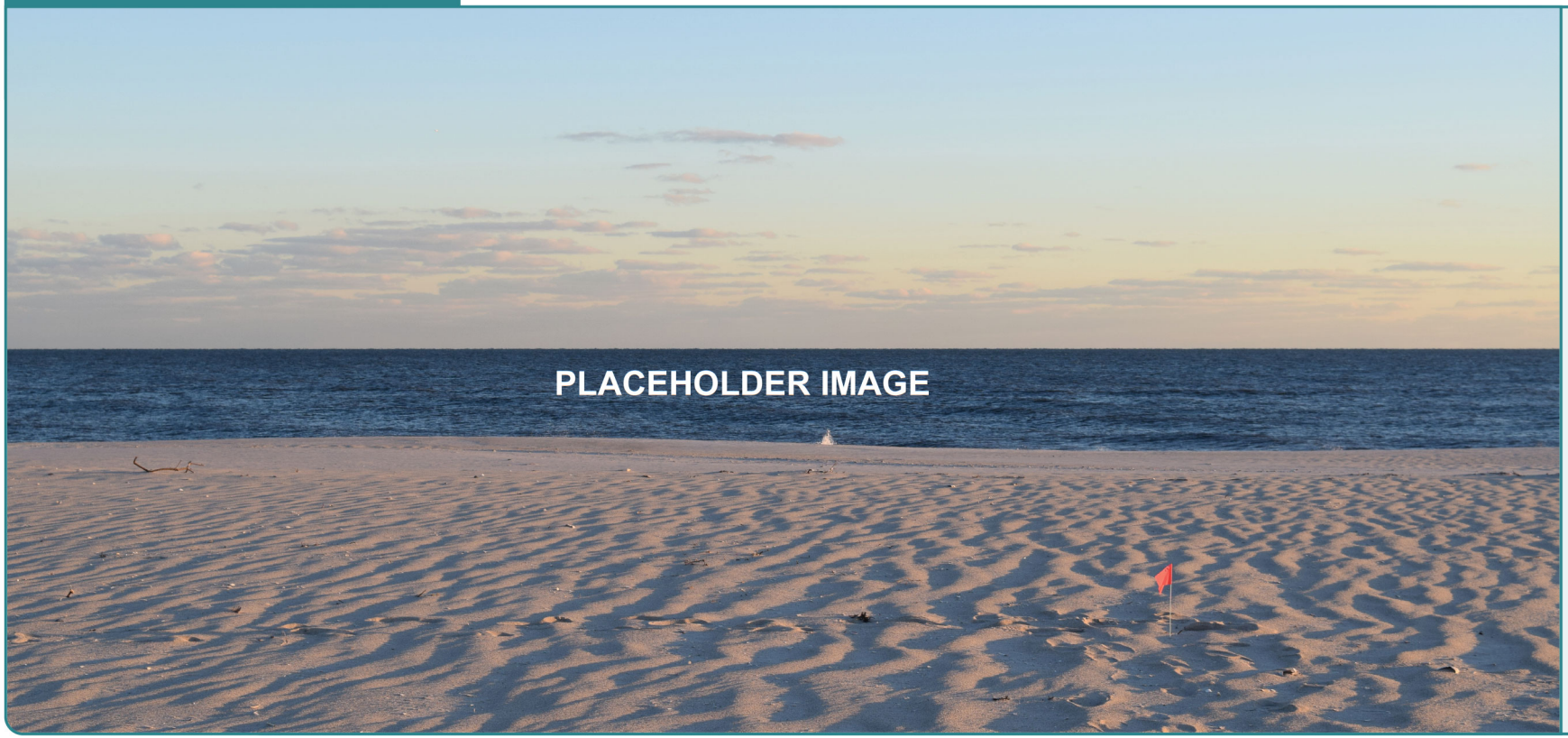
Closest Visible Turbine 14.2 miles Farthest Visible 31.8 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Jones Beach State Park
Date of Photograph:	December 7, 2018
Time of	3:30 PM (EDT)
Weather Condition:	Clear
Latitude:	40.580436° N
Longitude:	-73.55644° W
Viewing Direction:	Southeast
Ground Elevation + Tripod	16 feet

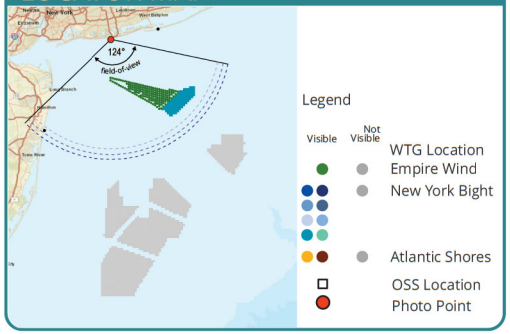
*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION



Simulation illustrating full lease buildout showing foreseeable projects located in leased area and those lease areas scheduled for auction with Empire Wind

LOCATOR MAP



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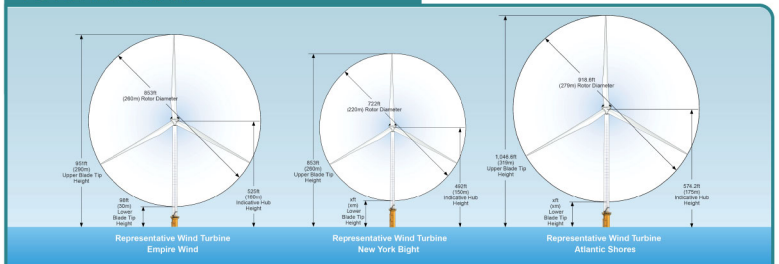


Viewpoint Visibility (Empire Wind)

Closest Visible Turbine 14.2 miles

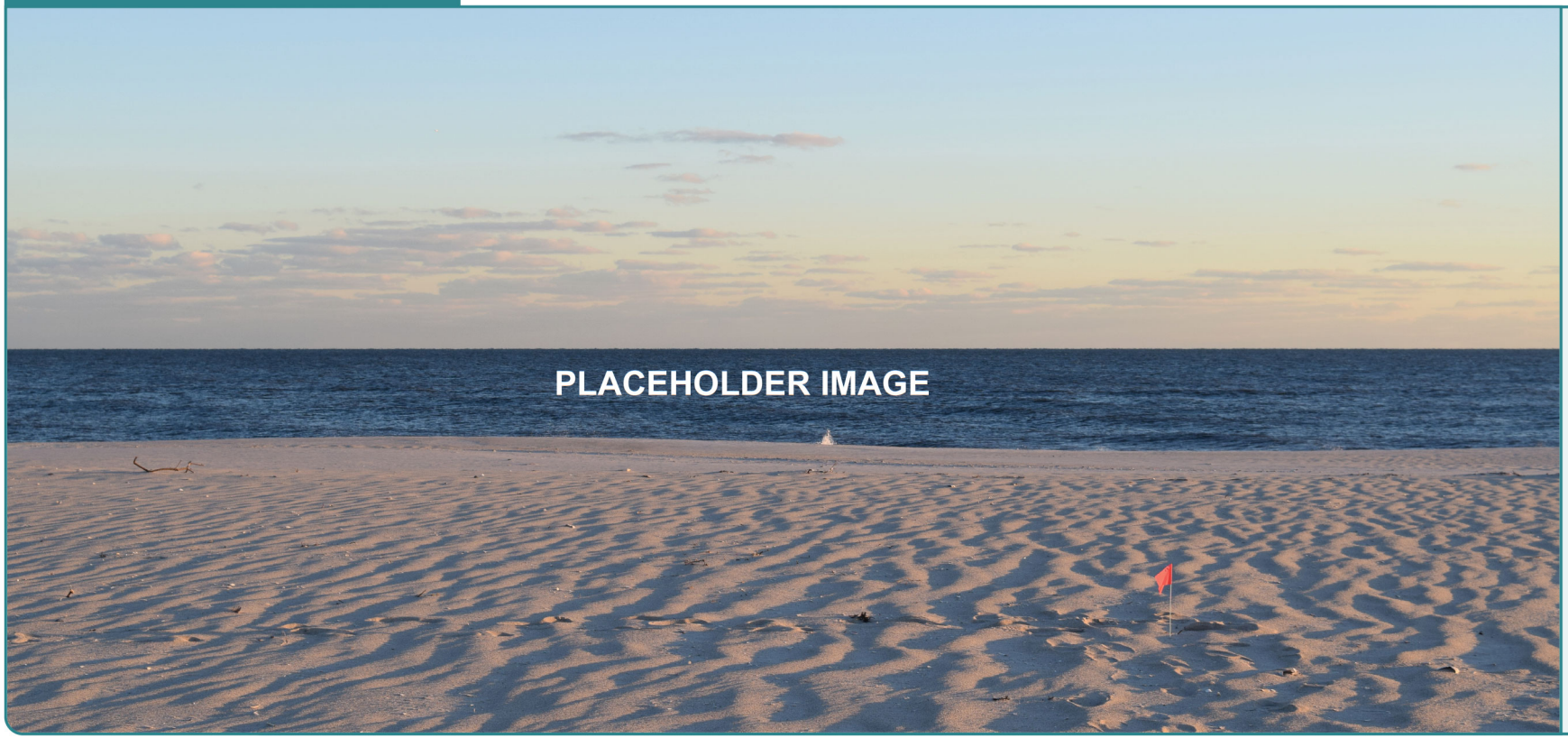
Farthest Visible 31.8 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Jones Beach State Park
Date of Photograph:	December 7, 2018
Time of	3:30 PM (EDT)
Weather Condition:	Clear
Latitude:	40.580436° N
Longitude:	-73.55644° W
Viewing Direction:	Southeast
Ground Elevation + Tripod	16 feet

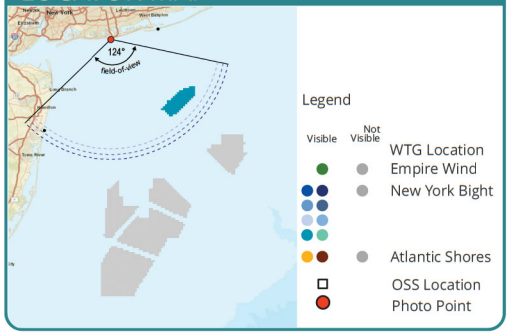
*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION

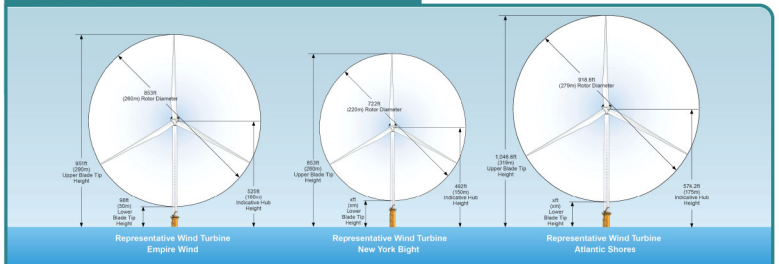


Simulation illustrating full lease buildout (leased and leases pending auction) not including Empire Wind

LOCATOR MAP



TURBINE DATA



Viewpoint Visibility (Empire Wind)

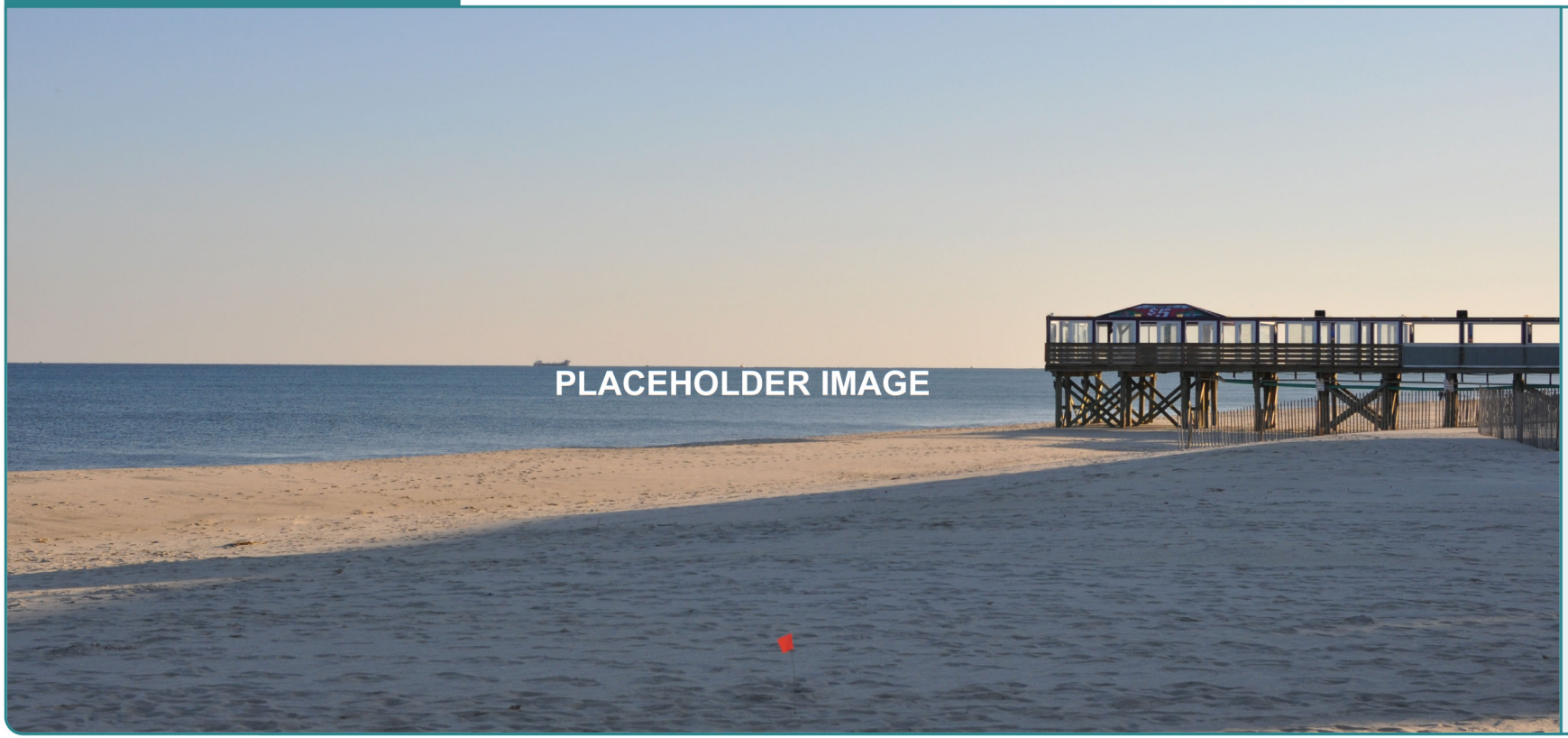
Closest Visible Turbine 14.2 miles Farthest Visible 31.8 miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Jones Beach State Park
Date of Photograph:	December 7, 2018
Time of	3:30 PM (EDT)
Weather Condition:	Clear
Latitude:	40.580436° N
Longitude:	-73.55644° W
Viewing Direction:	Southeast
Ground Elevation + Tripod	16 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

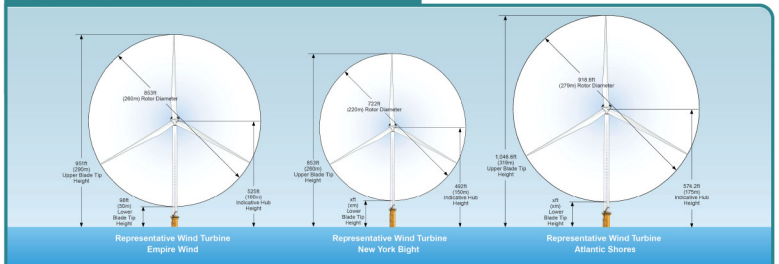
EXISTING CONDITION



View of the existing condition at Point Pleasant Beach

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine x miles

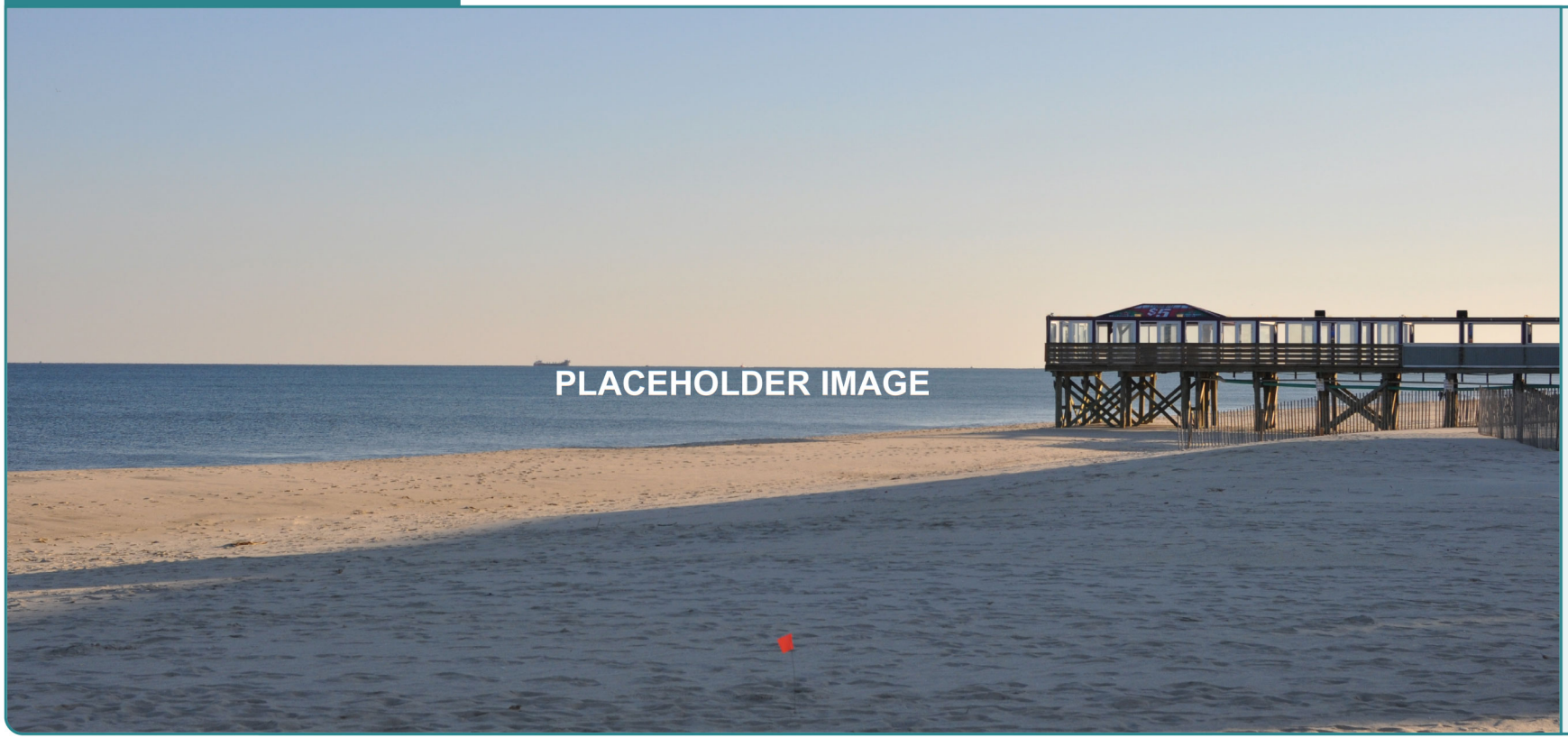
Farthest Visible x miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 11, 2018
Time of Photograph:	2:49 PM (EDT)
Weather Condition:	-
Latitude:	x° N
Longitude:	-x° W
Viewing Direction:	-
Ground Elevation + Tripod	10 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

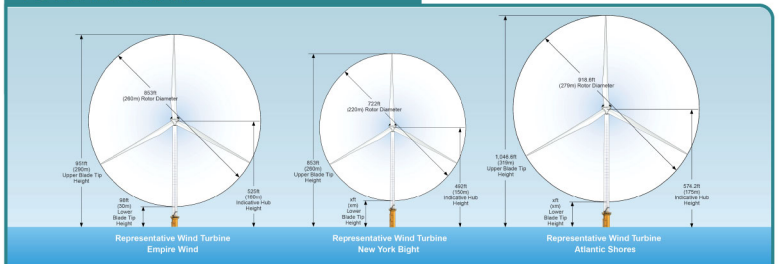
SIMULATION



Simulation illustrating Empire Wind without other foreseeable future changes

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine x miles

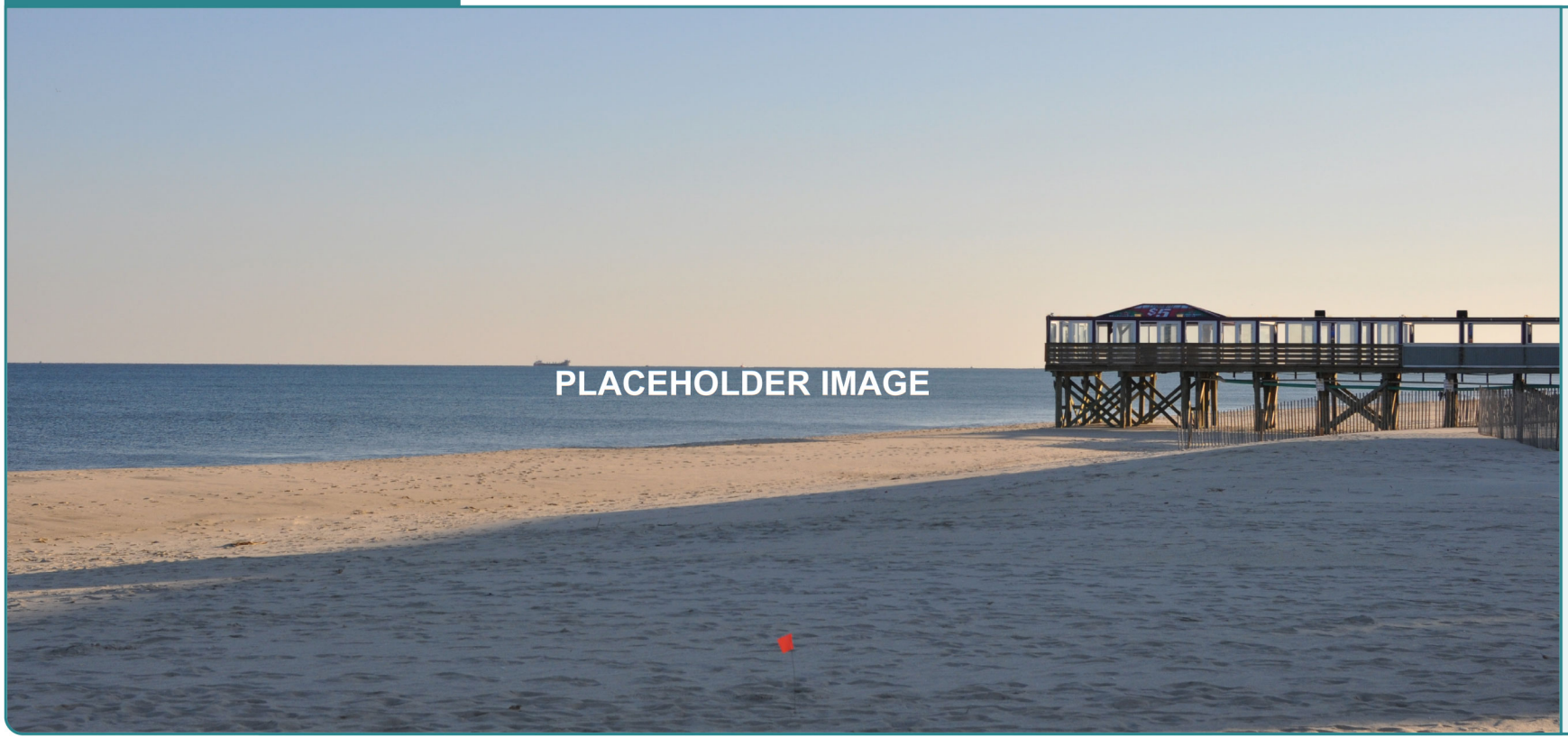
Farthest Visible x miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 11, 2018
Time of Photograph:	2:49 PM (EDT)
Weather Condition:	-
Latitude:	x° N
Longitude:	-x° W
Viewing Direction:	-
Ground Elevation + Tripod	10 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

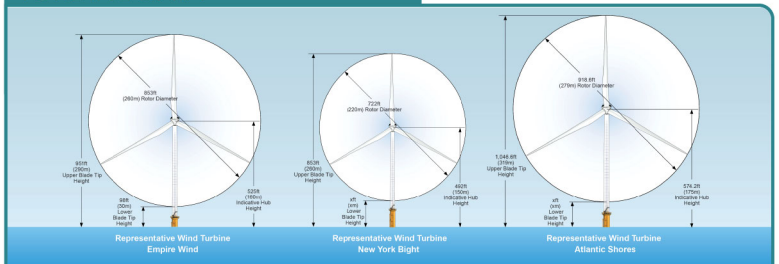
SIMULATION



Simulation illustrating full lease buildout showing foreseeable projects located in Atlantic Shores and those lease areas scheduled for auction with Empire Wind

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine x miles

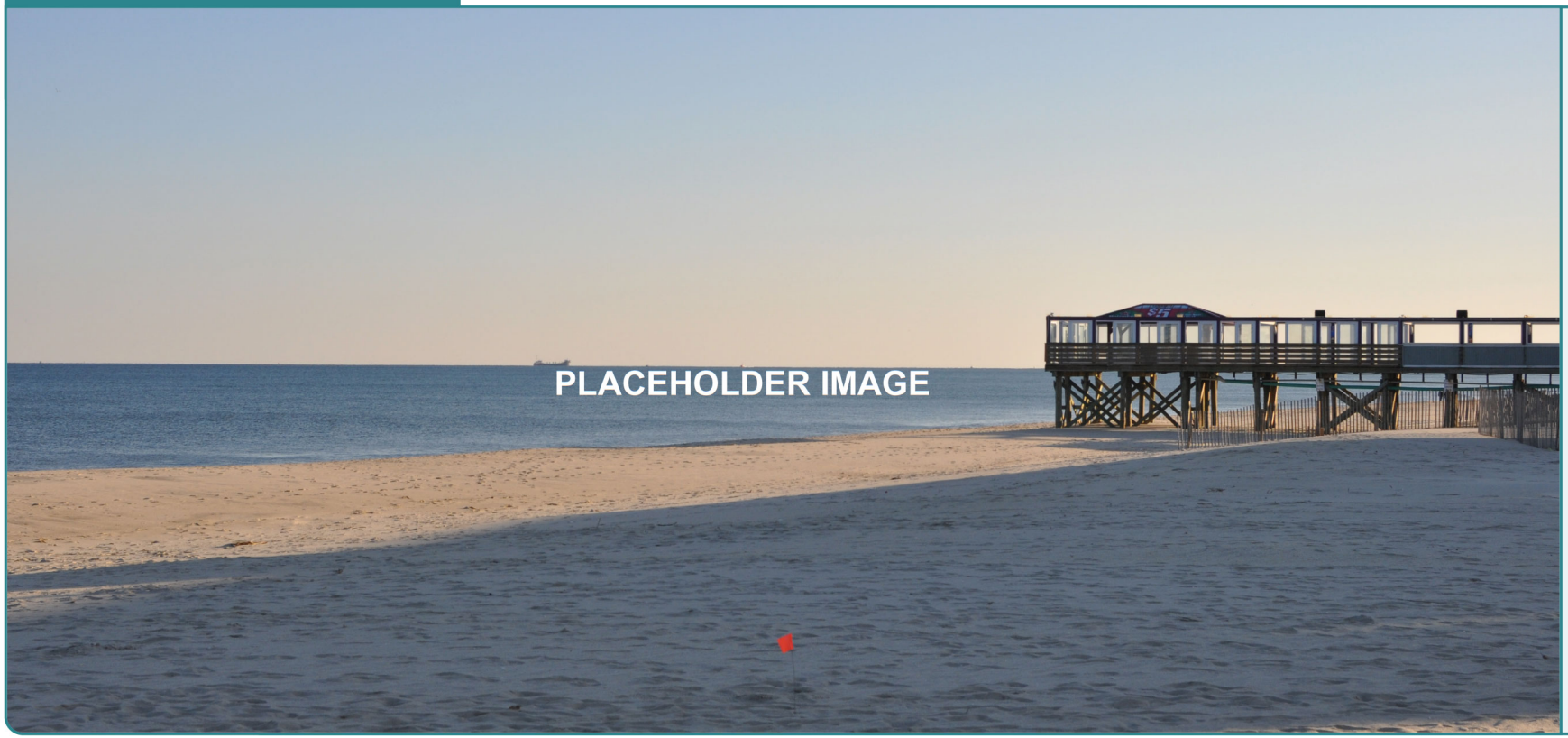
Farthest Visible x miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 11, 2018
Time of Photograph:	2:49 PM (EDT)
Weather Condition:	-
Latitude:	x° N
Longitude:	-x° W
Viewing Direction:	-
Ground Elevation + Tripod	10 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

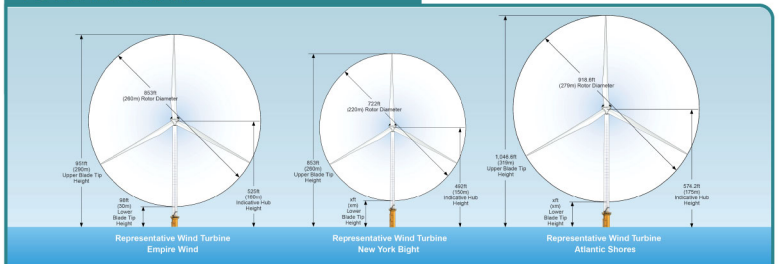
SIMULATION



Simulation illustrating full lease buildout showing foreseeable projects located in Atlantic Shores, New York Bight Lease Areas and those lease areas scheduled for auction with Empire Wind

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine x miles

Farthest Visible x miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 11, 2018
Time of Photograph:	2:49 PM (EDT)
Weather Condition:	-
Latitude:	x° N
Longitude:	-x° W
Viewing Direction:	-
Ground Elevation + Tripod	10 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

EMPIRE OFFSHORE WIND: CUMULATIVE EFFECTS SIMULATION | POINT PLEASANT BEACH

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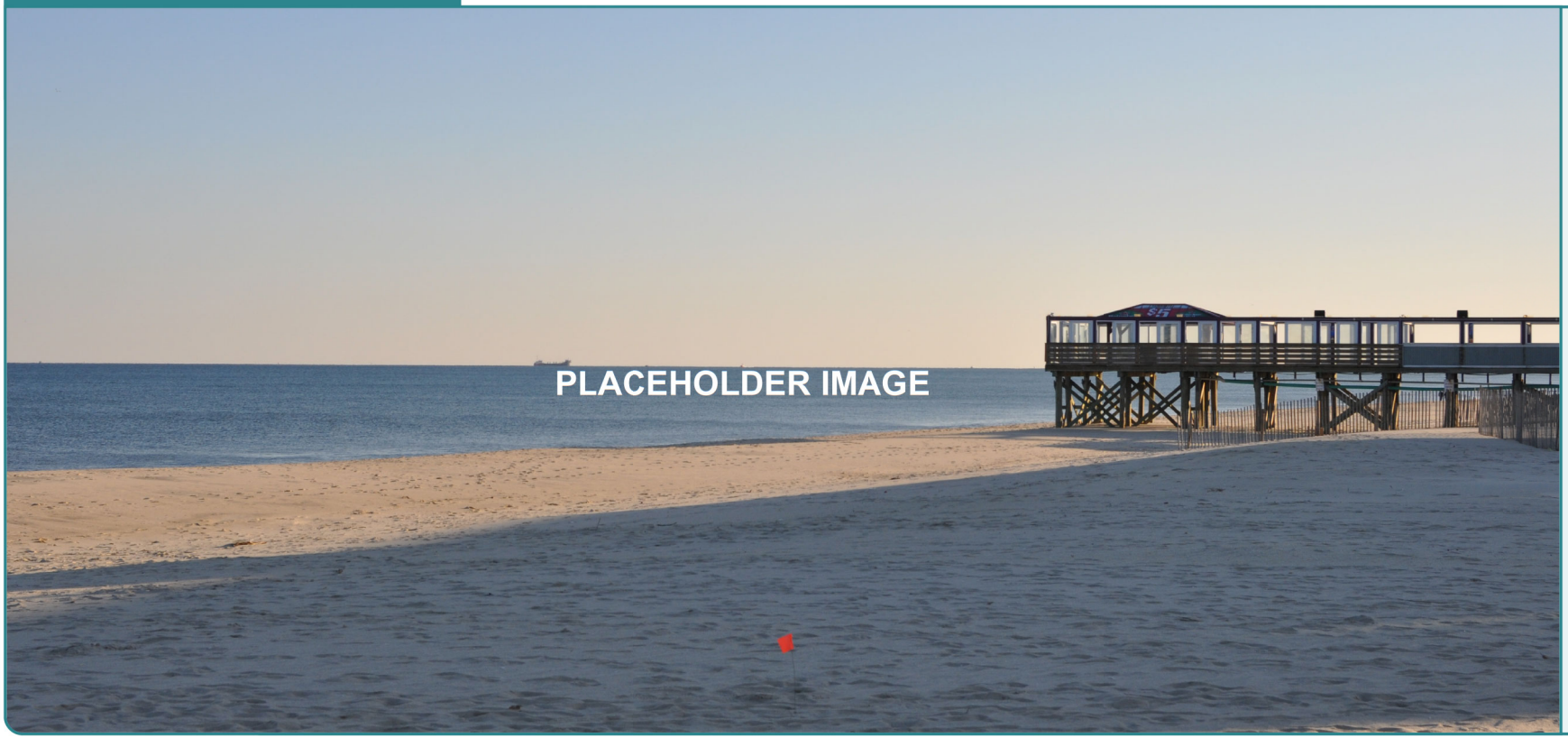
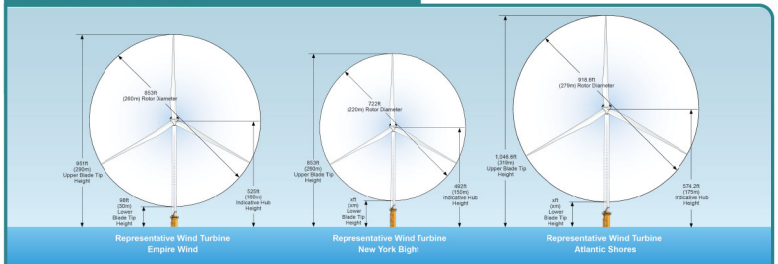
SIMULATION



Simulation illustrating full lease buildout (leased and leases pending auction) not including Empire Wind

LOCATOR MAP

TURBINE DATA



Viewpoint Visibility (Empire Wind)

Closest Visible Turbine x miles

Farthest Visible x miles

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 11, 2018
Time of Photograph:	2:49 PM (EDT)
Weather Condition:	-
Latitude:	x° N
Longitude:	-x° W
Viewing Direction:	-
Ground Elevation + Tripod	10 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

Appendix C
Empire Wind Cumulative Visual Simulations

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EMPIRE OFFSHORE WIND

CUMULATIVE EFFECTS SIMULATION

March 2022

EMPIRE OFFSHORE WIND
CUMULATIVE EFFECTS

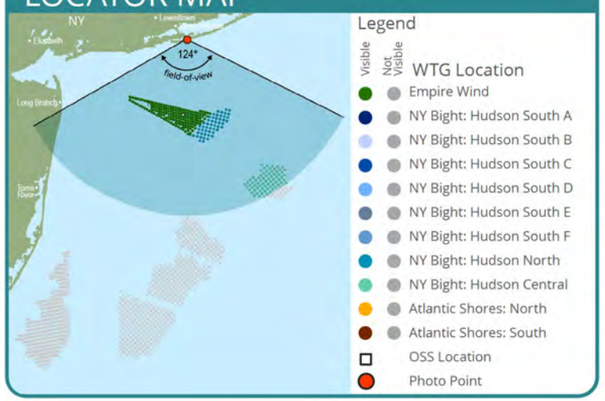
TABLE OF CONTENTS

EXISTING CONDITION

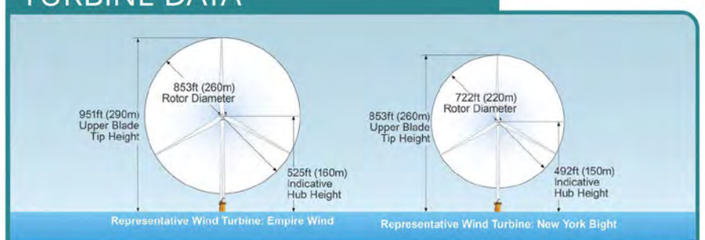
KOP 1

View of the existing condition at Fire Island Lighthouse

LOCATOR MAP



TURBINE DATA



	Distance to the closest WTG (mi)	Distance to the farthest WTG (mi)
Empire Offshore Wind	21.7	29.6
New York Bight - Hudson North	24.3	32.1
New York Bight - Hudson Central	45.9	60.5

PHOTOGRAPH INFORMATION

Viewpoint Location:	Fire Island Lighthouse
Date of Photograph:	February 10, 2022
Time of Photograph:	9:20 AM
Weather Condition:	Partly Cloudy
Temperature	35° F
Humidity	96%
Latitude:	40.632216° N
Longitude:	-73.218455° W

	Type	Brand	Model
Camera	Mirrorless	Nikon	Z6
Lens	NIKKOR Z 50mm f/1.8		
Focal Length	50 mm		
Viewing Direction:	South		
Ground Elevation + Tripod Height:	160 feet		

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION 1A.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes

COMPLETE PANORAMIC VIEW

SIMULATION 1A.2: EMPIRE WIND + NY BIGHT

Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

COMPLETE PANORAMIC VIEW

SIMULATION 1A.2: EMPIRE WIND + NY BIGHT *(Annotated)*

Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind. NY Bight Hudson Central is not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 1A.3: NY BIGHT

Simulation illustrating full lease buildout not including Empire Wind

COMPLETE PANORAMIC VIEW

KOP 1A

SIMULATION 1A.3: NY BIGHT *(Annotated)*

Simulation illustrating full lease buildout not including Empire Wind. NY Bight Hudson Central is not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 1B.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes

COMPLETE PANORAMIC VIEW

SIMULATION 1B.2: EMPIRE WIND + NY BIGHT

Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

COMPLETE PANORAMIC VIEW

KOP 1B

SIMULATION 1B.2: EMPIRE WIND + NY BIGHT *(Annotated)*

Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

COMPLETE PANORAMIC VIEW

KOP 1B

SIMULATION 1B.3: NY BIGHT

Simulation illustrating full lease buildout not including Empire Wind

COMPLETE PANORAMIC VIEW

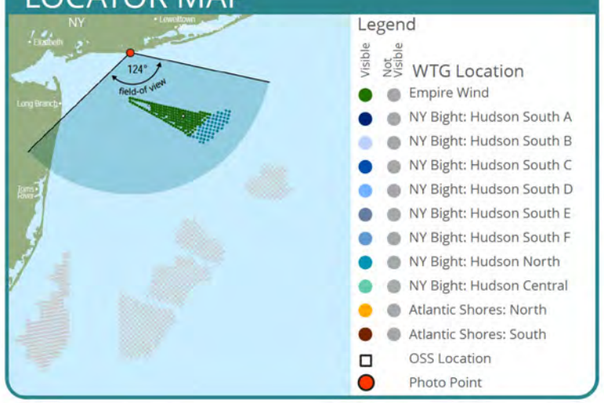
SIMULATION LOCATION 2: JONES BEACH STATE PARK

KOP 2

EXISTING CONDITION

View of the existing condition at Jones Beach State Park

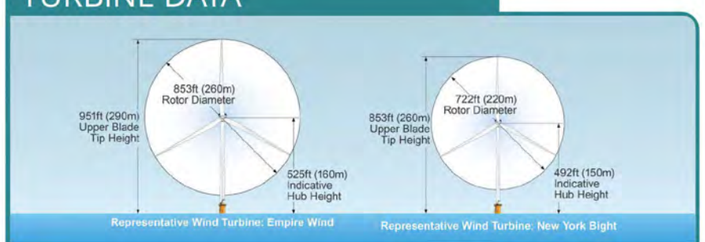
LOCATOR MAP



Legend

Visible	Not Visible	WTG Location
●	●	Empire Wind
●	●	NY Bight: Hudson South A
●	●	NY Bight: Hudson South B
●	●	NY Bight: Hudson South C
●	●	NY Bight: Hudson South D
●	●	NY Bight: Hudson South E
●	●	NY Bight: Hudson South F
●	●	NY Bight: Hudson North
●	●	NY Bight: Hudson Central
●	●	Atlantic Shores: North
●	●	Atlantic Shores: South
□		OSS Location
●		Photo Point

TURBINE DATA



	Distance to the closest WTG (mi)	Distance to the farthest WTG (mi)
Empire Offshore Wind	14.25	31.8
New York Bight - Hudson North	31.9	37.1

PHOTOGRAPH INFORMATION

Viewpoint Location:	Jones Beach State Park
Date of Photograph:	December 17, 2021
Time of Photograph:	11:12AM
Weather Condition:	Partly Cloudy
Temperature	58° F
Humidity	17%
Latitude:	40.580436° N
Longitude:	-73.55644° W

	Type	Brand	Model
Camera	Mirrorless	Nikon	Z6
Lens	NIKKOR Z 50mm f/1.8		
Focal Length	50 mm		
Viewing Direction:	South		
Ground Elevation + Tripod Height:	16.5 feet		

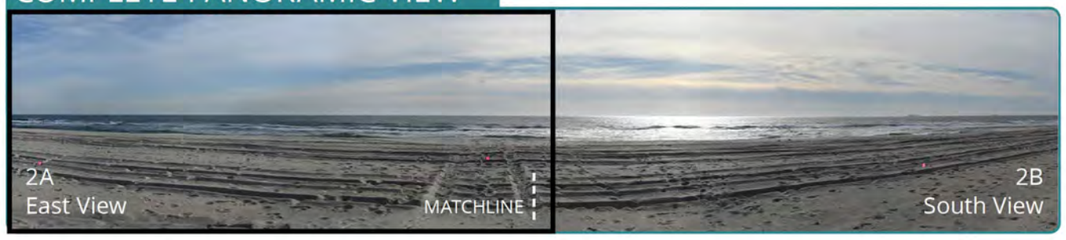
*The image on this page approximates the full horizontal field-of-view of typical human eyesight (124° horizontal)

SIMULATION 2A.1: EMPIRE WIND

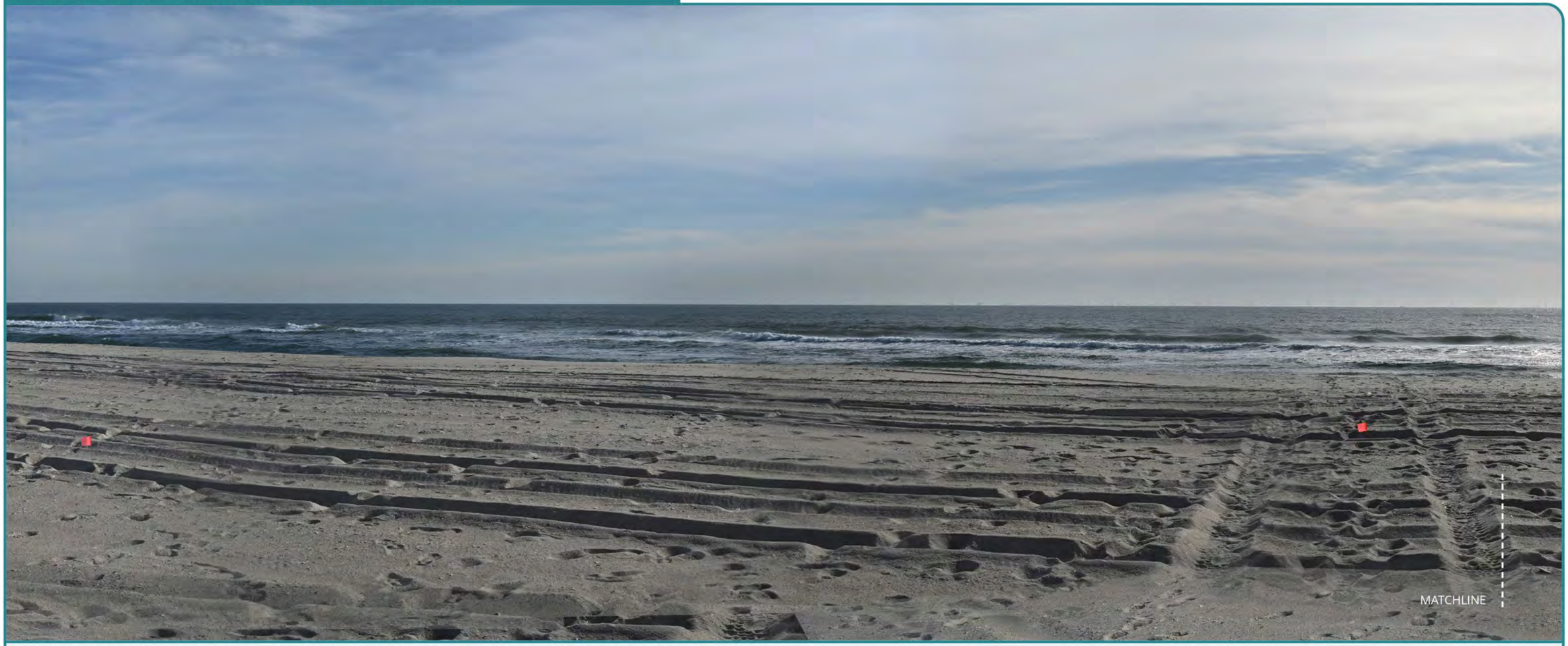
Simulation illustrating Empire Wind without other foreseeable future changes

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



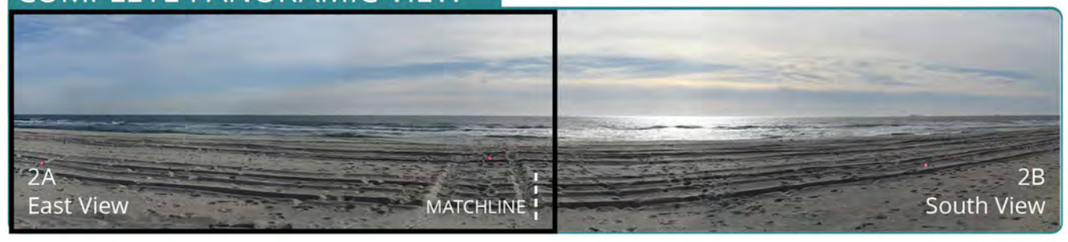
SIMULATION 2A.2: EMPIRE WIND + NY BIGHT



Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

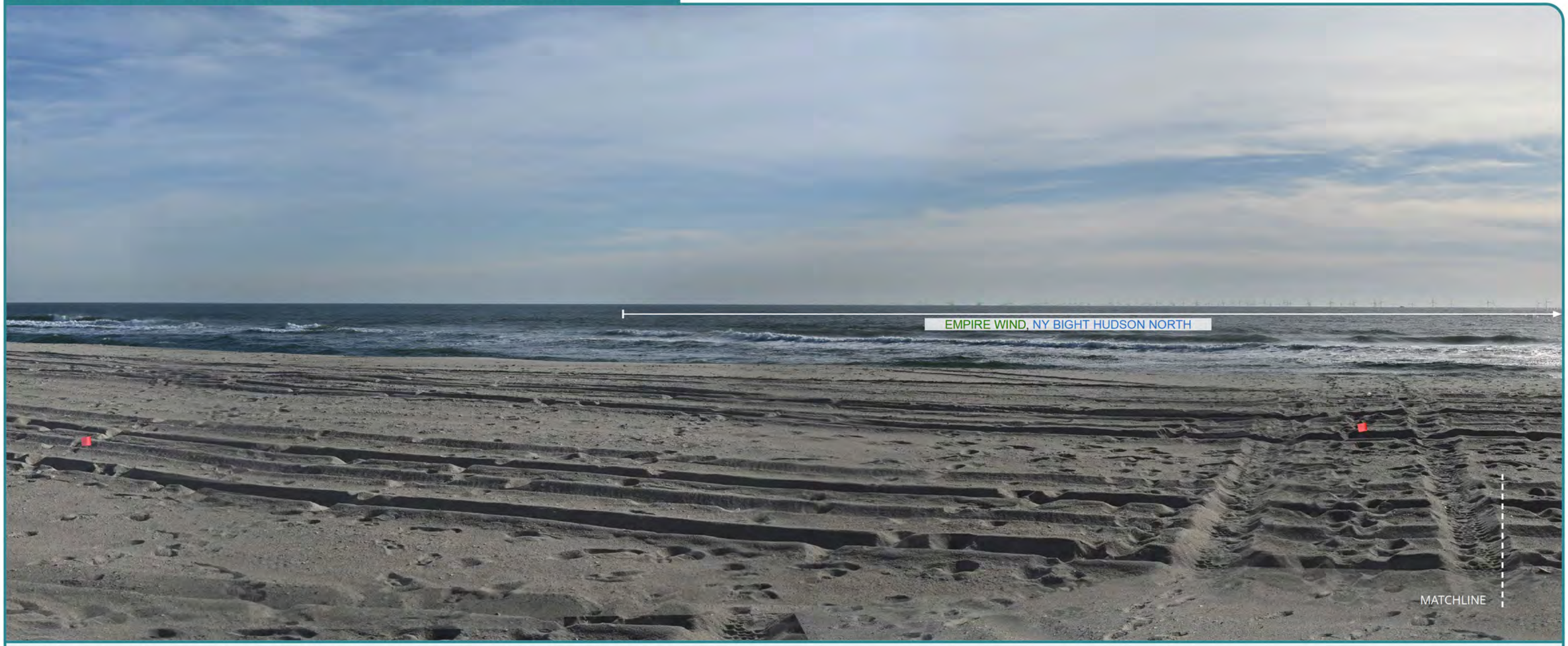
*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



KOP 2A

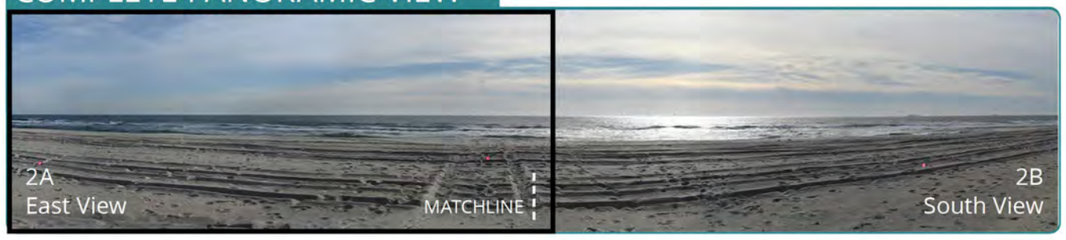
SIMULATION 2A.2: EMPIRE WIND + NY BIGHT *(Annotated)*



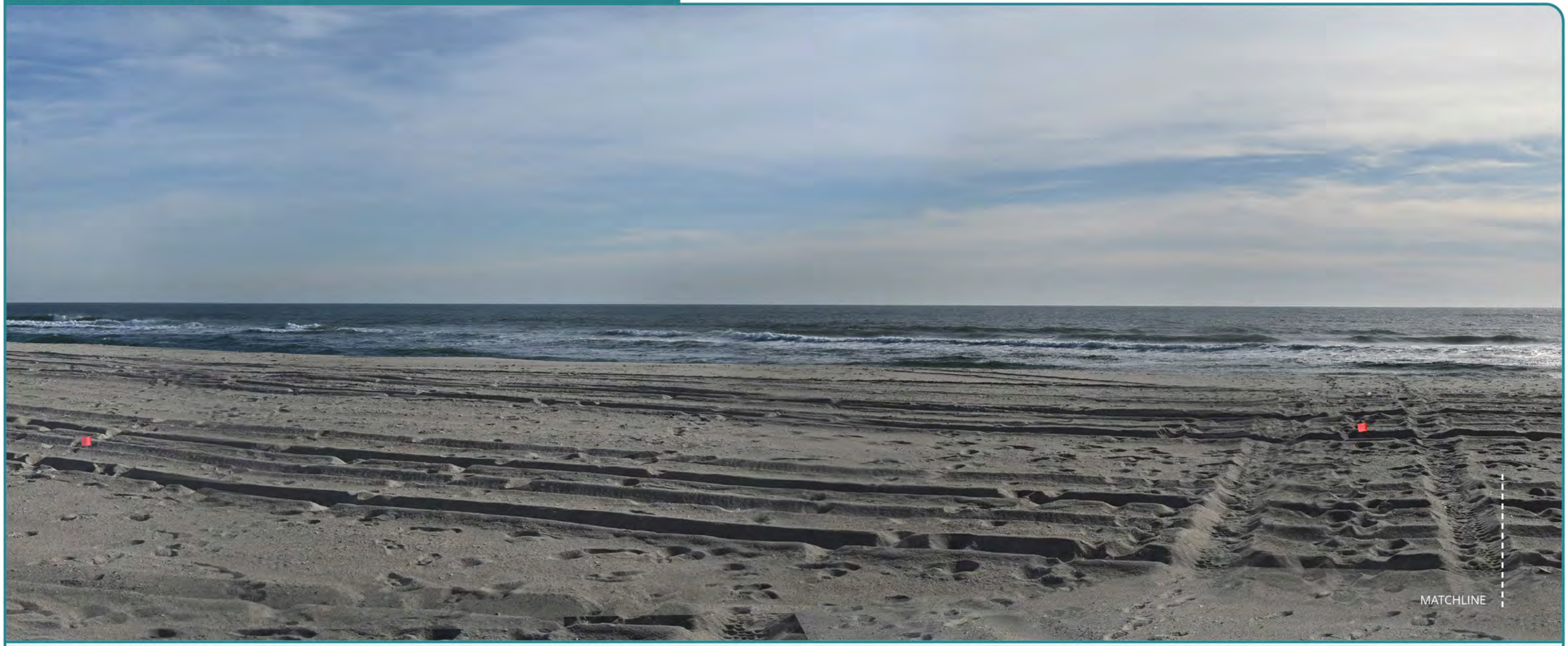
Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



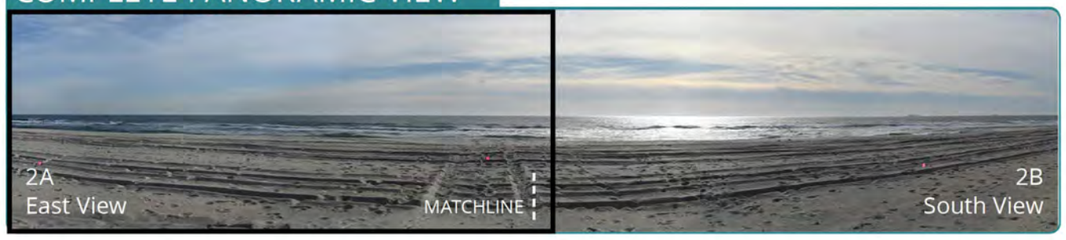
SIMULATION 2A.3: NY BIGHT



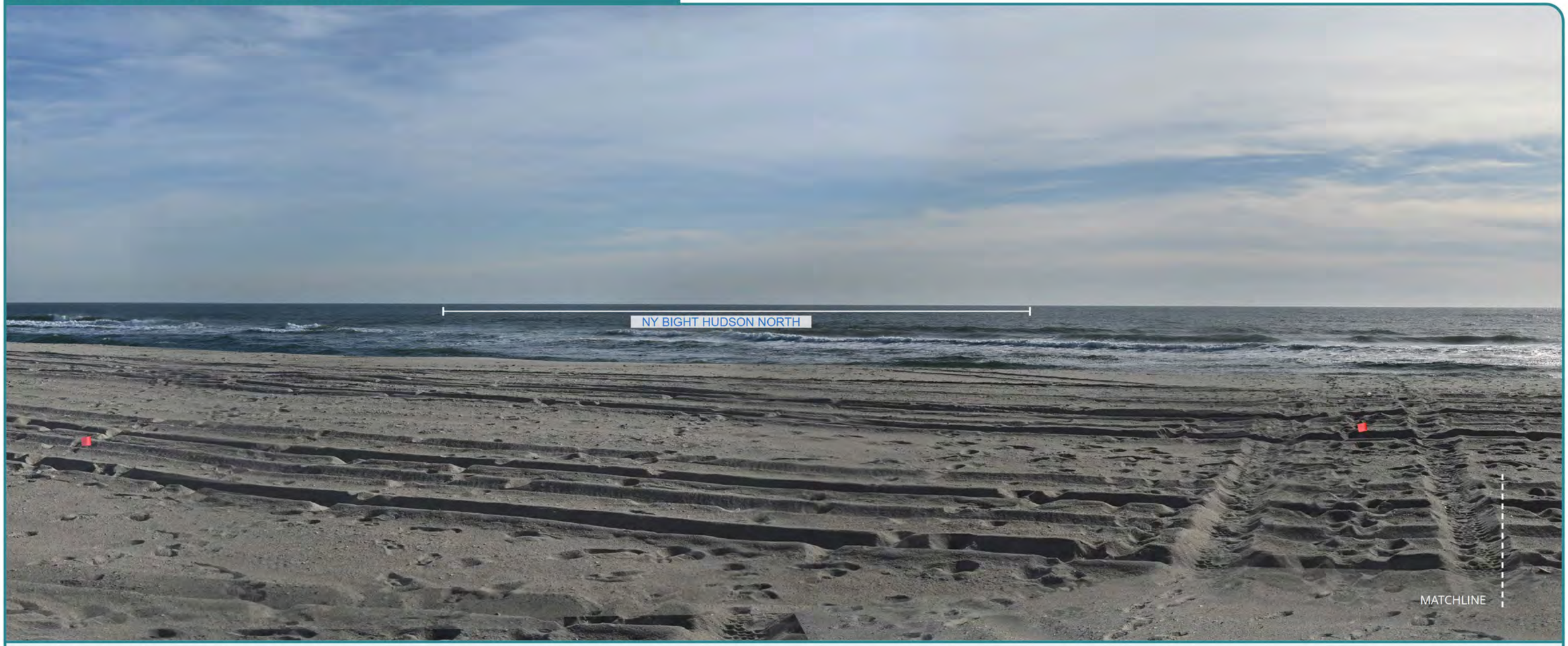
Simulation illustrating full lease buildout not including Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



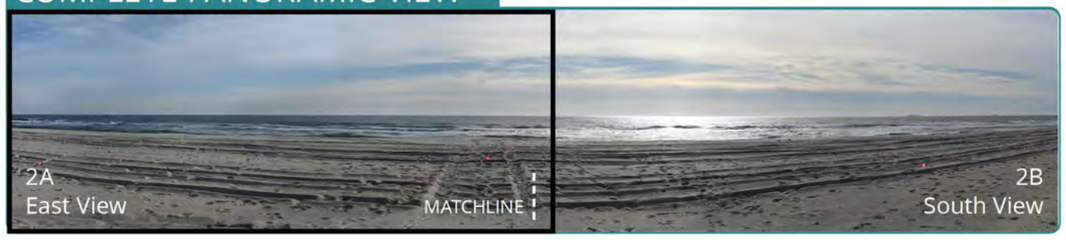
SIMULATION 2A.3: NY BIGHT *(Annotated)*



Simulation illustrating full lease buildout not including Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



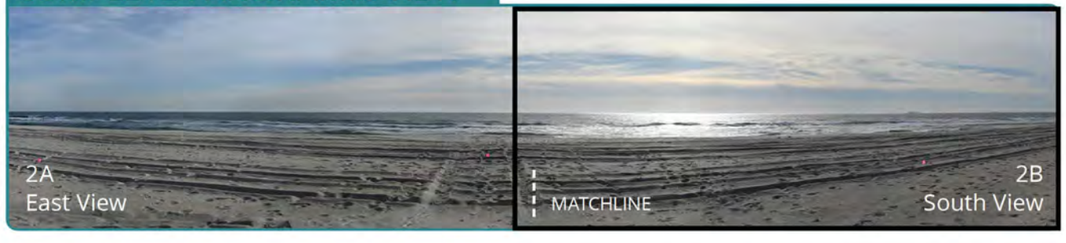
SIMULATION 2B.1: EMPIRE WIND

MATCHLINE

Simulation illustrating Empire Wind without other foreseeable future changes

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



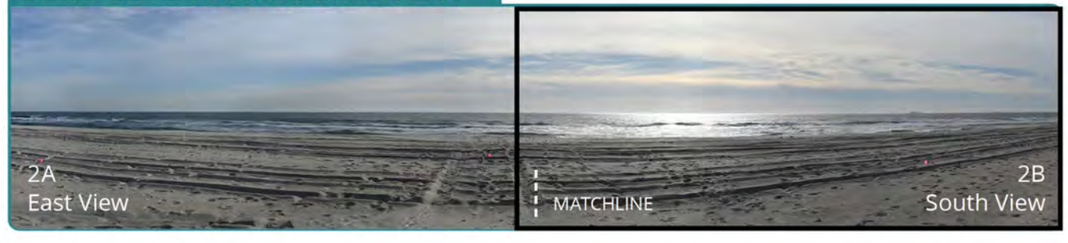
SIMULATION 2B.2: EMPIRE WIND + NY BIGHT

MATCHLINE

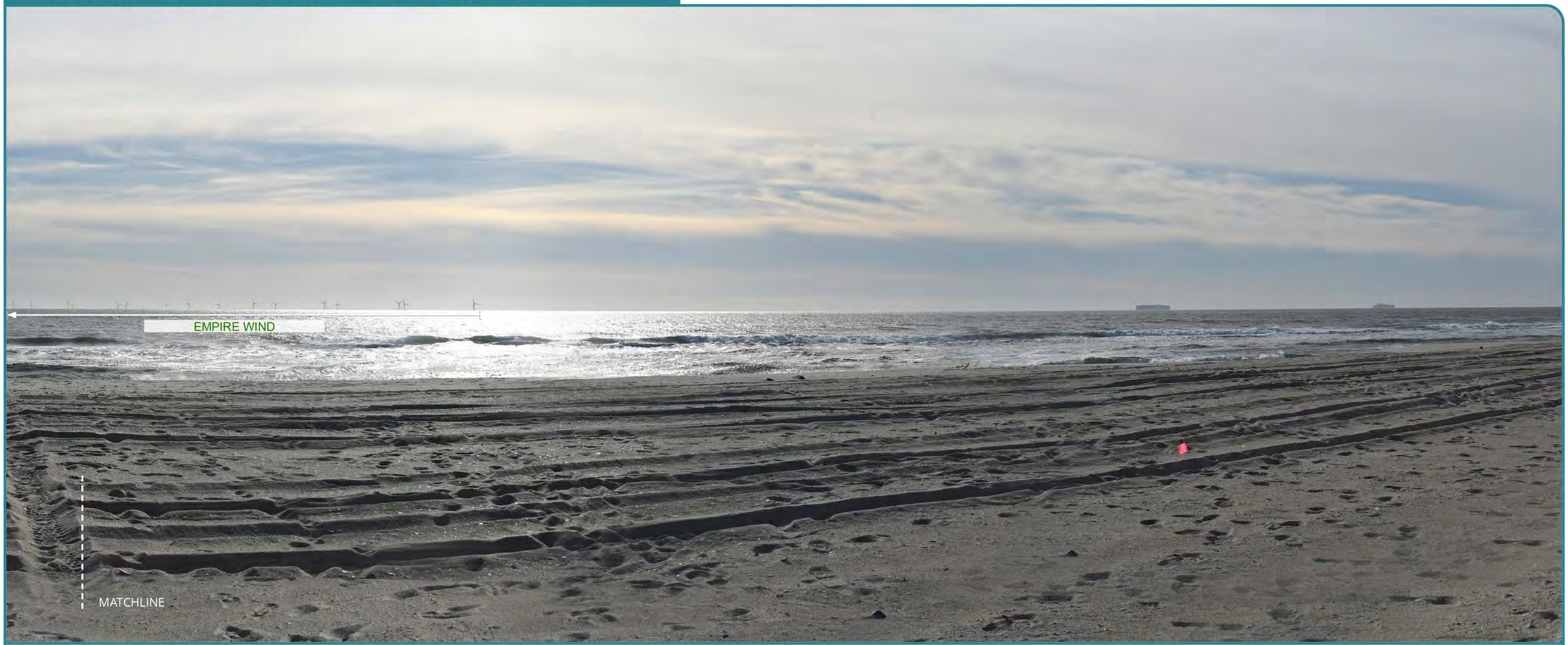
Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



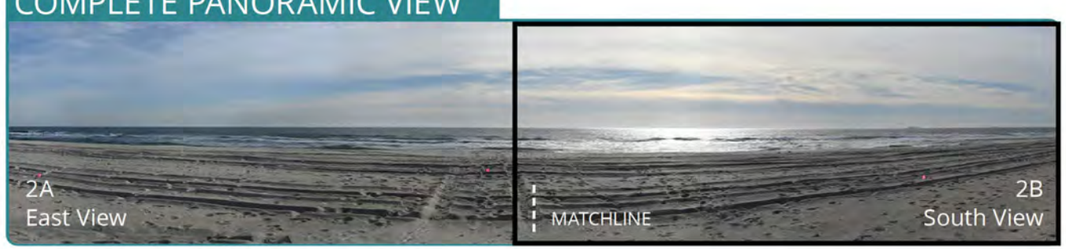
SIMULATION 2B.2: EMPIRE WIND + NY BIGHT *(Annotated)*



Simulation illustrating full lease buildout showing foreseeable projects located in leased areas with Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



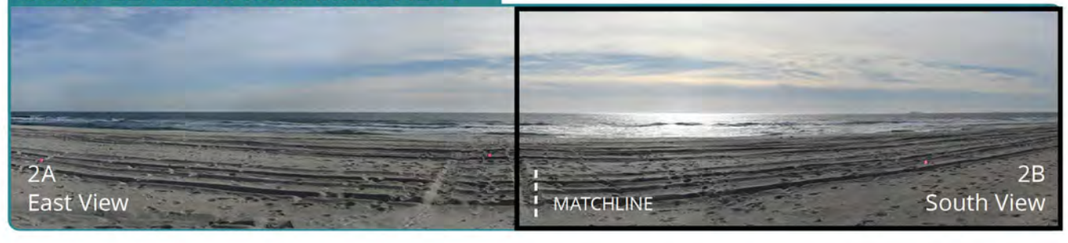
SIMULATION 2B.3: NY BIGHT

MATCHLINE

Simulation illustrating full lease buildout not including Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW



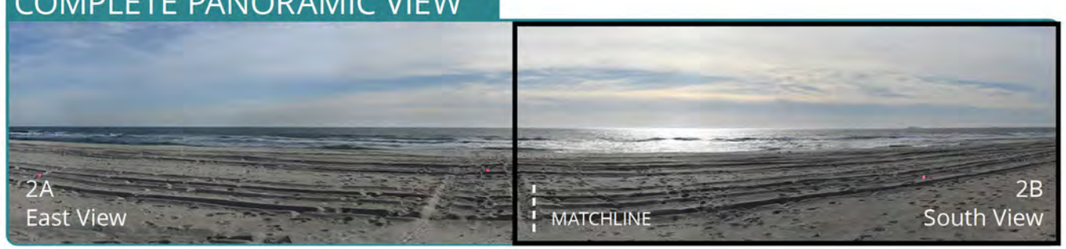
SIMULATION 2B.3: NY BIGHT *(Annotated)*

MATCHLINE

Simulation illustrating full lease buildout not including Empire Wind

*The simulation image includes approximately 62° horizontal field of view.

COMPLETE PANORAMIC VIEW

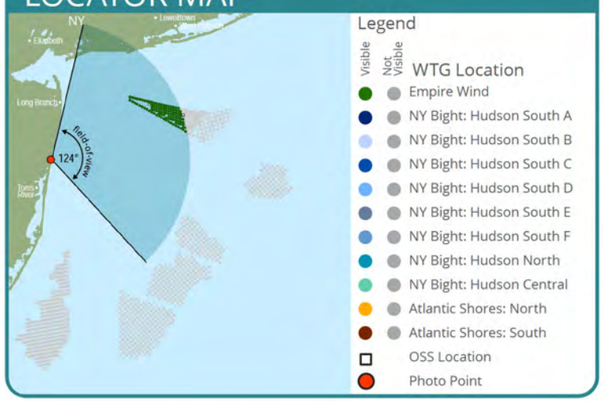


EXISTING CONDITION: NORTHEAST VIEW

KOP 3

View of the existing condition at Point Pleasant Beach

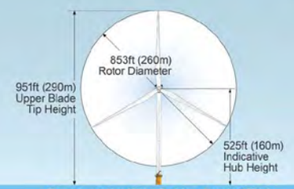
LOCATOR MAP



Legend

Visible	Not Visible	WTG Location
●	●	Empire Wind
●	●	NY Bight: Hudson South A
●	●	NY Bight: Hudson South B
●	●	NY Bight: Hudson South C
●	●	NY Bight: Hudson South D
●	●	NY Bight: Hudson South E
●	●	NY Bight: Hudson South F
●	●	NY Bight: Hudson North
●	●	NY Bight: Hudson Central
●	●	Atlantic Shores: North
●	●	Atlantic Shores: South
□		OSS Location
●		Photo Point

TURBINE DATA



Representative Wind Turbine: Empire Wind

	Distance to the closest WTG (mi)	Distance to the farthest WTG (mi)
Empire Offshore Wind	31	51.88

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 19, 2021
Time of Photograph:	1:00 PM
Weather Condition:	Partly Cloudy
Temperature	48° F
Humidity	37%
Latitude:	40.093589° N
Longitude:	-74.035308° W

	Type	Brand	Model
Camera	Mirrorless	Nikon	Z6
Lens		NIKKOR Z 50mm f/1.8	
Focal Length			50 mm
Viewing Direction:			East/Northeast
Ground Elevation + Tripod Height:			15 feet

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION 3A.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes

COMPLETE PANORAMIC VIEW

SIMULATION 3A.1: EMPIRE WIND *(Annotated)*

Simulation illustrating Empire Wind without other foreseeable future changes

COMPLETE PANORAMIC VIEW

SIMULATION 3B.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes

COMPLETE PANORAMIC VIEW

SIMULATION 3B.1: EMPIRE WIND *(Annotated)*

Simulation illustrating Empire Wind without other foreseeable future changes

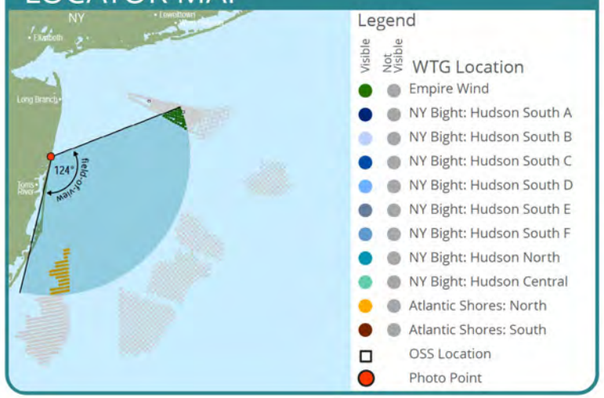
COMPLETE PANORAMIC VIEW

EXISTING CONDITION: SOUTHEAST VIEW

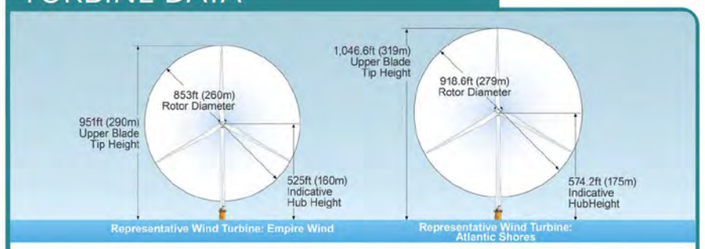
KOP 3

View of the existing condition at Point Pleasant Beach

LOCATOR MAP



TURBINE DATA



	Distance to the closest WTG (mi)	Distance to the farthest WTG (mi)
Empire Offshore Wind	31	51.88
Atlantic Shores North	29.6	53

PHOTOGRAPH INFORMATION

Viewpoint Location:	Point Pleasant Beach
Date of Photograph:	November 19, 2021
Time of Photograph:	1:00 PM
Weather Condition:	Partly Cloudy
Temperature	48° F
Humidity	37%
Latitude:	40.093589° N
Longitude:	-74.035308° W

	Type	Brand	Model
Camera	Mirrorless	Nikon	Z6
Lens	NIKKOR Z 50mm f/1.8		
Focal Length	50 mm		
Viewing Direction:	Southeast		
Ground Elevation + Tripod Height:	15 feet		

*The image on this page approximates the full horizontal and vertical field-of-view of typical human eyesight (124° horizontal by 55° vertical)

SIMULATION 3C.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes. Empire Wind is not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 3C.2: EMPIRE WIND + ATLANTIC SHORES

Simulation illustrating full lease buildout showing foreseeable projects with Empire Wind. Empire Wind and Atlantic Shores are not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 3C.3: ATLANTIC SHORES

Simulation illustrating full lease buildout not including Empire Wind. Atlantic Shores is not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 3D.1: EMPIRE WIND

Simulation illustrating Empire Wind without other foreseeable future changes. Empire Wind is not present in this view.

COMPLETE PANORAMIC VIEW

SIMULATION 3D.2: EMPIRE WIND + ATLANTIC SHORES

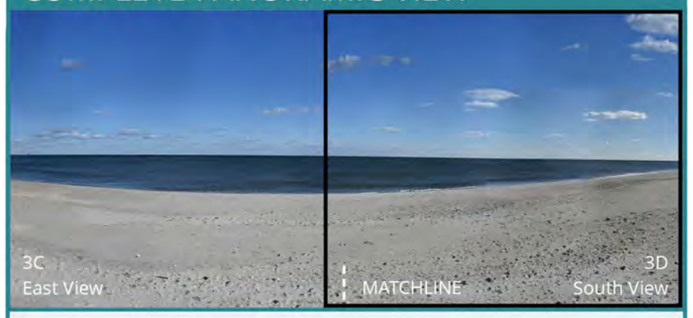
Simulation illustrating full lease buildout showing foreseeable projects located in Atlantic Shores with Empire Wind

COMPLETE PANORAMIC VIEW

SIMULATION 3D.2: EMPIRE WIND + ATLANTIC SHORES *(Annotated)*

Simulation illustrating full lease buildout showing foreseeable projects located in Atlantic Shores with Empire Wind

COMPLETE PANORAMIC VIEW



SIMULATION 3D.3: ATLANTIC SHORES

Simulation illustrating full lease buildout not including Empire Wind

COMPLETE PANORAMIC VIEW

SIMULATION 3D.3: ATLANTIC SHORES *(Annotated)*

Simulation illustrating full lease buildout not including Empire Wind

COMPLETE PANORAMIC VIEW

Appendix D
Key Personnel Resumes

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JANUARY M. TAVEL

Senior Manager, Historic Preservation

January Tavel is qualified as a historian and architectural historian under the Professional Qualification Standards of the U.S. Secretary of the Interior (as defined in 36 C.F.R. § 61) with more than twelve years of experience. January produces legally defensible cultural resources technical reports and Environmental Impact Statement (EIS) sections, meeting best practice standards for environmental compliance within local ordinance, and federal and state regulatory frameworks, including National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act (NHPA). January develops technical guidance, programmatic agreement documents, and preservation planning tools for the purpose of enhancing efficient and effective stewardship and regulatory compliance. She specializes in evaluating and guiding management of complex multi-component properties, such as cultural landscapes, traditional cultural properties, and historic districts. January's experience includes intensive research, preservation non-profit administration, heritage interpretation, grant management, and stakeholder outreach. She has been invited to more than a dozen events throughout the country to speak about her work at the intersection of climate resilience planning and historic preservation.

Years of Experience

- Professional start date: 07/2008
- ICF start date: 12/2015

Education

- MHP, Historic Preservation, University of Maryland College Park, School of Architecture Planning and Preservation, 2008
- BA, Journalism, University of Maryland Phillip Merrill College of Journalism, 2002

Selected Project Experience

Embedded Environmental Support for SR 520 I-5 to Medina Bridge Replacement— Washington Department of Transportation (WSDOT), Seattle, WA (07/2017–Present)

Architectural Historian and Project Manager. As embedded architectural historian for the SR 520 program, January supports the WSDOT cultural resources lead with quarterly meetings and reporting to Section 106 concurring parties; tracking completion of PA commitments; analyzing project changes for compliance with Section 106, PA stipulations, and additional applicable federal, state, and local regulations; providing technical support to ensure Section 106 compliance for the Noise Mitigation Pilot Program; and coordinating archaeological monitoring for multiple phases of construction. January's work includes fulfillment of PA mitigation commitments, including leading ICF's preparation of the Portage Bay floating homes survey and evaluation, and creation of interpretive signage content and graphic design for the Montlake historic district and Montlake Lid. 07/2017-Present.

National Historic Preservation Act Section 106 Support, Atlantic Renewable Energy Activities – U.S. Department of Interior, Bureau of Ocean Energy Management (BOEM)

Architectural Historian. In support of BOEM's mission to manage development of renewable wind energy leases in federal waters on the U.S. Outer Continental Shelf, January has provided programmatic Section 106 support services to BOEM as a contributing author to the *Models for Mitigation Fund Programs* and *A Framework for BOEM's Renewable Energy Mitigation Grant Fund* technical briefs. The goal of these documents is to explore feasibility of creating and implementing a mitigation grant fund program that would fulfill BOEM's commitments under Section 106 and support implementation of activities that mitigate for adverse effects to historic properties in ways that are most meaningful for affected communities. 06/2020-Present.

National Historic Preservation Act Section 106 Review for Ocean Wind Offshore Wind Farm Project Construction and Operations Plan – U.S. Department of Interior, Bureau of Ocean Energy Management (BOEM), NJ (01/2020-Present)

Section 106 Lead. January provides support to BOEM for Section 106 review and consultation for the Ocean Wind Offshore Wind Farm Project. She is responsible for preparing consultation plans; coordinating preparation and maintenance of the consulting parties list; preparing Section 106 consultation documents for distribution to SHPOs, THPOs, ACHP, and other consulting parties; and conducting Section 106-specific consultation meetings, as needed. January is lead author for preparation of the cultural resources section of the NEPA Environmental Impact Statement, Finding of Effect, and Cumulative Historic Resources Visual Effects Analysis. 01/2020-Present.

Technical Assistance to Prepare a Draft Historic Highway Bridge Programmatic Agreement—Washington Department of Transportation, Seattle, WA

Historic Preservation Planner. January collaborated with WSDOT Cultural Resources staff to prepare a draft Section 106 programmatic agreement (PA) applicable for undertakings and maintenance on bridges determined eligible for listing in the NRHP. The PA provided a prioritization framework for bridges in the Washington State Historic Highway Bridge Inventory and procedures for WSDOT regions, maintenance staff, and Bridge Office for: maintenance, repair, and rehabilitation consistent with the Secretary of the Interior's Standards; marketing to reuse historic bridges proposed for replacement; and identification of mitigation options. The purpose this guidance is to avoid impacts to historic bridges, and facilitate consistent and efficient application of procedures among WSDOT staff. 04/2019-06/2019.

2017 Heritage Preservation and Climate Change Survey, Findings and Recommendations Report—National Trust for Historic Preservation, U.S. Nationwide

Lead author and project manager. The *2017 Heritage Preservation and Climate Change Survey* was developed to guide the National Trust for Historic Preservation in its development of strategy, policy, and programming to support response to climate change within the context of the organization's heritage preservation mission. Information was gathered via questionnaire and interviews to determine awareness, needs, and priorities among National Trust stakeholders most likely to address climate change impacts on cultural heritage, and historic buildings and places. The *Findings and Recommendations Report* analyzes responses to identify key concerns and recommend methods, tools, and next steps for preservation planning response to climate risks. 11/2016–2/2018.

Environmental Services for the San Francisco Seawall Resiliency Project, San Francisco Waterfront Flood Study—U.S. Army Corps of Engineers, San Francisco, CA

Cultural resources lead consultant. January leads preparation of the Cultural Resources Technical Report and combined Feasibility Report/EIS section for the San Francisco Waterfront Flood Study. This work includes support to U.S. Army Corps of Engineers (USACE) in collaboration with the Port of San Francisco (Port) to develop alternatives for flood risk reduction measures with application of NPS Guidelines on Flood Adaptation for Rehabilitating Historic Buildings, and identification of key constraints for known historic properties. 04/2020–Present.

***Update to the Civil War Sites Advisory Commission Report on the Condition of Americas Civil War Battlefields* and Preservation Planning Grant Administration—National Park Service, American Battlefield Protection Program, Nationwide United States**

Historic Preservation Specialist. January began her career with the National Park Service (NPS) American Battlefield Protection Program (ABPP). She contributed to the *Update to the Civil War Sites Advisory Commission Report on the Nation's Civil War Battlefields*, serving as co-author for 26 statewide battlefield evaluation reports that addressed 386 civil war battlefields. January also administered the ABPP preservation planning grants program, which included grantee application review, jury coordination, and technical assistance for work product delivery. 07/2008-12/2010.

Corey Lentz

Historic Preservation Specialist

Corey Lentz is qualified as a historian and architectural historian under the Professional Qualification Standards of the U.S. Secretary of the Interior (as defined in 36 C.F.R. § 61) with more than three years of experience. Corey contributes to legally defensible cultural resources technical reports and Environmental Impact Statement (EIS) sections, meeting best practice standards for environmental compliance within local ordinance, and federal and state regulatory frameworks, including National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act (NHPA). Corey develops historic property documentation, programmatic agreement documents, and preservation planning tools for the purpose of enhancing efficient and effective stewardship and regulatory compliance. Corey's experience includes historic preservation regulatory compliance, preparation of National Register of Historic Places documentation, Federal Historic Tax Credit documentation, intensive research, stakeholder outreach.

Years of Experience

- Professional start date: 04/2018
- ICF start date: 10/2021

Education

- M.S., Historic Preservation, University of Oregon, School of Architecture & Environment, 2018
- B.A., History, Michigan State University, College of Social Science, 2014

Selected Project Experience

Embedded Environmental Support for SR 520 I-5 to Medina Bridge Replacement— Washington Department of Transportation (WSDOT), Seattle, WA (10/2021–Present)

Architectural Historian. As embedded architectural historian for the SR 520 program, Corey supports the WSDOT cultural resources lead with quarterly meetings and reporting to Section 106 concurring parties; tracking completion of PA commitments; analyzing project changes for compliance with Section 106, PA stipulations, and additional applicable federal, state, and local regulations; providing technical support to ensure Section 106 compliance for the Noise Mitigation Pilot Program (NMPP). Corey's work includes the development of Historic Property Inventory documentation for properties included in the NMPP and contributing to ICF's preparation of the Portage Bay floating homes survey and evaluation.

National Historic Preservation Act Section 106 Support, Atlantic Renewable Energy Activities – U.S. Department of Interior, Bureau of Ocean Energy Management (BOEM) (10/2021-Present)

Architectural Historian. In support of BOEM's mission to manage development of renewable wind energy leases in federal waters on the U.S. Outer Continental Shelf, Corey has provided programmatic Section 106 support services to BOEM. Corey has contributed to the preparation of an amendment to the current programmatic agreement that outlines BOEM's commitments under Section 106 and supports implementation of activities that mitigate for adverse effects to historic properties in ways that are most meaningful for affected communities.

National Historic Preservation Act Section 106 Review per Federal Transit Administration (FTA) Program Comment to Exempt Consideration of Effects to Rail Properties within Rail Rights-of-Way – San Francisco Bay Area Rapid Transit (BART), CA (10/2021-12/2021)

Architectural Historian. Corey supported planning and development efforts of the Bay Area Rapid Transit District (BART) by serving as key staff evaluating the significance of the BART system, a regional rail transit network designed and built during the 1960s and 1970s. As BART makes plans for future upgrades to meet rider demand and improve service, its original system facilities are now the age at which they could qualify for listing in historical resource registers. To help BART planning staff understand the historic significance of the system and associated regulatory requirements for future projects, Corey contributed to the survey and

evaluation of 10 pilot properties using the guidance in the historic context and evaluative framework developed by ICF, including a historic district that encompasses the original BART system.

Bullhead Solar Array Project – EDF Renewables and Kern County, California (12/2021 – 1/2022)

Architectural Historian. EDF Renewables (EDFR) is proposing the construction of solar facilities, including the solar array, battery energy storage system and substation, transmission infrastructure, and associated facilities and equipment, in an approximately1,854-acre project area located in unincorporated Kern County. EDFR is pursuing Conditional Use Permits (CUPs) for the project from the Kern County Board of Supervisors. EDFR engaged ICF to assist EDFR in California Environmental Quality Act (CEQA) compliance as part of the permitting process. Corey contributed through the preparation of Department of Parks and Recreation (DPR) 523 Forms to document and evaluate potentially significant properties located within the Bullhead Solar study area as part of CEQA compliance.

Washington State Legislative Campus Modernization Project – Washington Department of Enterprise Services, Olympia, WA (1/2021 – 2/2021)

Architectural Historian. Washington Department of Enterprise Services (WSDES) is proposing the modernization of the Legislative Campus including the demolition and rehabilitation of the Irving R. Newhouse, Joel M. Pritchard, and John L. O'Brien building, as well as the demolition of other minor buildings on the Legislative Campus. WSDES engaged ICF to assist in the preparation of State Environmental Policy Act (SEPA) compliance as part of the permitting process. Corey contributed to the preparation of a SEPA Cultural Technical Memorandum for the Legislative Campus Modernization Project including research of previously documented historic properties within the project area and the analysis of potential adverse effects to NRHP-listed and NRHP-eligible properties within the project area.

Desktop Cultural Resources Analysis for the Bitter Lake Reservoir Covering Replacement Project – Seattle Public Utilities, Seattle, WA (2/2021 – 2/2022)

Architectural Historian. Seattle Public Utilities is proposing to demolish and replace the Bitter Lake Reservoir in Seattle, Washington. SPU retained ICF to determine whether documented cultural resources are present in the project vicinity, to assess the risk of encountering as-yet undocumented archaeological resources, and to evaluate the National Register of Historic Places (NRHP) eligibility of historic-aged (more than 50 years old) built environment resources that have the potential to be affected by the project. ICF performed a desktop analysis for the Project, which included a search of relevant literature on the archaeology, ethnography, and history of the project's study area to provide information on previously identified cultural resources in the vicinity. Corey contributed to the preparation of a technical memorandum outlining the findings of the desktop analysis through the development of Historic Property Inventory documentation for two historic properties within the project area and drafted historic context sections for the property and Seattle Public Utilities.

Green Hills School Recreation Center, Cultural Resources Survey – Washington State Department of Enterprise Services, Olympia, WA (2/2022 – 3/2022)

Architectural Historian. The Washington State Department of Enterprise Services (WSDES) is proposing the demolition and replacement of the Recreation Center on the Green Hills School campus. WSDES engaged ICF to assist in the preparation of State Environmental Policy Act (SEPA) compliance as part of the permitting process. Corey contributed to the preparation of the Green Hills School Recreation Center, Cultural Resources Survey through the development of Historic Property Inventory documentation for three historic properties on the Green Hill School campus and drafted the Built Environment Survey section of the Cultural Resources Survey document.

Weatherization Assistance Program – California Department of Community Services and Development (4/2022-Present)

Architectural Historian. California Department of Community Services and Development (CDS) runs a long-term program that distributed federal funding to non-profits and agencies across the state to weatherize homes of low-income persons. ICF supports CDS in the completion of Section 106 review for funded projects per the agency's programmatic agreement with the California Office of Historic Preservation. Corey contributes to these reviews through routine desktop analysis of projects across California where proposed work has the potential to effect historic properties.