AECOM

APPENDIX R

BAT IMPACT ASSESSMENT

Prepared for

Beacon Wind LLC

Photo credit: Matt Goldsmith, Equinor

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Abbreviations and Acronyms	
Acronym	**Definition**
3D/E	3D/Environmental
ac	acre
AGRE	Astoria Gateway for Renewable Energy
Beacon Wind	Beacon Wind LLC
BOEM	Bureau of Ocean Energy Management
BW1	Beacon Wind 1
BW2	Beacon Wind 2
CFR	Code of Federal Regulations
CGS	Connecticut General Statutes
CMR	Code of Massachusetts Regulations
ConEd	Consolidated Edison
COP	Construction and Operations Plan
D	Discretionary Review
dB	decibels
dBa	A-weighted decibels
DEEP	Connecticut Department of Energy and Environmental Protection
E	Endangered
EasternGen	Eastern Power Generating Co.
EG	Electric Generation
EMF	electric and magnetic fields
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FR	Federal Register
ft	feet
GLD	Geographic Location Description
ha	hectare(s)s
HDD	Horizontal Directional Drilling
HPS	High Priority Species
IPaC	Information for Planning and Consultation
ISO	Independent System Operator
km	kilometer
kHz	kilohertz
kV	kilovolt
LED	light-emitting diode
Lease Area	Renewable Energy Lease Area OCS-A 0520
m	meter
MA WEA	Massachusetts Wind Energy Area
MassWildlife	Massachusetts Division of Fisheries and Wildlife
mi	mile

Abbreviations and Acronyms	
Acronym	**Definition**
MW	megawatt
NEPA	National Environmental Policy Act
nm	Nautical mile
NWR	National Wildlife Refuge
NYCRR	New York Code of Rules and Regulations
NY ISO	Independent System Operator
NYNHP	New York Natural Heritage Program
NYPA	New York Power Authority
NYSDEC	New York State Department of Environmental Conservation
NYSERDA	New York State Energy Research and Development Authority
O&M	Operations and Maintenance
OCS	Outer Continental Shelf
OSF	offshore substation facilities
OST	onshore transmission
P	Petitioned for Listing
PDE	Project Design Envelope
POI	Point of Interconnection
PPA	Power Purchase Agreement
RI WEA	Rhode Island Wind Energy Area
RINHS	Rhode Island Natural History Survey
RSZ	rotor swept zone
SC	Species of Special Concern
Stantec	Stantec Consulting Services, Inc.
T	Threatened
Tetra Tech	Tetra Tech, Inc.
U.S.	United States
USFWS	United States Fish and Wildlife Service
WEST	Western EcoSystems Technology, Inc.
WT	Wind Turbines

Appendix R Bat Impact Assessment

R.1. Introduction

Beacon Wind LLC (Beacon Wind) proposes to construct and operate an offshore wind facility located in the designated Renewable Energy Lease Area Outer Continental Shelf (OCS)-A 0520 (Lease Area). The Lease Area covers approximately 128,811 acres (ac; (52,128 hectares [ha]) and is located approximately 20 statute miles (mi) (17 nautical miles [nm], 32 kilometers [km]) south of Nantucket, Massachusetts and 60 mi (52 nm, 97 km) east of Montauk, New York. The Lease Area was awarded through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Massachusetts Wind Energy Area (MA WEA). Beacon Wind is indirectly owned by Equinor U.S. Holdings Inc. and bp Wind Energy North America Inc.

Beacon Wind proposes to develop the entire Lease Area with up to two wind farms, known as Beacon Wind 1 (BW1) and Beacon Wind 2 (BW2) (collectively referred to hereafter as the Project). The individual wind farms within the Lease Area will be electrically isolated and independent from the other via transmission systems that connect two separate offshore substations to two onshore Points of Interconnection (POIs). However, if BW1 and BW2 both interconnect with the New York Independent System Operator (NY ISO), the Project will assess the possibility of cable linkage between BW1 and BW2. Each wind farm will gather the power from the associated turbines to a central offshore substation and deliver the generated power via a submarine export cable to an onshore substation for final delivery into the local utility distribution system at the selected POI. The purpose of the Project is to generate renewable electricity from an offshore wind farm(s) located in the Lease Area. The Project addresses the need identified by northeast states to achieve offshore wind goals: New York (9,000 megawatts [MW]), Connecticut (2,000 MW), Rhode Island (up to 1,000 MW), and Massachusetts (5,600 MW).

BW1 will be developed first and constitutes the northern portion of the Lease Area. It covers approximately 56,535 ac (22,879 ha). The BW1 wind farm has a 25-year offtake agreement with the New York State Energy Research and Development Authority (NYSERDA) to deliver the power to its identified POI in Queens, New York.

BW2 spans the southern portion of the Lease Area and will be developed after BW1. It covers approximately 51,611 ac (20,886 ha). Beacon Wind is considering an Overlap Area of 20,665 ac (8,363 ha) that may be included in either wind farm. BW2 is being developed to addresses the need for renewable energy identified by states across the region, including New York, Massachusetts, Rhode Island, and Connecticut. The interconnectedness of the New England transmission system, managed by the New England ISO (ISO-NE), allows a single point of interconnection in the region to deliver offshore wind energy to all of the New England states (Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine). The magnitude of regional targets for offshore wind and the limited amount of developable area, given current and reasonably foreseeable BOEM leasing activity, demonstrates a need for full-build out of the Lease Area.

BW2 plans to deliver power to identified POIs either in Waterford, Connecticut or Queens, New York. Two locations are under consideration in Queens, New York for the single proposed BW1 landfall and onshore substation facility. These locations include the New York Power Authority (NYPA) site in the northeastern corner of the Astoria power complex and the Astoria Gateway for Renewable Energy (AGRE) site (which includes AGRE East and AGRE West) situated centrally and on the northern end of the complex adjacent to the East River, both collectively referred to hereafter as NYPA and AGRE. The Queens, New York, onshore substation facility sites that are not used (NYPA, AGRE East, or AGRE West) for BW1 will remain under consideration, in addition to the Waterford, Connecticut, site, for the single proposed BW2 onshore substation facility. Refer to **Figure R.1-1**.

Beacon Wind is developing up to 155 wind turbines and supporting tower structures, and up to two offshore substation facilities, using up to 157 foundations in the Lease Area (encompassing both BW1 and BW2). BW1 will include between 61 and 94 wind turbines and BW2 will include between 61 and 94 wind turbines. The Overlap Area includes 33 wind turbines that could be incorporated into either BW1 or BW2.

The layout of the wind turbine positions within the Lease Area is based on the agreement negotiated with the other Massachusetts Rhode Island Wind Energy Area (MA/RI WEA) leaseholders. A regional layout with 1 nautical mile (nm) (1.9 km) spacing in the cardinal directions (N/S/E/W) has been proposed to improve navigation safety for mariners across the multiple projects being developed concurrently.

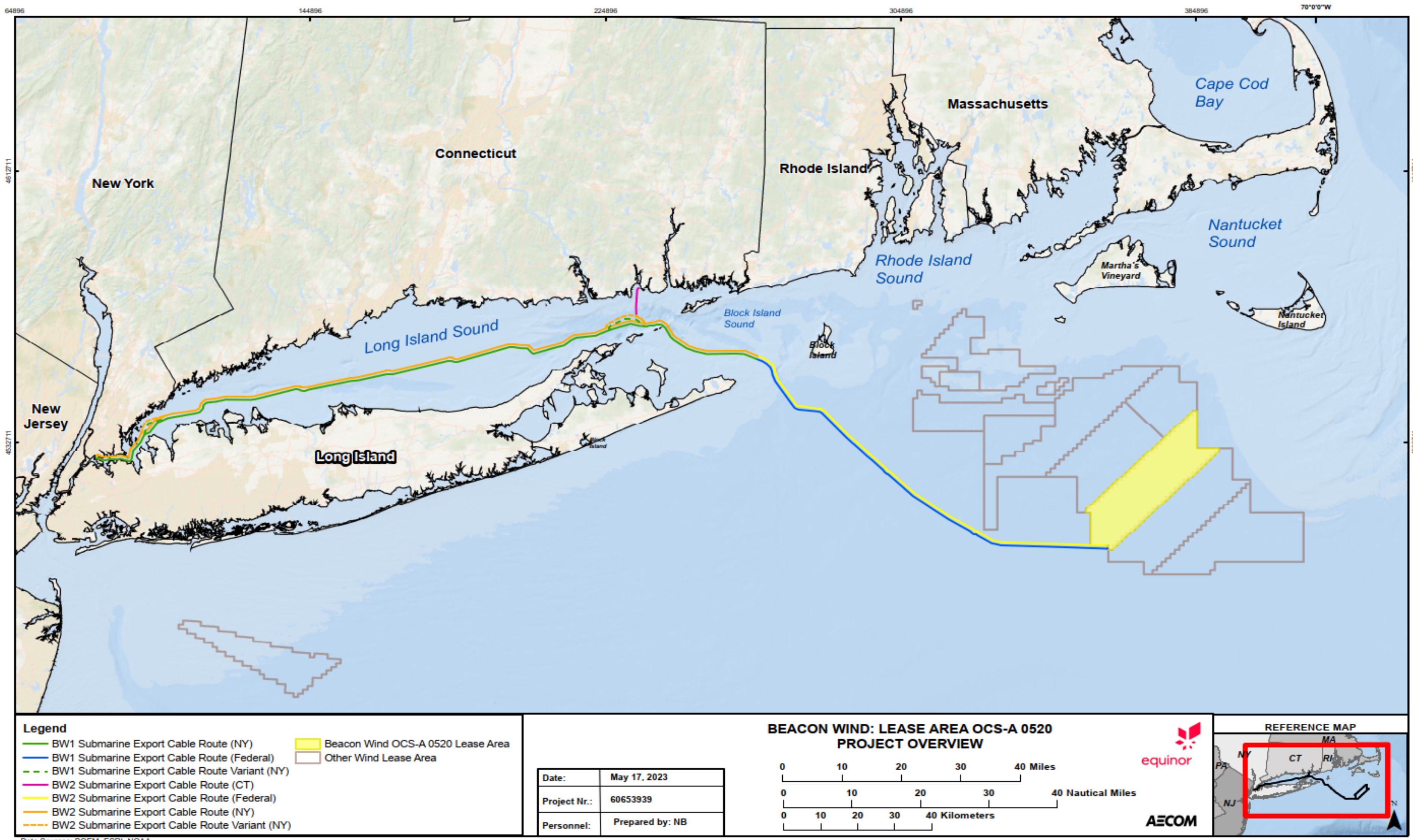
This report discusses the potential impacts to bats from the construction, operations, and decommissioning of the Project. The Project will consist of the development of the offshore wind turbine array located within the Lease Area, the installation of an offshore submarine export cables, and the construction of onshore facilities developed to connect the power generated to the existing grid infrastructure including landfall of the submarine export cables and interconnecting via an onshore substation facility in Queens, New York for BW1 and Queens, New York or Waterford, Connecticut for BW2. Each of these Project components will impact bat species utilizing the ecosystem in a different way and will require a unique solution to avoid or minimize potential impacts.

R.1.1 Goals and Objectives

The objective of this assessment is to identify the species of bats that may be exposed to effects (chance of harm or mortality) due to Project construction, operations, or decommissioning activities. Although this assessment addresses the species that may be found in the onshore and offshore portions of the Project Area, there are several bat species that are protected under state and federal laws and, therefore, risks to those species are of particular interest.

In this assessment, AECOM identifies potential impact-producing factors, discusses bat community characteristics and key factors that may influence the type and severity of effects posed by those impact producing factors, and provides qualitative discussion of the effects anticipated as a result of the Project development. Several avoidance and minimization measures are also identified that may reduce the likelihood or severity of potential effects on bats.

FIGURE R.1-1. SITE LOCATION MAP



Data Sources: BOEM, ESRI, NOAA
Service Layer Credits: Source: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other

R.2. Regulatory Framework

The Project will consist of the development of a portion of the OCS within a Lease Area administered by the BOEM. Therefore, agency approvals are required for the site to be developed and for the operation of the Project. As part of this approval process, a Construction and Operations Plan (COP) was prepared to meet the requirements of the National Environmental Policy Act (NEPA).

This assessment was developed to address the requirements for assessments of biological resources, support agency consultation, and provide further information to assist in the NEPA process. Biological and ecological data relevant to bat species required by the COP include “The results of the biological survey with supporting data” (30 Code of Federal Regulations [CFR] 585.626 (3)) as well as a description of Endangered Species Act (ESA)-listed species, and sensitive habitats such as maternity roosting habitat, hibernacula, and foraging areas (30 CFR 585.627). This impact assessment provides an overview of bat communities found on site that have a potential to be impacted by any phase of the Project including construction, operations, or decommissioning. This assessment is also intended to evaluate the likelihood of potential impacts to local or regional bat populations as a result of the Project.

R.3. Project Area Description

For the purposes of this Appendix, the Project Area refers to the entire Project including the wind turbine array, the submarine export cables, and the landfall site and development of two onshore substation facilities.

R.3.1 The Lease Area

The Lease Area encompasses approximately 128,811 ac (52,238 ha) located in water depths ranging from 118 to 203 feet (ft) (36 to 62 meters [m]). The Lease Area is approximately 20 mi (17 nm, 32 km) south of Nantucket, Massachusetts and 60 mi (52 nm, 97 km) east of Montauk, New York. The maximum build design for the Lease Area would include up to 155 wind turbines, two offshore substation facilities, and interarray cables trenched into the seafloor.

R.3.2 Submarine Export Cables

The submarine export cable routes will traverse areas of state and federal jurisdiction connecting the offshore wind area to the landfall sites in Queens, New York for BW1 and Queens, New York or Waterford, Connecticut for BW2. Most individual states and territories have jurisdiction over fisheries in marine waters within 3 nm (3.5 mi, 5.6 km) of their coasts. Federal jurisdiction includes fisheries in marine waters inside the United States (U.S.) Exclusive Economic Zone, which encompasses the area from a state boundary to 200 nm (230 mi, 370 km) from the U.S. coastline. The proposed submarine export cables exit the southern portion of the Lease Area, head generally northwest through Block Island Sound, and then west-southwest through Long Island Sound for BW1 and BW2 to Queens, New York and for the BW2 Waterford, Connecticut alignment; due west of The Race, the Waterford, Connecticut route would turn and continue northward to the Waterford landfall. The cable burial methods being considered as part of the Project Design Envelope (PDE) are plowing, jetting, trenching, and dredging. The submarine export cables cross federal, New York and Connecticut jurisdictional waters, as well as the Rhode Island Geographic Location Description (GLD).

R.3.3 Onshore Development

R.3.3.1 Queens, New York Landfall

The onshore portion of the Project Area includes two locations under consideration in Queens, New York (NYPA and AGRE [which includes AGRE East and AGRE West]) for the single proposed BW1 landfall and onshore substation facility (including the converter station and substation), onshore export and interconnection cable routes, and proposed POIs located within existing substations located in the Astoria power complex in Queens, New York. The Queens, New York onshore substation facility sites that are not used (NYPA, AGRE East, or AGRE West) for BW1 will remain under consideration, in addition to the Waterford, Connecticut site, for the single proposed BW2 onshore substation facility.

The onshore portion of the Project Area in Queens, New York is bounded to the north and northeast by the East River, to the southeast by Luyster Creek, and by densely developed commercial and residential areas to the west-southwest. This area is also densely developed with commercial and industrial properties including New York Power Authority (NYPA), Consolidated Edison of New York (ConEd) and Astoria Generating Co. This includes extensive impervious areas comprised by buildings, paved roads, and parking lots accounting for approximately 80 percent of the total area. The remaining land use includes some areas of maintained lawns (10 percent), disturbed open space (e.g., dirt parking lots, unpaved equipment storage yards) (six percent) and semi-natural areas vegetated with shrubs and small trees (two percent). The shoreline areas adjacent to the East River and Luyster Creek consist primarily of concrete seawalls and riprap slopes. **Table R.3-1** details the summary of Project specific delineated land use covers within the onshore portions of the Project Area.

TABLE R.3-1. LAND USE COVER WITHIN THE ONSHORE PORTIONS OF THE PROJECT AREA – QUEENS, NEW YORK

Land Use	Area (ac)	Area (ha)
Roads, Parking, Buildings, and other Structures	237.1	96.0
Riprap	2.7	1.1
Maintained Lawn	29.0	11.7
Disturbed Open Space	17.1	6.9
Scrub-Shrub/Forest Mix	5.5	2.2
Open Water	3.8	1.5
Grand Total	**295.2**	**119.5**

Due to the intensely developed nature of the onshore portion of the Project Area, few areas of natural vegetation cover were observed. Interior portions of the Project Area are primarily maintained lawn with few scattered landscape tree and shrub species. No areas of contiguous forested land were observed on site. The onshore portion of the Queens, New York Project Area includes two potential landfall locations, onshore substation facilities for BW1 and BW2, onshore export and interconnection cable routes, and proposed POIs. Potential landfall locations at the Astoria power complex include NYPA and AGRE (**Appendix N Wetlands Delineation Reports**). Onshore export and interconnection cable routes between the BW1 and BW2 onshore substation facilities and the 138 kilovolt (kV) Substation, Astoria East (hereafter Astoria POI East) and/or the 138 kV Substation, Astoria West (hereafter Astoria POI West) are planned with underground electric transmission lines from NYPA and aboveground electric transmission lines from AGRE East and AGRE West. Final locations for these routes are still being determined.

R.3.3.1.1NYPA Landfall

The NYPA parcel for onshore substation facilities is located at the northwest corner of the Astoria power complex adjacent to Lawrence Point and the East River (**Figure R.3-1**). The site contains a mosaic of paved impervious surfaces (concrete pads and bituminous concrete driveways and parking areas) with maintained lawn areas and a few scattered trees suggesting past commercial land use activities and development. However, several buildings are located along the southeastern limits of the site including storage sheds and a maintenance garage. The north and west perimeter of the site are bounded by the East River and a fenced security road.

The submarine export cable route is anticipated to make landfall via either trenchless (e.g., horizontal directional drilling (HDD, as the base case installation method)) or trenched (open cut trench) landfall design. Landfall will occur via HDD or open trench that would extend from the onshore substation facility at the site northward into the East River. For the HDD, nearshore work would be completed by utilizing a goalpost pipe which marks and keeps the borehole in place. Goalposts are installed along the established nearshore alignment of the HDD with the intent to support the large diameter casing pipe during drilling operations. Proper installation of casing pipe nearshore aids in the containment of drilling fluid by facilitating an open flow pathway from the HDD exit location to the marine support equipment and to the fluid collection barge. Marine support is needed (e.g., vessels, barges, divers) to support HDD drilling operations.

Onshore export and interconnection cable routes will include 138 kV outgoing circuits from the onshore substation facility to Astoria POI West , as underground transmission lines.

R.3.3.1.2AGRE Landfall

The AGRE parcel (which includes both AGRE East and AGRE West) for onshore substation facilities is located south of the AGRE site (**Figure R.3-1**). The site contains a mosaic of constructed buildings, paved impervious surfaces (concrete pads and parking areas) and grind material surfaces (gravel and bituminous concrete driveways and parking areas), with a few trees and lawn areas.

The submarine export cable is anticipated to make landfall at the AGRE parcel from the East River via HDD (as the base case installation method). The HDD will drill from the shore into the East River, utilizing the same goalpost and casing pipe components as detailed above, to facilitate the drill and containment of drilling fluid, if this is the selected solution.

Onshore export and interconnection cable routes will include 138 kV outgoing circuits from the onshore substation facility to Astoria POI East and/or Astoria POI West utilizing overhead transmission lines.

R.3.3.2 Waterford, Connecticut Landfall

The Waterford, Connecticut parcel for the BW2 onshore substation facility is located north of the existing Dominion Millstone Power Station and west of the existing substation proposed for the POI (**Figure R.3-2**). Current conditions within the Waterford parcel consist mainly of forested upland areas with a sizable portion of paved areas currently utilized in support of the Dominion Millstone Power Station. A small area of forested wetlands is located in the southern portion of the proposed onshore substation facility site. **Table R.3-2** details the summary of Project specific delineated land use covers within the onshore portions of the Project Area.

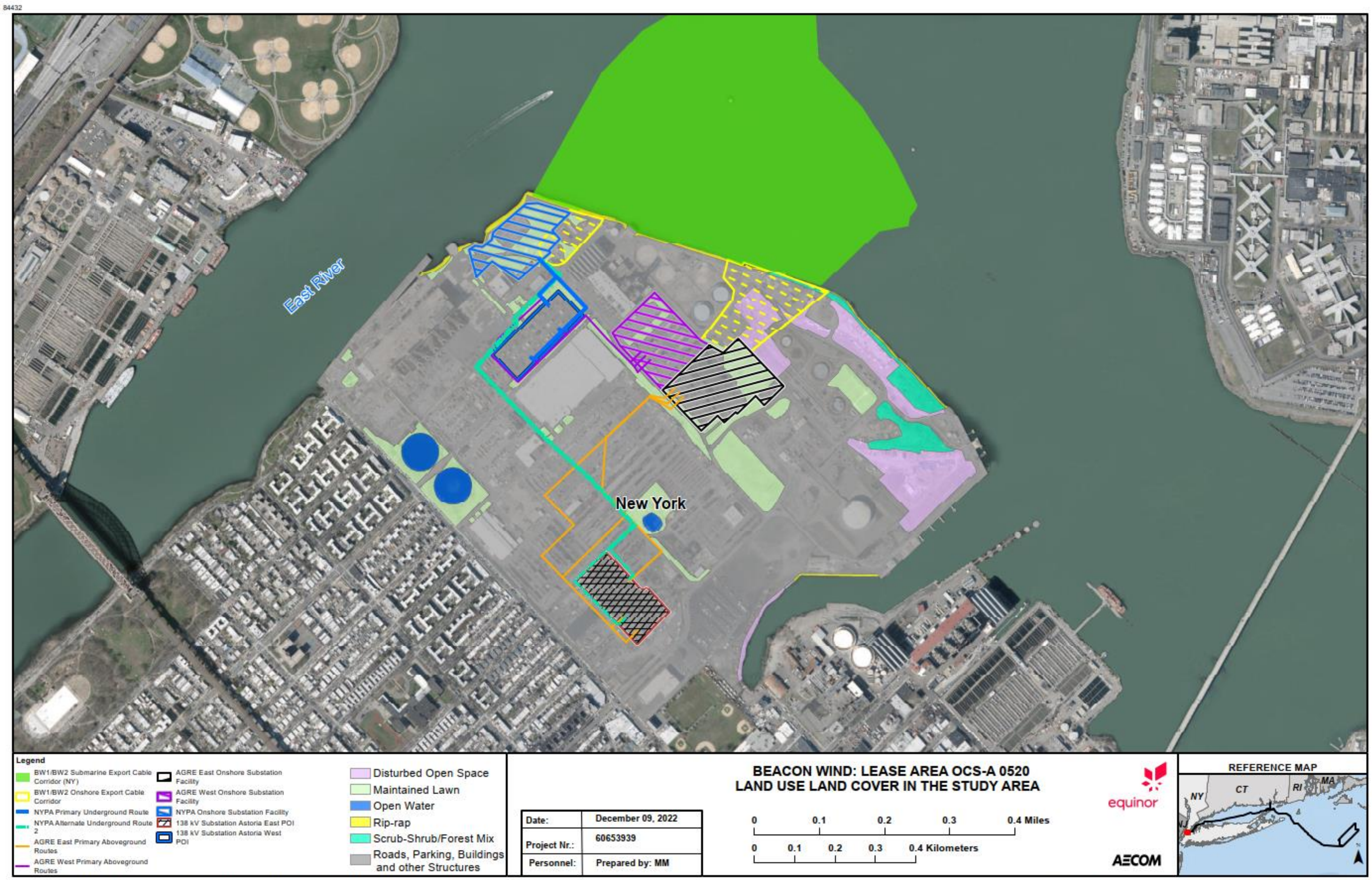
The submarine export cable is anticipated to make landfall at the Waterford parcel from the Niantic Bay via trenchless (e.g., HDD, jack and bore, or micro-tunnel) methods. Landfall will occur via trenchless methods and the onshore export cable would then extend eastward 1,037 ft (316 m) from the landfall to the onshore substation facility. Two areas of temporary staging are proposed that consist of existing parking and open undeveloped land currently used for material storage.

Onshore export and interconnection cables will include 138 kV outgoing circuits utilizing aboveground transmission lines and tower from the onshore substation facility to the existing neighboring POI substation.

TABLE R.3-2. LAND USE COVER WITHIN THE ONSHORE PORTIONS OF THE PROJECT AREA – WATERFORD, CONNECTICUT

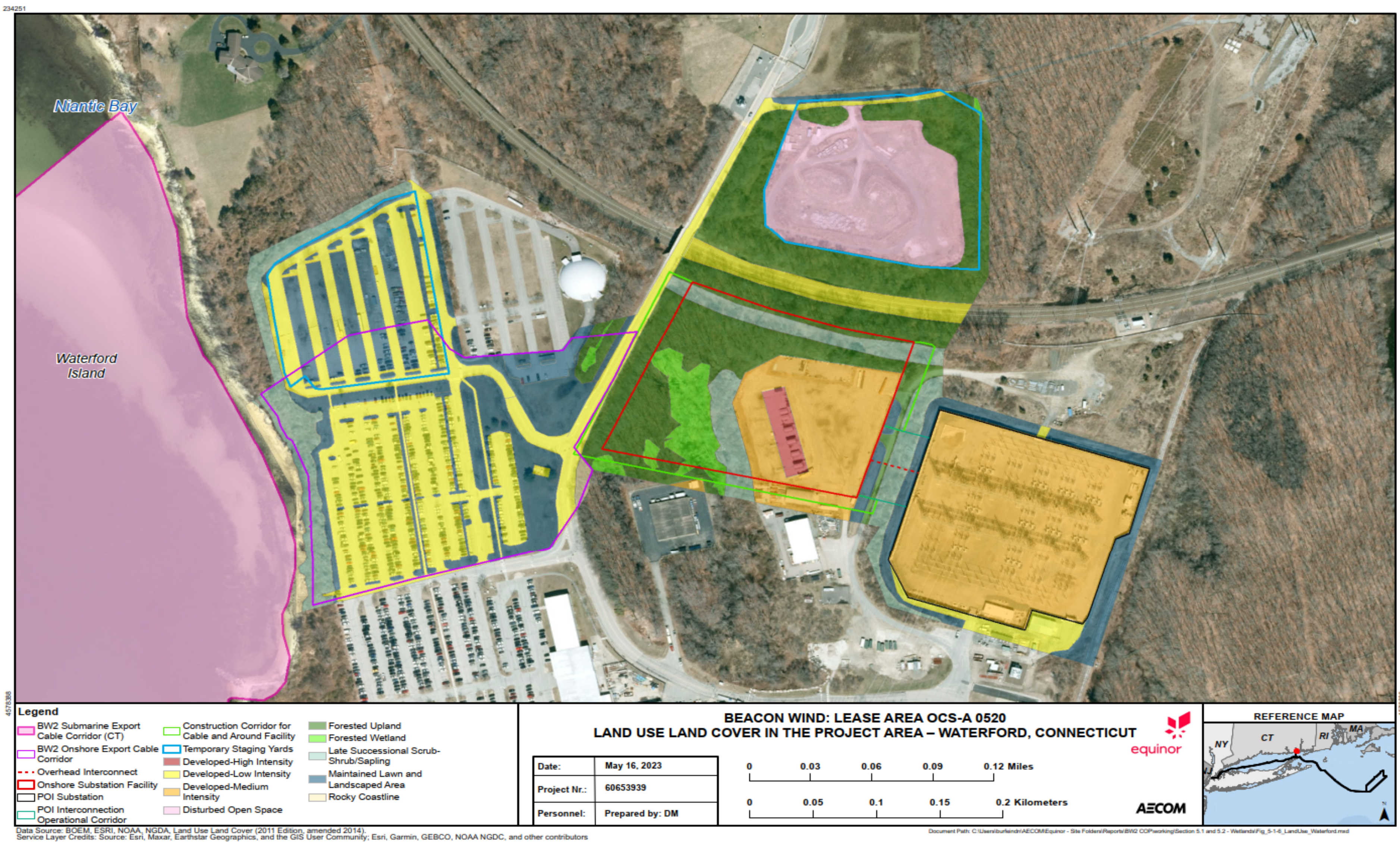
Land Use	Area (ac)	Area (ha)
Developed - High Intensity	0.3	0.1
Developed - Low Intensity	4.1	1.7
Developed - Medium Intensity	10.8	4.4
Maintained Lawn and Landscaped Area	9.5	3.8
Disturbed Open Space	8.6	3.5
Late Successional Scrub-Shrub/Sapling	1.1	0.4
Forested Upland	3.6	1.5
Forested Wetland	7.5	3.0
Grand Total	**45.5**	**18.4**

FIGURE R.3-1. LAND USE COVER AT THE QUEENS, NEW YORK LOCATION



Data Sources: BOEM, ESRI, NOAA, NGDA, Land Use Land Cover (2011 Edition, amended 2014), NYSDEC. 2021. 2020 Half-Foot 4 Band Long Island Zone NYC Aerial Ortho-Photography.
Service Layer Credits: Source: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributions

FIGURE R.3-2. LAND USE COVER AT WATERFORD, CONNECTICUT LOCATION



R.4. Bat Community Characterization

R.4.1 Species Potentially Present in the Project Area

Bats of the northeastern U.S. can be generally categorized into two life-history strategies based on their winter behavior: 1) cave-hibernating species, which typically spend their winters hibernating in caves, underground mines, or man-made structures with similar conditions, and migrate regionally in a radial pattern to summer maternity areas; and 2) long distance, latitudinal migrants (i.e., migratory tree-roosting bats), which may travel hundreds or even thousands of miles between their summer and winter habitats. Although they are considered a cave-roosting species, some recent evidence suggests that tri-colored bats (*Perimyotis subflavus*) may undertake a greater degree of altitudinal migration than previously thought (Fraser et al. 2021). However, for the purposes of this assessment tri-colored bats are not included with the long-distance migrants. New York and Connecticut are home to nine regularly occurring species of bats, including three long-distance migrants and six cave-hibernating bats (**Table R.4-1**). Eight of these species are also regularly found in Massachusetts and Rhode Island, excluding Indiana bats.

Table R.4-1. Migrating and Cave-Hibernating Bat Species of the Northeastern United States

Life History Strategy	Species	Typical Reproduction Rates
Long Distance Migrants	Eastern red bat (*Lasiurus borealis*)	3 pups/year
	Hoary bat (*Lasiurus cinereus*)	2 pups/year
	Silver-haired bat (*Lasionycterus noctivagans*)	2 pups/year
Cave-hibernating	Big brown bat (*Eptesicus fuscus*)	2 pup/year
	Tri-colored bat (*Perimyotis subflavus*)	2 pups/year
	Little brown bat (*Myotis lucifugus*)	1 pup/year
	Eastern small-footed bat (*Myotis leibii*)	1 pup /year
	Northern long-eared bat (*Myotis septentrionalis*)	1 pup/year
	Indiana bat (*Myotis sodalis*)	1 pup/year

Source: Harvey et al. 2011

R.4.2 Federally Listed Bat Species

Indiana bats (*Myotis sodalis*) are known to occur in the northeastern United States, including New York and Connecticut. Indiana bats were also historically known to occur in the western, non-coastal portions of Massachusetts. However, the last known record of Indiana bats in Massachusetts was an individual banded in November 1936 at Nickwackett Cave in Brandon, Vermont and recaptured in October 1939 at the Chester Emery Mines in Hampden County, Massachusetts (Griffin 1945). Indiana bats are no longer considered to be present in Massachusetts and are not known to be present in Rhode Island (USFWS 2019).

Indiana bats will typically hibernate in caves or mines in the winter and roost in tree crevices or under loose tree bark in the spring, summer, and fall. Potentially suitable summer roosting habitat includes trees (dead, dying, or alive) or snags with loose bark, or with cracks or crevices that could be used by

Indiana bats to roost. Overwintering habitats (hibernacula) for Indiana bats have been documented in New York State. Indiana bats do migrate between winter and summer habitats, which may make them uniquely susceptible to injury from wind turbines; however, numerous studies on the migratory patterns of Indiana bats have demonstrated that these species tend to avoid open areas when migrating and remain close to tree lines (Butchkoski and Turner 2006; Hicks and Herzog 2006; Turner 2006). These studies also showed that migrating Indiana bats tended to avoid areas of open water greater than 2 mi (3.2 km) in width such as Lake Champlain and, therefore, would be unlikely to come into contact with wind turbines for the Project. Indiana bats are not known to occur in Queens County, New York where the onshore portions of the Project Area is located (NYNHP 2020).

Northern long-eared bats are known to occur throughout the Northeast U.S., including New York, Massachusetts, Connecticut, and Rhode Island, and have been documented in coastal regions as well as flying over coastal waters (Dowling et al. 2017; Tetra Tech 2015; Tetra Tech 2017; Western EcoSystems Technology, Inc. [WEST] 2017).

In January 2020, Judge Emmet Sullivan of the U.S. District Court for the District of Columbia ruled in *Center for Biological Diversity v. Everson*, No. 15-CV-477, 2020 WL 437289 (D.D.C. Jan. 28, 2020) that the U.S. Fish and Wildlife Service (USFWS) decision to list northern long-eared bats as threatened, rather than endangered, was “arbitrary and capricious” in its reasoning. The listing determination was not vacated by the Court but was remanded back to the USFWS to consider whether a different listing determination may be warranted.

On March 23, 2022, the USFWS published a proposed rule which would change the northern long-eared bat’s federal listing from threatened to endangered (87 Federal Register [FR] 16442-16452). On November 29, 2022 USFWS finalized, the rule which became effective March 31, 2023 therefore eliminating the 4(d) rule and making the northern long-eared bat listed as endangered throughout its range, which includes the Project Area (87 FR 73488-73504).

Although they do not currently have a federally-protected status, tri-colored bats and little brown bats are being considered for listing under the ESA. In 2017, the USFWS issued its positive 90-day finding on the petition from the Center for Biological Diversity and Defenders of Wildlife that tri-colored bats be listed as threatened or endangered and that critical habitat be designated under the ESA (82 FR 60362-60366). On September 14, 2022 UFWS published a proposal in the FR to list the tri-colored bat as endangered under the ESA (FR2022-18852). USFWS has up to 12-months from the date the proposal was published to make a final determination (USFWS 2023a). The little brown bat is being considered for potential federal listing under the USFWS’s discretionary review process. According to the USFWS *National Listing Workplan* (USFWS 2023b), the 12-month finding and potential listing for little brown bat is anticipated to be completed in fiscal year 2024.

R.4.3 State Listed Bat Species

New York, Connecticut, Rhode Island, and Massachusetts each maintain lists of threatened, endangered, and special concern species found within their state. The definitions of each listing category by state can be found in **Table R.4-2**,**Table R.4-3**, and **Table R.4-4**. A list of state-listed bat species with their designation categories is provided in **Table R.4-5**. Rhode Island Natural History Survey (RINHS) does not list any bat species as having special state-level designations; therefore, Rhode Island is excluded from **Table R.4-5**.

TABLE R.4-2. NEW YORK SPECIES LISTING DESIGNATIONS UNDER 6 NEW YORK CODE OF RULES AND REGULATIONS (NYCRR) 182.5

Designation	Definition
Endangered (E)	Species that are native to New York and are in imminent danger of extirpation or extinction in New York or are species listed as endangered by the United States Department of the Interior in the Code of Federal Regulations (50 CFR part 17).
Threatened (T)	Species that are native to New York and likely to become an endangered species within the foreseeable future in New York or are species listed as threatened by the United States Department of the Interior in the Code of Federal Regulations (50 CFR part 17).
Species of Special Concern (SC)	Native species of fish and wildlife found by the department to be at risk of becoming threatened in New York. Species of special concern do not qualify as either endangered or threatened. but have been determined by the NYSDEC to require some measure of protection to ensure that the species does not become threatened.
High Priority Species of Greatest Conservation Need (HPS)	Not Currently Endangered, Threatened, or Special Concern

TABLE R.4-3. MASSACHUSETTS SPECIES LISTING DESIGNATIONS UNDER 321 CODE OF MASSACHUSETTS REGULATIONS (CMR) 10

Designation	Definition
Endangered (E)	Any species of plant or animal in danger of extinction throughout all or a significant portion of its range and species of plants or animals in danger of extirpation as documented by biological research and inventory.
Threatened (T)	Any species of plant or animal likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future.
Species of Special Concern (SC)	Any species of plant or animal which has been documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked or that occurs in such small numbers or with such a restricted distribution or specialized habitat requirements that it could easily become threatened within Massachusetts.

TABLE R.4-4. CONNECTICUT SPECIES LISTING DESIGNATIONS UNDER CONNECTICUT GENERAL STATUTES (CGS) § 26-304

Designation	Definition
Endangered (E)	Any native species documented by biological research and inventory to be in danger of extirpation throughout all or a significant portion of its range within the state and to have no more than five occurrences in the state, and any species determined to be an "endangered species" pursuant to the federal Endangered Species Act.
Threatened (T)	Any native species documented by biological research and inventory to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range within the state and to have no more than nine occurrences in the state, and any species determined to be a "threatened species" pursuant to the federal Endangered Species Act, except for such species determined to be endangered by the Commissioner in accordance with Section 4 of the Connecticut Endangered Species Act of 1989.
Species of Special Concern (SC)	Any native plant species or any native non-harvested wildlife species documented by scientific research and inventory to have a naturally restricted range or habitat in the state, to be at a low population level, to be in such high demand by man that its unregulated taking would be detrimental to the conservation of its population or has been extirpated from the state.

TABLE R.4-5. STATE AND FEDERAL LISTING DESIGNATIONS OF NORTHEASTERN BAT SPECIES

Life-History Strategy	Common Name	Scientific Name	New York Status	Massachusetts Status	Connecticut Status	Federal Status
Cave-hibernating	Big brown bat	*Eptesicus fuscus*	-	-	-	-
	Eastern small-footed bat	*Myotis leibii*	SC	E	E	-
	Little brown bat	*Myotis lucifugus*	HPS	E	E	D
	Northern long-eared bat	*Myotis septentrionalis*	T	E	E	E
	Indiana bat	*Myotis sodalis*	E	E	E	E
	Tri-colored bat	*Perimyotis subflavus*	HPS	E	E	P a/
Long Distance Migrants	Eastern red bat	*Lasiurus borealis*	-	-	SC	-
	Hoary bat	*Lasiurus cinereus*	-	-	SC	-
	Silver-haired bat	*Lasionycteris noctivagans*	-	-	SC	-

Note**:**
E = Endangered; T = Threatened; SC = Special Concern; HPS = High Priority Species of Greatest Conservation Need; D = Discretionary Review for Listing Determination; P = Petitioned for Listing
a/ Proposed Endangered
Sources: CTDEEP 2015; MassWildlife 2020; NYSDEC 2015; USFWS 2021; USFWS 2023b.

R.5. Key Risk Factors

To evaluate the type and degree of ecological risk posed by the impact-producing factors listed in COP **Section 5.4 Bat Species**, a variety of factors were considered that may contribute to or mitigate potential direct and indirect effects. These "key risk factors" include both external (e.g., weather, environmental conditions) and intrinsic (e.g., behavior, species abundance) considerations. Eight key risk factors are listed below and are considered in **Section R.5.1** through **Section R.5.8**:

- Key Risk Factor 1: Bat abundance and seasonal use;
- Key Risk Factor 2: Bat behavior;
- Key Risk Factor 3: Bat flight height;
- Key Risk Factor 4: Risk of collision;
- Key Risk Factor 5: Modification of foraging and roosting habitats;
- Key Risk Factor 6: Weather conditions;
- Key Risk Factor 7: Visibility and lighting; and
- Key Risk Factor 8: Noise sensitivity.

R.5.1 Key Risk Factor 1: Bat Abundance and Seasonal Use

There are many records, both historical and contemporary, of bats flying over marine environments (Hatch et al. 2013; Mackiewicz and Backus 1956; Nichols 1920; Peterson 1970; Thompson et al. 2015; Zenon et al. 2011). Migratory species such as eastern red bats are the most often observed bats in the offshore environment, and evidence of their willingness to travel long distances over water can be found in the presence of island populations. Two such examples are the Hawaiian hoary bat and eastern red bats, which occur seasonally on the island of Bermuda, indicating that they are capable of regularly travelling over 620 mi (1,000 km) over open water (Allen 1923; Grady and Olson 2006; Van Gelder and Wingate 1961).

Recent studies provide a baseline understanding of the presence, abundance, and seasonality of bats within the Project Area (including the OCS, state waters, and coastal lands of Massachusetts, which are located in the vicinity of the Lease Area). A summary of these studies is as follows:

- Pelletier et al. (2013) compared acoustic detection data from inland, coastal, and offshore survey locations to model acoustic activity in the Gulf of Maine. Acoustic results were analyzed to compare detection probability and activity level (intensity based on rate of file recording per unit of recording time). Researchers found that bat activity was observed at each of the sites surveyed, and that acoustic activity was highest at coastal sites. Migratory species were as likely to be detected offshore as they were at inland or coastal sites (though activity levels were lower), whereas cave-hibernating species were less likely to be detected offshore.
- Stantec Consulting Services, Inc. (Stantec) (2016a) conducted a long-term study of bat movements in the coastal, near-shore, and offshore environments of the northeast, mid-Atlantic, and Great Lakes from 2012 - 2014, building upon the data collected by Pelletier et al. (2013). This study is the largest of its kind and represents one of the most robust datasets of coastal bat movements available. Stantec found that bat activity was highly seasonal, with peak activity periods in the spring and fall migration periods. The fall had the greatest recorded

bat activity levels, with eastern red bats and other migrants representing the most frequently observed species. Bat calls were detected from 3 - 80 mi (5 - 130 km) offshore, including several detections approximately 9 - 30 mi (14 - 49 km) southeast of Montauk and Block Island, west of the Lease Area.

- Smith and McWilliams (2012) used passive acoustic monitoring at six locations in Rhode Island National Wildlife Refuges (NWRs), including one site each at Sachuest Point NWR, Trustrom Pond NWR, Ninigret NWR, and Rhode Island NWR pond house, and two locations on Block Island NWR. The goal of their study was to compare the relative activity, species composition, and seasonal and nightly patterns of migrating bats at the six survey locations. The researchers found a high degree of seasonality to bat activity during peak periods, with most bat activity recorded prior to the end of the first week of October. They also found that bat activity was not consistent across nights, but that a large portion of each site's annual activity occurred on a small number of nights. Migratory species were the most commonly identified calls, and bat activity was greatest just after sunset. Atmospheric conditions (e.g., wind conditions, atmospheric pressure, temperature, humidity) also appeared to correlate to bat activity levels, with higher passage rates associated with conditions that typically correlate to approaching cold fronts.
- Tetra Tech and DeTect (2012) conducted passive acoustic surveys at four locations on Block Island and on two offshore buoys as part of their pre-construction surveys for Deepwater Wind's Block Island Wind Farm. They detected bat activity at each of the survey locations except at the furthest buoy, which was located approximately 15 nm (27.8 km) east of Block Island. Bat activity followed a seasonal pattern, with most bat activity occurring in late spring or late summer/early fall. Hoary bats, silver-haired bats, and eastern red bats were identified to species, and several calls were identified as *Myotis* sp. A number of calls (29 percent) were high frequency but could not be confidently identified to genus or species (could be *Myotis* sp, *P. subflavus*, or *L. borealis*).
- Vessel-based surveys conducted during the construction phase near Block Island recorded bat calls in the Block Island Wind Farm lease area located approximately 59 nm (95 km) west of the offshore portions of the Project Area. Of the calls recorded, most were eastern red bats, followed by silver-haired bats (Stantec 2016b, as cited in Stantec 2018). Post-construction acoustic surveys at the Block Island Wind Farm in the fall and winter of 2017 - 2018 found that passage rates were highest in September, and that the majority of passing bats were eastern red bats or other long-distance migrants (Stantec 2018).
- Dowling et al. (2017) conducted a manual and automated telemetry study of northern long-eared bats on Martha's Vineyard in 2015 and 2016. Researchers tagged a total of 36 bats in the two years of study, including 20 northern long-eared bats, five little brown bats, seven big brown bats, and four eastern red bats with coded very high frequency nanotags. Tagged bats were tracked manually to their daily roost sites and tracked automatically within the Motus wildlife tracking network by automated telemetry stations. The researchers did not detect any offshore movement of northern long-eared bats, but did detect offshore movement of other species, including little brown bats. These offshore detections were limited in range due to the limited range of detection for each tower in the Motus network (estimated at approximately 15 mi [25 km]).

In addition to a review of available literature, Beacon Wind conducted passive acoustic bat surveys in concert with a variety of other vessel-based surveys undertaken on the *Stril Explorer* within the Lease Area. Detectors were mounted to the handrails of the vessel bridge, and recorded nightly from early August through November of 2020, and again in March and April of 2021. The results of this survey can be found in **Appendix Q Offshore Bat Survey Report**. Beacon Wind identified four species within the Lease Area (big brown bat, silver-haired bat, eastern red bat, and hoary bat), as well as unidentified calls in both high and low frequency ranges. The most commonly recorded species was eastern red bats, and the least commonly recorded species was big brown bats. Bat activity followed trends seen in the above-cited literature and listed below:

- Activity levels in the August – November 2020 monitoring period peaked in August and September;
- Activity levels were greater in the Fall 2020 monitoring period than the early Spring 2021; and
- Bat passes were less frequently record during high winds and low temperatures.

The body of evidence provided by nearby studies in the OCS and coastal regions of the northeastern U.S., combined with the results of Beacon's own baseline studies indicate that bats are present within the Project Area. Both migratory and cave-hibernating species are anticipated to be seasonally common within the onshore areas. Bats are expected to be less common and more seasonal in their occurrence as distance from shore increases, mostly occurring during migration periods. Within the Lease Area, the majority of passing bats are likely to be migratory species. In its response to the information request for the Project, the NYSDEC did not identify any bat species or habitats located in the Project Area. Results of an Information for Planning and Consultation (IPaC) review did not identify any federally listed bats or their habitats in the vicinity of the Lease Area. An IPaC review identified both the Queens, New York and Waterford, Connecticut landfall locations as being within the known range of the northern long-eared bat (**Appendix M USFWS IPaC and State Listed Species**).

R.5.2 Key Risk Factor 2: Bat Behavior

For the purposes of this assessment, the consideration of bat behavior is confined to those behaviors that may increase the likelihood of positive or negative interaction with Project facilities and activities in the Lease Area.

The manner in which migrating or foraging bats interact with novel objects such as vessels, wind turbines, and buoys (attraction, repulsion) has obvious implications for the risks associated with collision (including wind turbine strikes and barotrauma) and caloric expenditure. Research on the interactions of bats with wind turbines and other tall, anthropogenic structures has demonstrated an overall pattern of attraction (Cryan and Barclay 2009; Cryan et al. 2014; Jameson and Willis 2014; Kunz et al. 2007; Smallwood and Bell 2020). This pattern of attraction to novel anthropogenic structures has been observed in nearby offshore areas: during the installation of offshore turbines at Block Island Wind Farm when construction vessel crews observed multiple instances of bats found roosting on the vessels during daytime hours (Stantec 2016b, as cited by Stantec 2018).

Bats could be attracted to tall structures for a variety of reasons. For example, if tall structures are mistaken for trees, bats may attempt to roost on them or forage near them (Cryan and Barclay 2009). However, bat mortalities at wind farms tend to affect migratory species more than non-migrants, and mortalities are distributed bimodally (most occurring in spring and fall), rather than evenly throughout the year (Arnett et al. 2008). A recent study (Jameson and Willis 2014) suggests that migratory species may use tall, anthropogenic structures as social hubs, rather than foraging grounds, during periods of spring and fall migration. Further contributing to the risk of collision, a recent study (Smallwood and Bell 2020) suggests that bats may be more likely to interact with operational turbines than inoperable or curtailed turbines. This study found that bats were not only more likely to be struck by blades or have their flight interrupted by active wind turbines, but that bats were more likely to pass through the rotor-swept zone (RSZ) of active wind turbines than inactive ones.

The best available literature suggests that there is a chance of bats interacting with offshore wind turbines, vessels, and structures, due in part to the potential attraction of such features for bats, in particular for migratory species.

R.5.3 Key Risk Factor 3: Bat Flight Height

The flight height of bats relative to the RSZ has obvious implications for the risk of collision posed by wind turbines. Unfortunately, very little information is available regarding the flight height of bats within the OCS or the Lease Area. Hatch et al. (2013) observed 17 eastern red bats flying over the ocean in the mid-Atlantic region, ranging from 10 - 26 mi (16 - 42 km) offshore. Flight heights were typically 330 - 660 ft (100 - 200 m) above sea level or greater. Other studies have shown bats to fly at lower than usual elevations when flying over water. For example, Ahlen et al. (2007) and Ahlén and Bach (2009), using radar and visual observation of migrating and foraging bats over the ocean, found that most bats flew at low altitudes over water, often less than 32.8 ft (10 m) above the water's surface. Rydell (1986) observed that bats foraging over the surface of a lake typically flew 7 - 16 ft (2 - 5 m) above the ground.

Bats may fly at low altitudes over water as a way of taking advantage of the aerodynamic ground effect, where the ground surface (or in this case, water) reduces the energy required to sustain flight by acting as an aerodynamic mirror. By flying within the ground effect, bats may be able to reduce aerodynamic power by nearly 30 percent (Johansson et al. 2018). Flying at low elevations may also allow bats to avoid the highest wind speeds during inclement weather, as the air encounters friction with the water's surface.

Bats may also fly at low altitudes over water for the purpose of echolocation and foraging. Insects may be more plentiful near the surface of the water when air temperatures cool and the surface of the water may allow bats to echolocate more easily. Evidence suggests that bats may take advantage of an "echo-acoustic ground effect" to target insects more easily over smooth surfaces like the surface of water (Zsebok et al. 2013).

In addition to normal flying behaviors, there is sufficient evidence from onshore and offshore facilities to suggest that bats may be attracted to wind turbines and frequently interact with turbine blades in the RSZ regardless of their ordinary flight height (Ahlén et al. 2007; Arnett et al. 2008; Cryan et al. 2014; Cryan and Barclay 2009).

R.5.4 Key Risk Factor 4: Risk of Collision

There is a growing body of evidence to indicate that bat migration and foraging over marine environments is a relatively common phenomenon, and that certain behaviors may increase the risk of collision with turbine blades. Studies at onshore wind facilities have found significant seasonal mortality risk to bats, particularly migratory species (Arnett et al. 2008). The primary cause of mortality at wind farms is the moving turbines, either through collision with moving blades or through barotrauma caused by rapid pressure changes at the tips and trailing edges of blades (Cryan and Barclay 2009), though recent studies indicate barotrauma may be a less common occurrence than once thought (Rollins et al. 2012). The vast majority of bats found beneath operational turbines with observed injuries do not survive the rehabilitation process. However, it is not likely that the differential between offshore and onshore environments has a material effect on overall fatality rates.

R.5.5 Key Risk Factor 5: Modification of Foraging and Roosting Habitats

Installation of new, novel structures in the offshore environment could create new roosting habitats for migrating bats. Migrating bats have shown a willingness to roost on anthropogenic structures at sea, including vessels (Stantec 2018; Thompson et al. 2015). Construction vessels and infrastructure associated with the turbine towers or the offshore substation facilities could potentially be appealing roosts to migrating bats.

The greatest potential for disruption of typical foraging and roosting habitats is in the onshore environment where bats typically roost and forage because many bats are philopatric (tending to stay near or return to a particular area) (Lewis 1995; Perry 2011). If forced to find new roost trees or foraging grounds, bats may expend a greater amount of energy during vulnerable times of the year, such as upon return to summer maternity areas after winter hibernation or spring migrations, when bats may be expected to have lower than average fat reserves and high energetic demands for pregnancy.

R.5.6 Key Risk Factor 6: Weather Conditions

Evidence suggests that weather conditions and patterns influence bat behavior and may affect migration patterns and flight height (Kunz et al. 2007; Smith and McWilliams 2012; Smith and McWilliams 2016). Some relationships between weather conditions and bat activity or mortality near wind turbines are better understood than others. For example, mortality at onshore wind facilities has been shown to vary with temperature and windspeed (Arnett et al. 2008), and this relationship has been supported by the success of windspeed and temperature-dependent curtailment strategies at wind farms (Arnett et al. 2010; Hayes et al. 2019). Cold temperatures, excessive windspeed, and precipitation are associated with lower overall bat activity and reduced mortality at wind farms (Arnett et al. 2008). In less extreme wind conditions, some studies have indicated an increase in migratory bat activity with small increases in overall windspeed, with a greater influence attributed to wind profit (wind speed relative to the expected direction of migratory flight) (Arnett et al. 2007; Smith and McWilliams 2012; Smith and McWilliams 2016).

Changes in weather, such as storm fronts, may also influence bat mortality. For example, bat fatalities at wind turbines occur more frequently with the passage of storm fronts (Arnett et al. 2008). However, the exact relationship between some indicators of front passage, such as humidity and barometric pressure, and bat activity are less clear. Some studies have indicated increased bat activity (measured by acoustic detection or capture rates using mist nets) associated with low or decreasing barometric pressure (Baerwald and Barclay 2011; Cryan and Brown 2007; Dechmann et al. 2017), while others have suggested just the opposite (Bender and Hartman 2015; Gonzalez and Bender 2017; Smith and McWilliams 2016). In their coastal New England study area, Smith and McWilliams (2012) noted that increased bat activity with favorable wind profit and increasing atmospheric pressure was correlated with the passage of cold weather fronts, indicating that migratory bats may have been traveling at least partly in response to indicators of changing seasonal conditions.

It is also unclear whether humidity plays a significant role in bat activity. Lacki (1984) found that little brown bats were more active during periods of high humidity, speculating that this was a result of higher ambient water vapor pressures producing lower vapor pressure deficits between bats' respiratory tracts and the environment, resulting in less evaporative water loss. However, other studies that considered humidity among other weather parameters did not find humidity or changes in humidity to be strongly correlated with bat activity when controlled for other variables such as temperature and barometric pressure (Gonzalez and Bender 2017; Smith and McWilliams 2016).

R.5.7 Key Risk Factor 7: Visibility and Lighting

Various bat species react differently to light, and some appear to be more willing than others to cross illuminated areas (Hale et al. 2015; Mathews et al. 2015; Spoelstra et al. 2017). Because the insects on which bats feed are attracted to light, some species of bats may seek out light sources in search of food. Fast-flying species (e.g., *Eptesicus* or *Lasiurus* spp.) appear to seek light sources more than slower-flying species (e.g., *Myotis* spp.) (Rydell 1992; Rydell and Racey 1995). For example, in residential areas, bats can often be seen foraging for insects near porch lights, stadiums, and pole lights. For other species, illuminated roadways and similar "light barriers" limit movement across the landscape as bats, perhaps avoiding a perceived increase in predation risk, avoid those lit corridors (Hale et al. 2015).

Light of different wavelengths may affect bats differently and those effects may vary by species or season. For example, some studies have suggested that migratory species of bats were attracted to red light-emitting diode (LED) lights (Voigt et al. 2018) and green LED lights (Voigt et al. 2017), but not to warm white lights (Voight et al. 2018). However, this theory is contradicted by Spoelstra et al. (2017), who found that bat behavior was affected by white and green lights, but not red lights. Perhaps more relevant to the context of this assessment, several studies have demonstrated that aviation safety lights are not associated with a greater risk of mortality at onshore wind turbine locations (Arnett et al. 2008; Bennet and Hale 2014; Horn et al. 2008).

Researchers have also found that migrating bats did not make more "feeding buzzes" (rapid echolocations across a broad frequency range associated with the taking of a prey item) in the presence of light, which may indicate that migrating bats are not attracted to light sources primarily as foraging grounds (Voight et al. 2017; Voight et al. 2018). Voight hypothesized that bats may be attracted to lights during migration because they are relying on vision more than echolocation or other environmental cues for orientation. This hypothesis finds support in other studies, which demonstrated that non-migratory bat species seem to use polarized light at dusk to aid in orientation and navigation (Greif et al. 2014), whereas migratory bats do not (Lindecke et al. 2015).

R.5.8 Key Risk Factor 8: Noise Sensitivity

Construction, operations, and decommissioning will result in some level of noise disturbance in those offshore and onshore portions of the Project Area, as discussed further in **Appendix K In-Air Acoustic Assessment**. The degree of impact resulting from such disturbances is dependent on a variety of factors, including the amount of noise generated, the distance it travels, the degree to which bats are exposed to it, and the sensitivity of bats to anthropogenic noise. The distance that noise travels is dependent on many variables such as equipment type, vegetative cover, topography, and other barriers.

Another factor to consider when analyzing the effect of noise on roosting bats is the biology of their hearing. Noise ratings for construction equipment are typically provided in A-weighted decibels (dBA), which is based on the peak noise response of human hearing. The perceived noise level from similar equipment would likely be lower for the hearing range of bats, which is centered on higher frequency and faster-attenuating pitches. Little brown bats (*Myotis lucifugus*), for example, have a typical range of hearing from approximately 10 kilohertz (kHz) – 120 kHz (Grinnell 1963), and their own echolocation calls are quite loud, often up to or exceeding 120 decibels (dB). While construction noises may certainly occupy a wide frequency range, most are not ultrasonic in nature. High frequency sounds also attenuate more quickly than low frequency sounds, and do not travel as far from their source.

Early literature on the subject seemed to indicate that some species of bats may seek roost sites away from noise sources. For example, Indiana bats, especially reproductive females, have been shown to typically roost farther from noisy, paved roads and highways than they do from quieter gravel ones (Gardner et al. 1991). However, factors other than noise may also contribute to this correlation; gravel roads may be narrower and present less risk of predation as an open space barrier for travel and foraging activities, may have fewer streetlamps, may carry less risk of injury and death via collision with vehicles, or may have less surrounding human development. Gardner et al. (1991) suggested that noise and exhaust from machinery may disturb colonies of roosting bats, though noting that such disturbances would have to be severe to cause roost abandonment.

Subsequent studies generally seem to indicate that bats are very tolerant of anthropogenic noise, including persistent and sudden noises. Documented instances can be found of bats roosting in very noisy circumstances: near airports (Federal Aviation Administration [FAA] 1992); near highways (Brack et al. 2004); regularly crossing major highways (3D/Environmental [3D/E] 1995); roosting under concrete road bridges and underpasses (Kiser et al. 2002); and roosting and foraging on active military bases where construction and training activities take place during the active season (3D/E 1996). These instances seem to indicate that bats are either indifferent to many anthropogenic noises or, at the very least, adapt to them without major disruption.

R.6. Assessment Approach and Impact Producing Factors

Interactions between bats and wind turbines are the subject of a developing field of research, and much of what is known about bat-related mortality and risk associated with wind turbines has been learned through scientific studies and post-construction mortality monitoring at onshore wind facilities. Comparatively little is known about bat foraging and migration activities in the offshore environment, including the Project's Lease Area, although recent studies in the Mid-Atlantic and OCS have established that bats are in fact using these areas for migration and foraging activities (**Section R.5.1 Key Risk Factor 1: Bat Abundance and Seasonal Use**). This assessment relies on desktop resources, including scientific research, offshore acoustic survey results, and behavioral studies regarding bats' reactions to various conditions and stimuli that may be similar to those presented by various stages of the Project. This assessment considers the available information using a "weight of evidence" approach that prioritizes literature and data that are: 1) the most recent; 2) the best supported; and 3) the most clearly applicable to the activities and locations that pertain to the Project.

R.6.1 Effects Characterization Approach

The following provides a description of the approach used to characterize effects of the Project on resources (receptors) within or in the vicinity of the Project. The approach used in this Report includes three primary steps:

1) Identification of impact-producing factors;
2) Identification of potentially affected resources; and
3) Impact characterization.

R.6.1.1 Impact-Producing Factors

BOEM, in its *Information Guidelines for a Renewable Energy Construction and Operations Plan (COP)* (BOEM 2020), identified seven potential impact-producing factors that may affect biological resources. These were adapted to address the impact-producing factors associated with the Project for this assessment and are summarized in **Section 5.4 Bat Species** of the COP.

Based on these criteria, an effect intensity is assigned (no/none, very low, low, medium, or high).

Table R.6-1 below provides definitions of the criteria used to qualitatively assess the anticipated effect intensity with the effect being change to the resource brought about by the presence of a Project component or by the execution of a Project activity.

Based on that qualitative assessment and the application of professional judgment, each anticipated effect is assigned one of the intensity levels defined in **Table R.6-2**.

Based on an assessment of the environment described in **Section R.3 Project Area Description**, the subject biological resources (i.e., bats and their habitat) are assigned a sensitivity "ranking" based on a qualitative assessment of the criteria presented in **Table R.6-3**, whereby sensitivity is ranked as follows: Very Low, Low, Medium and High. The degree of sensitivity of the resource is, in part, based on the resource's resilience and its ability to naturally adapt to changes or recover from impact. This characterization is supported by the analysis of Key Risk Factors presented in **Section R.5 Key Risk Factors**.

R.6.1.2 Potentially Affected Resources

For this assessment, the potentially affected resources are bats and their habitat. Key risk factors that may affect the type and degree of ecological risk posed by impact-producing factors are described in **Section R.5 Key Risk Factors**.

TABLE R.6-1. EFFECT CRITERIA QUALITATIVE DEFINITIONS

Effect Criteria a/	Definitions a/
Nature	**Positive** – An effect that is considered to represent an improvement to the baseline or to introduce a new desirable factor. **Negative** – An effect that is considered to represent an adverse change from the baseline, or to introduce a new undesirable factor.
Type	**Direct** – An effect created as a direct result of the Project or Project activities. **Indirect** – An effect that may be caused by the Project but will occur in the future or outside the direct area of Project influence.
Reversibility	**Temporary** – Effects that are transient, intermittent, or occasional in nature and/or largely reversible. **Permanent** – Effects that occur during the development of the Project and cause a permanent change in the affected impact indicator or resource that endures substantially beyond the Project lifetime (irreversible).
Duration	**Short-Term** – Effects that are predicted to last only for a limited period (less than four years) but will cease on completion of an activity, or as a result of mitigation measures and natural recovery. **Medium-Term** – Effects that will occur over a period of four to 10 years. This will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period. **Long-Term** – Impacts that will occur over an extended period (more than 10 years). This will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period.

Effect Criteria a/	Definitions a/
Geographical Extent (Area)	**Local** – Effects that alter or influence locally important resources or are restricted to a single (local) administrative area or local community (not widespread). **Regional** – Effects that alter or influence regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries (fairly widespread). **National** – Effects that alter or influence nationally important resources, affect an area that is nationally important/protected or macro-economic consequences (widespread).
Cumulative	**Cumulative** – Direct or indirect effects that could have a greater expression due to the proximity and timing of other activities in the Project Area. **Synergistic** - Direct or indirect effects that could have a greater expression due to the additive or interactive nature of the effect in a particular place and within a particular time.

Note:

a/ Effect criteria and definitions adapted from International Institute for Sustainable Development (IISD) (IISD 2016)

Table R.6-2. Impact-Producing Factor Intensity Levels and Defining Characteristics

Intensity Level	Example Characteristics
High	• Negative effect is irreversible or permanent. • Long-term negative effects (more than 10 years) that are widespread (i.e., regional or national). • Effects that influence or alter nationally important resources. • Effects that change ambient conditions so as to cause (or reasonably may cause) death or injury with population level effects to non-protected species. • Changes to ambient conditions that may cause death or injury to a protected species and could influence overall species survival. • Cumulative or synergistic effects will occur, or may be reasonably expected to occur, and have population level effects on a protected species.
Medium	• Medium-term effects (five to 10 years) that are geographically widespread (national or regional). • Direct or indirect effects that are reversable, with recovery over a longer period of time. • Air pollution, water contamination, coastal pollution by slightly biodegradable products and/or hazardous substances having a chronic effect on human health after long-term exposure. • Ambient in-air sound level slightly higher than legal threshold.

Intensity Level	Example Characteristics
	• Underwater sound level resulting in death or injury of individuals of a protected species; however, no impact to the survival of the species.
Low	• Shorter-term effect (one to five years); effects that are local and reversible. • Level of air, water, and coastal pollution detectable, but below thresholds known to have a negative effect on human health or resident and migratory populations. • Acceptable in-air sound, light, or electric and magnetic fields (EMF) below the established thresholds for effects on human health, native/resident and migratory animal populations, and/or plant populations. • Low-level, long-term effects to the landscape. • Effects causing only temporary behavioral shifts to a protected species.
Very Low	• Short-term effects (less than one year), local and reversible. • Waste effluents released into water, air, and soil/ground at near-background concentrations. • Post-construction/operation levels (e.g., light, EMF, vegetation cover) similar to background levels or pre-construction conditions. • Little to no change in the ecosystems and/or landscape; no permanent change to ecosystems or landscapes. • No impact on protected species.
None	• Intensity is so immaterial that any resulting impact is scoped out of the impact assessment process.

TABLE R.6-3. BIOLOGICAL RESOURCES SENSITIVITY RANKING

Ranking	Resource Characteristics
High	• Numerous sensitive or protected fauna and/or flora where a high level of biodiversity can be observed; or is a protected ecosystem of regional, state, or federal importance. • An already vulnerable resource with very little capacity and means to adapt to or tolerate the changed conditions.
Medium	• A few species of sensitive or protected fauna and/or flora or a sensitive ecosystem or a locally protected ecosystem or habitat. • A protected species or habitat with limited capacity and means to adapt to change and tolerate changed conditions. Adaptation may take time and/or may only be partial.
Low	• Very few individuals of sensitive or protected fauna and/or flora or is an ecosystem which is not protected at local, state, or federal levels. • A resource with some capacity and means to adapt to change and maintain/improve current conditions. Adaptation may take time and/or may only be partial.

Ranking	Resource Characteristics
Very Low	• No sensitive or protected fauna and/or flora or is an ecosystem that is not sensitive or that is already impacted. • A resource with the capacity and means to adapt to change and tolerate the changed conditions.

R.6.2 Identification and Characterization of Effects

The following sections describe the potential for effects associated with planned Project activities (construction, operations, and decommissioning). Potential for effects to bats and bat habitat are associated with above-ground construction, presence of structures during Project operations, and decommissioning. As such, the identification and characterization focus on above-ground Project facilities and infrastructure.

Each of the above impact-producing factors are discussed below, and their intensity as well as resource sensitivity with and without mitigation are provided in **Table R.7-1.** and **Table R.7-2**.

R.6.2.1 Ground Disturbance

This section discusses the potential effects associated with ground disturbance.

R.6.2.1.1 Construction and Decommissioning

Ground disturbance will occur for the construction of the onshore Project infrastructure. As indicated in **Section R.4 Bat Community Characterization**, key habitats for cave-hibernating bats are not located near onshore Project infrastructure. Other than minimal potential tree clearing (addressed as displacement of bats and bat habitat in **Section R.6.2.3 Displacement of Biological Resources**), such activities will include temporary disturbance of the ground surface, vegetation removal, grading, installation of temporary work pads, construction access roads and laydown areas. These temporary ground disturbances are not expected to have material effect on bats or bat habitat due to the highly developed nature of the onshore portion of the Project Area and the relative lack of contiguous vegetated habitats, although development of the Waterford, Connecticut site would require some conversion of vegetated habitat. The effects associated with ground disturbing activities will be temporary, short-term, and local. Therefore, the intensity of this impact-producing factor is Very Low.

Not all onshore infrastructure may be removed during decommissioning. To the extent that above-ground infrastructure are removed during decommissioning, the nature and impact-producing factor intensity would be comparable to that for construction. To the extent that Project components are decommissioned, the impacts associated with ground disturbance are likely to be similar in type and degree to those of construction.

R.6.2.1.2 Operations and Maintenance

Throughout Project operations, small amounts of routine ground disturbance may occur as a result of maintenance activities. However, as previously stated, the onshore portion of the Project Area already lacks any significant habitat for bats.

R.6.2.2 Introduction of Sound/Change of Ambient Lighting

This section discusses the potential effects associated with the introduction of sound and/or change of ambient lighting.

R.6.2.2.1 Construction and Decommissioning

Noise and light are two Project impacts that have the potential to affect bats beyond the physical footprint of the facilities. The exact distance at which either disturbance may be perceptible to bats will depend on the magnitude of the light or noise source, surrounding obstacles, or topography that may attenuate sound or occlude light sources, and the amount of background noise or light pollution in the area prior to and during the disturbance. As described in **Section R.5.7 Key Risk Factor 7: Visibility and Lighting** and **Section R.5.8 Key Risk Factor 8: Noise Sensitivity**, both noise and light may affect bat behavior.

Construction activities may introduce noise and light into the environment as a result of construction equipment, vehicle traffic (onshore), vessel traffic (offshore), and equipment and safety lighting. The overall noise and light disturbance of construction is anticipated to be minor and will be limited to the approximate construction area, though some amount of noise and light may be perceptible outside the physical workspace.

Noise and light introduction from construction activities are anticipated to be short-term and temporary in nature; the impact-producing factor intensity is Very Low for noise and Low for light. Bats that are exposed to such disturbances are likely to have low sensitivity to such disturbances, with ample ability to adapt to or avoid such disruptions.

Not all onshore infrastructure may be removed during decommissioning. To the extent that above-ground infrastructure is removed during decommissioning, changes to ambient sound and light would be comparable to that for construction.

R.6.2.2.2 Operations and Maintenance

Small amounts of noise may be introduced into the surrounding environment from the rotating wind turbines and the onshore substation facilities. However, operational noise is expected to be significantly less than noise associated with construction, and bats are not expected to be sensitive to such disturbances.

The wind turbines will require artificial lighting during operations, including both safety lighting (illumination of work areas) and aviation avoidance lighting on the offshore structures. The overall intensity of light introduction is expected to be low. Offshore lighting is anticipated to be a low-intensity effect due to the minimal amount of lighting required and the amount of distance between each light source (approximately 1 nm, 1.9 km). Onshore lighting is not anticipated to change significantly, as the onshore substation facilities are anticipated to be added to existing substation infrastructure within parcels predominantly characterized by utility land uses, which is already well lighted and situated in an industrialized setting.

R.6.2.3 Displacement of Biological Resources

This section discusses the potential effects associated with displacement of biological resources.

R.6.2.3.1 Construction and Decommissioning

Construction activities that may result in the destruction and disturbance of limited amounts of bat habitat are associated with certain onshore Project components. Key habitat features for cave-hibernating bats are not present near the onshore Project infrastructure locations and, therefore, destruction or disturbance to these features (caves, mines, voids) are not expected. Facility siting, including the selection of the onshore substation facility locations, seeks to minimize effects on natural areas. The proposed Queens, New York landfall and onshore substation facility locations would not likely require clearing of forested habitats, although some small trees and shrubs may be affected. The Waterford, Connecticut landfall and onshore substation facility location would require the clearing of up to five ac (2 ha) of forested habitat. Refer to COP **Section 5.1 Terrestrial Vegetation and Wildlife** for additional information regarding potential impacts to onshore habitats.

Given that Beacon Wind's onshore substation facilities follow previously disturbed areas, with the exception of the potential new Waterford onshore substation facility site that contains a portion of forested habitat, no new habitat fragmentation, open corridors, or significant new open spaces will be created. The Waterford parcel is bordered on all sides by paved lots, existing electric utility facilities, railroad tracks, and roads and does not consist of a predominately undeveloped/vegetated land use. Provided that active roosts are not cleared during the summer maternity season, the sensitivity of bats to any minimal tree clearing is likely to be low, as roosts are ephemeral resources subject to regular loss or disturbance in nature. The period of disturbance to any bat habitat during construction will be short-term but will have permanent effects in the form of new above-ground structures and lost habitat in the form of any tree clearing required for construction of the onshore substation facilities, such as at the Waterford, Connecticut location. The sensitivity of bats to these minor disturbances is likely to be very low. The intensity of this impact-producing factor is expected to be Very Low for wind turbine and offshore substation facilities and Very Low to Low for onshore components, depending on whether the Waterford, Connecticut landing site is selected.

Not all onshore infrastructure may be removed during decommissioning. Although there is some limited potential for individual bats occasionally to use onshore or offshore structures for temporary roosting habitat during migration periods, it is unlikely that bats will depend upon them as a resource or that the decommissioning of onshore or offshore structures will result in the displacement of bats from the Project Area.

R.6.2.3.2 Operations and Maintenance

Any natural habitat that is permanently altered during construction may also pose a risk of resource displacement. Bats that used those areas for foraging, roosting, or maternity sites will necessarily seek out alternative areas, resulting in their displacement. However, as previously described, the anticipated location of the onshore substation facilities is not likely to represent significant bat habitat.

R.6.2.4 Direct Injury or Death of Biological Resources

This section discusses the potential effects associated with direct injury or death of biological resources.

R.6.2.4.1 Construction and Decommissioning

Potential causes of injury or death during construction include tree trimming or removal (if required), collisions between bats and construction equipment, or disruption of bat activity, which result in roost abandonment or significant energy expenditure during the migratory or pup-rearing time periods. Of these potential risks, the greatest risk to bats is tree trimming and clearing activities, which could result in crushing death or significant injury for bats whose roosts are destroyed while they are occupied. Such risks are greatest during the early summer period when pups are not yet volant. Activities that may result in injury or death would be short-term, temporary, and localized, and the potential for such activities to occur is minimal. As such, the impact-producing factor intensity for onshore construction is Very Low. The amount of anticipated tree clearing is minimal, and the risk of injury or death can be mitigated or eliminated by adhering to a restricted time period for these activities if suitable habitat is identified in the final onshore portions of the Project Area. Offshore construction has an impact-producing factor intensity of Very Low.

Not all onshore infrastructure may be removed during decommissioning. Although some individual bats may occasionally roost on the Project's above-ground structures, it is unlikely that significant numbers will do so, and the overall disturbance of decommissioning activities would likely disrupt roosting bats before the structures were taken down. It is unlikely that decommissioning of these structures will result in meaningful impacts to bats through direct injury or death.

R.6.2.4.2 Operations and Maintenance

The most likely cause of direct injury or death during Project operations is collision with the wind turbines. As discussed in **Section R.5.1 Key Risk Factor 1: Bat Abundance and Seasonal Use** and **Section R.5.4 Key Risk Factor 4: Risk of Collision**, bats are likely to be exposed to this hazard seasonally, mostly during the spring and fall migration periods. Due to the relative infrequency of bat occurrence offshore, the intensity of the effect and sensitivity to this hazard are likely to be low for bat populations both overall and locally.

R.6.2.5 Produce Accidental Events

This section discusses the potential effects associated with accidental events (e.g., spills, unplanned releases).

R.6.2.5.1 Construction and Decommissioning

During construction activities, there is some small chance of spills, unplanned releases of chemical contaminants or solid waste, or similar accidental events that could result in environmental harm, affecting bats. Any such events would likely be short-term, local, and temporary, and unlikely to result in significant harm to bats. Beacon Wind has committed to prioritizing safety, health, and the environment, and has outlined their commitments to avoiding such accidental events in the COP. The impact-producing factor intensity is Very Low. Decommissioning-related effects are likely to be similar to those for construction.

R.6.2.5.2 Operations and Maintenance

As with construction activities, operation and maintenance activities could potentially result in spills, unplanned releases of chemical contaminants or solid waste, or similar accidental events which could result in environmental harm, affecting bats. Any such events would likely be short-term, local, and temporary, and would be unlikely to result in significant harm to bats. Beacon Wind has committed to prioritizing safety, health, and the environment, and has outlined their commitments to avoiding such accidental events in the COP. Beacon Wind has developed COP **Appendix E Oil Spill Response Plan** under which the Project will operate.

R.6.2.6 EMF Introduction

This section discusses the potential effects associated with EMF introduction.

R.6.2.6.1 Construction and Decommissioning

No effects from EMF are anticipated to bats during construction or decommissioning.

R.6.2.6.2 Operations and Maintenance

The potential effects of electric and magnetic radiation on bats are unclear and are the subject of only a limited amount of research. Some studies have indicated a reduction of bat activity in the presence of EMF, using radar units as the source of the EMF (Nicholls and Racey, 2007; Nicholls and Racey, 2009). Researchers have theorized several mechanisms by which EMF may deter bats, including effects on insect prey species, thermal induction, and high-frequency interference with echolocation. Bat activity was reduced significantly in habitats exposed to an EMF strength of 2 volts/m or greater when compared to matched sites with no measurable EMF. However, the reduction in activity was not statistically significant at EMF strengths less than 2 volts/m within 1,300 ft (400 m) of the EMF source (Nicholls and Racey, 2007).

Potential impacts of EMF within the Project Area are characterized as long-term, permanent, and localized, and the impact-producing factor intensity is Very Low.

R.7. Potential for Effects

Potential effects of the Project construction, operations, and decommissioning were evaluated according to the methods described in **Section R.6.1 Effects Characterization Approach**.

R.7.1 Pre-mitigation Potential for Effects

The potential for effect was scored initially without consideration of potential measures to mitigate potential effects (**Table R.7-1.** and **Table R.7-2**). The construction and decommissioning intensity levels are expected to be Very Low to Low. Similarly, pre-mitigation operations intensities are expected to be Low to Very Low. Resource sensitivities to impact-producing factors associated with construction, operations, and decommissioning are also characterized as Very Low to Low.

R.7.2 Mitigation and Residual Effects

The following summarizes some of the key mitigation measures employed during siting, design, construction, and operations to avoid, minimize, and mitigate effects where practicable.

R.7.2.1 Onshore

Beacon Wind has minimized the Project's onshore effects to the greatest extent practicable by undertaking the following avoidance and minimization measures:

- Onshore Project infrastructure is not sited near key habitat locations for cave-hibernating species;
- The onshore substation facilities are proposed to be constructed mostly within open/disturbed areas where tree clearing is expected to be minimal;
- The Project will utilize an existing O&M Base and will not require construction of a new O&M Base in the State of New York, therefore avoiding additional potential habitat impacts as a result of new construction; and
- Beacon Wind will coordinate as necessary with the USFWS and NYSDEC to determine appropriate mitigation measures.

By implementing these avoidance and minimization measures, in addition to the safety, health, and environmental protection measures described in **Section 8 Human Resources and the Built Environment** of the COP, Beacon Wind expects to mitigate any potential effect on bats through onshore Project activities and facilities.

R.7.2.2 Offshore

Beacon Wind has committed to the following avoidance and minimization measures for the offshore Project components:

- Minimize vessel lighting to the extent practicable to reduce potential attraction or light barrier effects during construction, operations, and decommissioning

By implementing the above measures in addition to the safety, health, and environmental protection measures described in COP **Section 8 Human Resources and the Built Environment**, the risk of impact to bats is very low through offshore Project activities and facilities. Although some injury/mortality may occur with the wind turbines, such occurrences are likely to be seasonal in distribution, few in number, and have no significant long-term impact on populations.

TABLE R.7-1. CHARACTERIZATION OF POTENTIAL PROJECT EFFECTS DURING CONSTRUCTION AND DECOMMISSIONING

Impact-Producing Factor	Related Activities a/	Intensity Criteria	Pre-Mitigation Intensity Level	Resource Sensitivity Rank	Mitigation Type	Post-Mitigation Intensity Level
Sea bottom/ground disturbance	WT, OSF	Short-term Temporary Local	None	None	N/A	None
	OST	Short-term Temporary Local	Very Low	Low	Minimize onshore Project footprint	None- Very Low
Introduce sound into the environment	WT, OST, OSF	Short-term Temporary Local	Very low	Very Low	N/A	Very Low
Change ambient lighting	WT, OST, OSF	Short-term Temporary Local	Low	Very Low	Minimize vessel and construction lighting	Very Low
Resource displacement	WT, OSF	Long-term Permanent Local	Very Low	Very Low	N/A	Very Low
	OST	Long-term Permanent Local	Low	Low	Minimize tree clearing	Very Low
Direct injury or death	WT, OSF	Short-term Temporary Local	Very Low	Low	N/A	Very Low
	OST	Short-term Temporary Local	Very Low	Low	Limit tree clearing Timing restrictions	None to Very Low
Produce accidental events	WT, OST, OSF	Short-term Temporary Local	Very Low	Very Low	Implement Environmental Health and Safety Plan	None

Note:
a/ WT = wind turbines; OST = onshore transmission (including landfall locations, transmission, and substations); OSF = offshore substation facilities

TABLE R.7-2. CHARACTERIZATION OF POTENTIAL PROJECT EFFECTS DURING OPERATIONS

Impact-Producing Factor	Related Activities a/	Intensity Criteria	Pre-Mitigation Intensity Level	Resource Sensitivity Rank	Mitigation Type	Post-Mitigation Intensity Level
Sea bottom/ground disturbance	WT, OSF	Long-term Permanent Local	None	None	N/A	None
	OST	Long-term Permanent Local	Very Low	Low	N/A	None
Introduce sound into the environment	WT, OST, OSF	Long-term Permanent Local	Very Low	Very Low	N/A	Very Low
Change ambient lighting	WT, OST, OSF	Long-term Permanent Local	Low	Low	Minimize lighting	Very Low
Change ambient EMF	WT	Long-term Permanent Local	Very Low	Very Low	N/A	Very Low
Resource displacement	WT, OSF	Long-term Permanent Local	None	Very Low	N/A	None
	OST	Long-term Permanent Local	None to Very Low	Low	Minimize tree clearing	None to Very Low
Direct injury or death	WT, OSF	Long-term Permanent Local	Low	Low	N/A	Low
	OST	Long-term Permanent Local	Very Low	None	Timing restrictions for tree clearing	None
Produce accidental events	WT, OST, OSF	Short-term Temporary Local	None to Very Low	Very Low	Implement Environmental Health and Safety Plan	None

Note:
a/ WT = wind turbines; OST = onshore transmission (including landfall locations, transmission, and substations); OSF = offshore substation facilities

R.8. Conclusions

Overall, the Project is anticipated to result in only low or very low effects to bats. Onshore facilities represent the greatest construction and decommissioning risks to bats due to the number of bats expected to occur on a terrestrial landscape relative to the offshore portion of the Project Area. The greatest Project operations risks to bats are associated with wind turbine collisions during operation and are expected to mostly affect species that travel long distances for latitudinal migration, particularly eastern red bats, hoary bats, and silver-haired bats. Other species of bats may occur in the Lease Area in rare instances but are less likely to be regularly or seasonally present. Regardless of species, bat activity in the Lease Area is expected to be much lower than in the onshore portions of the Project Area and bats are mostly expected to be encountered in the Lease Area during spring and fall migration.

As described in this assessment, bat activity and behavior are influenced by the presence of wind turbines. Therefore, while this assessment is based on the “weight of evidence” and considers the potential attractive force of wind turbines, post-construction monitoring would be necessary to confirm if actual effects are consistent with the projected effect levels. Beacon Wind will coordinate with the appropriate resource agencies for the scope and implementation of any pre- and/or post-construction monitoring as may be required to assess presence/absence in specific Project work locations, and/or as may be required as a condition of Beacon Wind’s regulatory authorizations.

R.9. References

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