Supplemental Information for the Vineyard Wind 1 Project
Biological Assessment
May 11, 2020

This document transmits supplemental information to the March 27, 2019 Vineyard Wind 1 Project Biological Assessment (BA) as a result of updates to the project design envelope (PDE). In addition, this document addresses several outstanding requests discussed at the March in-person project meeting between The Bureau of Ocean Energy Management (BOEM) and National Marine Fisheries Service (NMFS).

On January 31, 2020, Vineyard Wind, LLC (Vineyard Wind) submitted an update to its PDE in an updated Construction and Operations Plan (COP). Primarily, the PDE increased the maximum wind turbine generator (WTG) size to up 14 megawatts (MW) from 10 MW, which was presented in the March 2019 BA. As shown below in Table 4.1-1, most of the updates relate to the WTG and associated rotor diameter, tip height, and hub height. Tables 4.1-1 and 4.1-2 from the BA can be replaced with the revised tables below. Changes from the BA have been highlighted in boldface type for your convenience.

Table 4.1-1: Vineyard Wind 1 Project WTG Specifications with Maximum Design Scenario

Wind Facility Capacity	Approximately 800 MW [a]	
Wind Turbine Generator Foundation Arrangement Envelope	Up to 100 monopiles	Up to 10 may be jacket foundations
Wind Turbine Generators	**Minimum Turbine Size**	**Maximum Turbine Size**
Turbine Generation Capacity	8 MW	**14** MW
Number of Turbine Positions [b]	106	88
Number of Turbines Installed	100	**57**
Total Tip Height	627 ft (191 m) MLLW [c]	**837** ft (**255** m) MLLW [c]
Hub Height	358 ft (109 m) MLLW [c]	**473** ft (**144** m) MLLW [c]
Rotor Diameter	538 ft (164 m) MLLW [c]	**729** ft (**222** m) MLLW [c]
Tip Clearance	89 ft (27 m) MLLW [c]	**105** ft (**32** m) MLLW [c]
Platform Level/Interface Level Height for Monopile	62 ft (19 m) MLLW [c]	75 ft (23 m) MLLW [c]
Tower Diameter for WTG	20 ft (6 m)	28 ft (8.5 m)
Monopile Foundations [d]	**Minimum Foundation Size**	**Maximum Foundation Size**
Diameter	25 ft (7.5 m)	34 ft (10.3 m)
Pile footprint	490 ft^2 (45.5 m^2)	908 ft^2 (84.3 m^2)
Height between Seabed and MLLW (water depth)	121 ft (37 m)	162 ft (49.5 m)
Penetration	66 ft (20 m)	148 ft (45 m)
Transition Piece Tower Diameter	20 ft (6 m)	28 ft (8.5 m)
Transition Piece Length	59 ft (18 m)	98 ft (30 m)
Platform Level/Interface Level Height	64 ft (19.5 m)	74 ft (22.5 m)
Number of Piles/Foundation	1	1
Number of Piles Driven/Day within 24 hours [e]	1	2
Typical Foundation Time to Pile Drive [f]	approximately 3 hours	approximately 3 hours
Hammer size	4,000 kJ	4,000 kJ
Jacket (Pin Piles) Foundation	**Minimum Foundation Size**	**Maximum Foundation Size**
Diameter for WTG and ESP	5 ft (1.5 m)	10 ft (3 m)
Jacket Structure Height for WTG	180 ft (55 m)	262 ft (80 m)
Jacket Structure Height for ESP	180 ft (55 m)	213 ft (65 m)
Platform Level/Interface Level Height for WTG and ESP	74 ft (22.5 m) MLLW	94 ft (28.5 m) MLLW
Pile Penetration for WTG	98 ft (30 m)	197 ft (60 m)

Pile Penetration for ESP	98 ft (30 m)	246 ft (75 m)
Pile Footprint for WTG	59 ft (18 m)	115 ft (35 m)
Pile Footprint for ESP	59 ft (18 m)	248 ft (45 m)
Number of Piles/Foundation	3 to 4	3 to 4
Number of Piles Driven/Day within 24 Hours [e]	1 (up to 4 pin piles)	1 (up to 4 pin piles)
Typical Foundation Time to Pile Drive [f]	approximately 3 hours	approximately 3 hours
Hammer Size	3,000 kJ	3,000 kJ

Source: COP Volume I (Epsilon **2020**)

ESP = electrical service platform; ft = foot; ft^2 = square feet; kJ = kilojoule; m = meter; m^2 = square meters; MLLW = mean lower low water; MW = megawatt; WTG = wind turbine generator

[a] Vineyard Wind's Proposed Action is for an approximately 800 MW offshore wind energy project. The Draft Environmental Impact Statement evaluates the potential impacts of a facility up to 800 MW to ensure that it covers projects constructed with a smaller capacity.

[b] Additional WTG positions allow for spare turbine locations or additional capacity to account for environmental or engineering challenges.

[c] Elevations relative to mean higher high water are approximately 3 feet (1 meter) lower than those relative to MLLW.

[d] The foundation size is not connected to the turbine size/capacity. Foundations are individually designed based on seabed conditions and the largest foundation size could be used with the smallest turbine.

[e] Work would not be performed concurrently. No drilling is anticipated; however, it may be required if a large boulder or refusal is met. If drilling is required, a rotary drilling unit would be mobilized, or vibratory hammering would be used.

[f] Vineyard Wind has estimated that typical pile driving for a monopile is expected to take less than approximately 3 hours to achieve the target penetration depth, and that pile driving for the jacket foundation would take approximately 3 hours to achieve the target penetration depth. Different hammer sizes are used for installation of the monopile and jacket foundations.

Table 4.1-2: Vineyard Wind 1 Project ESP Specifications with Maximum Design Scenario [a]
Electrical Service Platform (ESP)

Dimensions	148 ft x 230 ft x 125 ft (45 m x 70 m x 38 m)	148 ft x 230 ft x 125 ft (45 m x 70 m x 38 m)
Number of Conventional ESPs	1 (800 MW)	2 (400 MW each)
Number of Transformers per ESP	1	2
Foundation Type	Monopile	Jacket
Number of Piles/Foundation	1	3 to 4
Maximum Height [b]	**215 ft (65.5 m)**	218 ft (66.5 m) MLLW

Source: COP Volume I, Table 3.1-1 (Epsilon **2020**)

ESP = electrical service platform; ft = foot; m = meter; MW = megawatt

[a] Vineyard Wind's Proposed Action is for an approximately 800 MW offshore wind energy project. The Draft Environmental Impact Statement evaluated and the Supplemental to the Draft Environmental Impact Statement evaluates the potential impacts of a facility up to 800 MW to ensure covering the maximum-case scenario impact.

[b] Elevations provided are relative to Mean Lower Low Water—average of all the lower low water heights of each tidal day observed over the National Tidal Datum Epoch.

Increase in WTG Capacity

By increasing the upper WTG capacity to 14 MW, the minimum number of foundations required to generate a total of 800 MW decreases to 57. Therefore, the range in the possible number of WTG foundations is 57 to 100 with the PDE change. Note, the maximum number of foundations (and pile driving required) will not change as described in the BA. Additionally, there are also no changes to the PDE for dimensions, footprint, or installation methodologies for the foundations since the size of the piles for the foundations remains unchanged.

Vineyard Wind has indicated there will be no changes to the types, sizes, and number of vessels and cranes or the number of vessel trips during construction, operations, or maintenance. Please note that although the maximum number of WTGs included in the PDE (i.e., 100 WTGs) is not changing, as few as

57 WTGs may be required if 14 MW is selected. Accordingly, a shorter duration for pile driving would result with the 14 MW. With the 14 MW, up to 43 percent fewer WTGs would be required resulting in a direct percent reduction in the duration of pile driving time required. Fewer vessel trips during construction would be required if 57 WTGs are installed. Also, fewer WTGs would reduce the number of vessel trips required during operations, maintenance, and decommissioning. Although Vineyard Wind does not anticipate using multiple WTG sizes, the COP does not preclude Vineyard Wind from doing so and the total number of WTGs in the Proposed Action ranges from 57 to 100, plus 2 ESPs.

Pile Driving Exposure Estimates for the Lower Number of Possible Foundations

Exposure estimates for the maximum-case scenario are already completed and included in the COP, BA, and proposed Incidental Harassment Authorization under the Marine Mammal Protection Act (MMPA). Considering the range of WTG foundations, 57-100, and the amount of total take is directly related to the duration of construction, 43 percent fewer takes would be expected for 57 WTG foundations than for 100 under the maximum-case scenario. The scenarios considering a lower number of foundations for the 14 MW WTGs results in two additional exposure scenarios than described in the BA and in Table 5 of the proposed IHA (84 FR 18346).

Lower PDE Scenario for 57 WTG foundations	**WTG monopiles (pile size: 10.3 m (33.8 ft))**	**WTG jacket foundations (pile size: 3 m (9.8 ft))**	**ESP jacket foundations (pile size: 3 m (9.8 ft))**	**Total number of piles**	**Total number of installation locations**
Maximum Design	47	10	2	95	59
Most Likely Design	57	0	2	65	59

Using the number of exposures of listed marine mammals in Tables 10, 11, 12, and 13 of the proposed IHA (84 FR 18346) and Tables 26-29 of the sound modeling report for sea turtles, the tables below show the commensurate reduction in takes by 43 percent for the 57 WTG and 2 jacket ESP scenarios above.

Table 10-Mean Numbers Of Listed Whales And Sea Turtles Estimated To Be Exposed Above Auditory Impact And Harassment Thresholds During The Proposed Project Using 57 Monopiles, 2 Jacket ESPs and One Foundation Installed Per Day

Species	**6 dB Attenuation**		**12 dB attenuation**	
	Auditory Impact	**Harassment**	**Auditory Impact**	**Harassment**
Fin whale	2.35	18.87	0.17	12.41
NARW	0.78	7.55	0.05	4.98
Sei whale	0.08	0.62	0.01	0.42
Sperm whale	0.0	0.0	0.0	0.0
Kemp's ridley	0.01	0.18	0.01	0.09
Leatherback	0.01	0.22	0.01	0.11
Loggerhead	0.04	0.98	0.01	0.51

Table 11-Mean Numbers Of Listed Whales And Sea Turtles Estimated To Be Exposed Above Auditory Impact And Harassment Thresholds During The Proposed Project Using 57 Monopile WTGs, 2 Jacket ESPs And Two Foundations Installed Per Day

Species	6 dB Attenuation		12 dB attenuation	
	Auditory Impact	Harassment	Auditory Impact	Harassment
Fin whale	2.56	16.93	0.23	11.71
North Atlantic right whale	0.79	6.70	0.06	4.54
Sei whale	0.08	0.53	0.01	0.37
Sperm whale	0.0	0.0	0.0	0.0
Kemp's ridley	0.01	0.11	0.0	0.06
Leatherback	0.01	0.17	0.0	0.09
Loggerhead	0.05	1.21	0.02	0.72

Table 12-Mean Numbers Of Listed Whales And Sea Turtles Estimated To Be Exposed Above Auditory Impact And Harassment Thresholds During The Proposed Project Using 47 WTGs, 10 Jacket WTGs, 2 ESPs And One Foundation Installed Per Day

Species	6 dB Attenuation		12 dB attenuation	
	Auditory Impact	Harassment	Auditory Impact	Harassment
Fin whale	1.62	17.01	0.13	11.08
North Atlantic right whale	0.41	6.17	0.03	4.04
Sei whale	0.05	0.45	0.01	0.31
Sperm whale	0.0	0.0	0.0	0.0
Kemp's ridley	0.01	0.18	0.0	0.09
Leatherback	0.01	0.19	0.0	0.10
Loggerhead	0.04	0.86	0.0	0.46

Table 13-Mean Numbers Of Listed Whales And Sea Turtles Estimated To Be Exposed Above Auditory Impact And Harassment Thresholds During The Proposed Project Using 47 WTGs, 10 Jacket WTGs, 2 ESPs And Two Foundations Installed Per Day

Species	6 dB Attenuation		12 dB attenuation	
	Auditory Impact	Harassment	Auditory Impact	Harassment
Fin whale	1.85	14.86	0.21	10.31
North Atlantic right whale	0.43	5.25	0.03	3.56
Sei whale	0..5	0.44	0.01	0.03
Sperm whale	0.0	0.0	0.0	0.0
Kemp's ridley	0.01	0.10	0.0	0.06
Leatherback	0.01	0.14	0.0	0.08
Loggerhead	0.05	1.12	0.02	0.69

Atmospheric and Oceanographic Influence from Larger WTGs

The Project layout was determined in accordance with industry best practices to reduce wake losses and optimize energy production on a Project level. The wake effects are determined using an ensemble of state-of-the-art wake models (e.g. N.O. Jensen and PARK2) which have been validated empirically and with computer models. In general, Project engineers target a wind turbine spacing of 6-9 rotor diameters to account for wake losses. The layout provides typical spacing of 1.4-1.8 km (0.76-1.0 NM) between turbines, which provides a typical spacing of at least 6 rotor diameters for even the largest turbines (with 222 m [729 ft] rotor diameters) included in the PDE.

There is no research that evaluates the relationship between turbine size and effects to the Cold Pool. It is understood that offshore wind turbines may result in minor wind or water wake effects; however, each of these effects is highly localized and not expected to have ecosystem level impacts nor adversely impact the habitat of listed species. The Cold Pool in the New England Shelf area is ~50 km (~27 NM) wide and ~35 m (~115 ft) thick and is located in water depths between ~80 (~262 ft) and ~40 m (~131 ft) as defined by the 6°C isotherm, but is always at least ~25 m (~82 ft) below the surface (Lentz 2017). Given that the wind and water wake effects are minor and restricted to local areas around the turbines, the Cold Pool stratification or stability is not expected to be affected by the Project.

Fuel and Oils

The larger 14 MW WTGs may include a larger amount of fuels/oils/HAZMAT. Oil sources in the WTGs will total up to approximately 4,887 gallons (116 barrels), increased from the previous value listed in the COP of 4,502 gallons (107 barrels) per WTG. If only 57 WTGs are used with 4,887 gallons of oil each, the total oil quantity for WTGs will be 278,559 gallons. This is less oil than if 100 WTGs were used with 4,502 gallons each, where the total oil quantity would be approximately 450,200 gallons. This information does not change BOEM's analysis in the BA that small accidental spills may affect, but not likely to adversely affect listed species.

Other Updates

Additional updates to the COP include updates to the Proposed Action (as updated in the 2020 COP amendment) that were previously submitted to BOEM. This information includes:

- The Project will not use Connecticut ports for major construction activities. No other changes to ports are proposed.
- The COP text was updated to accommodate for activities anticipated to occur that have in fact now occurred such as the 800 MW Power Purchase Agreement [PPA] was finalized in April 2019, instead of stating that the PPA would occur in the future.
- WTGs will be off-white/light grey (within the spectrum recommended by FAA) to reduce their visibility from against the horizon.
- Updated description of marine navigation lighting and marking to reflect refinements to the Project's lighting and marking plans that have been developed through extensive consultation with USCG.
- Change to the elevation of the marine navigation lights.
- Removed discussion of the outdated regional transit lanes that were presented during the September 20th, 2018 Massachusetts Fisheries Working Group (FWG) on Offshore Wind meeting. USCG is currently conducting a Massachusetts and Rhode Island Port Access Route Study (MARIPARS) to evaluate the need for vessel routing measures, including regional transit lanes, within the Rhode Island (RI)/Massachusetts (MA) and MA Wind Energy Areas (WEAs). On January 29, 2020, USCG published the draft MARIPARS (USCG-2019-0131), which recommended that WTGs be sited in a standard and uniform grid pattern with at least three lines of orientation. USCG concluded that "If such a uniform grid pattern is adopted and approved by BOEM, the USCG will not pursue vessel routing measures through the MA/RI WEA at this time."
- Updated the target burial depth and clarified that the minimum target burial depth is 1.5 m (described as 1-2 m in the BA).
- Clarified that anchoring may occur along the entire Offshore Export Cable Corridor (OECC).
- Clarified that there will be no dredging or dumping in hard bottom.

Other minor updates that do not have any potential effects to listed species can be found in the amended COP. Besides these minor updates and those directly related to modifying the PDE for the 14 MW WTG, the updated COP does not contain any other new information. Additional information from BOEM

related to the National Environmental Policy Act (NEPA), such as the cumulative effects of offshore wind, are being coordinated separately between the BOEM and NMFS. Below are responses to outstanding questions discussed at the March 2-5, 2020 meeting between BOEM and NMFS.

Response to NMFS Questions from the March 2-5, 2020 Meeting

Please confirm if Vineyard intends to install one monopile and one jacket without sound attenuation.

The NMFS draft IHA for Vineyard Wind states in condition 4(h) that: "(i) Vineyard Wind must employ a noise attenuation device(s) during all impact pile driving, with the exception of one pile (described under condition 4(h)(iv)) " and "(iv) One single pile may be driven without the noise attenuation device(s) activated, for comparison purposes. Sound source verification (described under condition 5(c)(ii)) must be employed during the driving of this pile." Whether Vineyard Wind will exercise the option to install one pile without noise attenuation has not yet been determined and will be evaluated with the to-be-selected contractor. This information will be included in the Final EIS. ESA consultation includes NMFS as a co-action agency for issuance of the IHA(s) that will be issued for the Vineyard Wind Project. Consequently, BOEM expects the consultation will be consistent and cover the entirety of the Proposed Action.

Would the new 57 WTG construction scenario still include more than 2 jacket foundations?

Vineyard Wind has not modified the maximum PDE of the COP or the IHA application (up to 10 jackets for WTG and 2 jackets for ESPs). However, a most likely scenario includes up to 100 WTG monopiles, barring circumstances that may warrant up to 10 jacket foundation be used. This is consistent with the IHA application.

Table 1. Modeling scenarios **Scenario**	**WTG monopiles (pile size: 10.3 m [33.8 ft])**	**WTG jacket foundations (pile size 3 m [9.8 ft])**	**ESP jacket foundations (pile size 3 m [9.8 ft])**	**Total # piles**	**Total # locations**
Maximum design envelope	90	10	2	138	102
Most likely	100	--	2	108	102

Please provide an updated construction schedule for the construction scenarios, including 57-100 WTG foundations.

Regarding the construction schedule, Vineyard Wind indicates that the contracting process for the major project components must be repeated due to the permitting delay. Therefore, a more detailed construction schedule is not yet finalized. Vineyard Wind expects to provide an updated schedule to BOEM, at which time BOEM will also provide it to NMFS. Despite a detailed schedule not available yet, all seasonal restrictions and mitigation and monitoring measures proposed for all scenarios remain in place for consultation purposes.

Does Vineyard Wind have any additional information on how it would implement real-time PAM when vessels exceed 10 knots, and how that information would affect decision-making on vessel speed mitigation?

Vineyard Wind does not have any additional information at this time on how real-time PAM would be implemented or used in decision-making. Details on the implementation of the real-time PAM system are dependent on the future procurement process and the final selection of contractor. Please note, these are

voluntary measures proposed by Vineyard Wind and included as part of the Proposed Action and BOEM believes these measures are subject to additional consultation with BOEM, as appropriate.

Please provide any additional details that may be available on the types and numbers of vessel trips that may originate from and return to Canada.

Table 3.7-1 of the COP Addendum (shown below) provides estimated vessel trips from Canada.

Origin or Destination	Estimated Maximum Daily Trips	Estimated Maximum Trips/Month
New Bedford	46	1,100
Brayton Point	4	100
Montaup	4	100
Providence	4	100
Quonset	4	100
Canada (at present, S heet Harbor, Saint John, or Halifax)*	5	50

Please clarify the proposed conditions (time of year, SMAs, DMAs) and vessel types that seasonal vessel speed restrictions will and will not apply to during operation.

Applicable to construction, operations, maintenance, and decommissioning, from November 1 through May 14, all vessels must travel at 10 knots or less when transiting to/from or within the WDA, except within Nantucket Sound (unless an active NMFS-designated Dynamic Management Area (DMA)is in place) and except crew transfer vessels as described below. From November 1 through May 14, crew transfer vessels may travel at over 10 knots if there is at least one visual observer on duty at all times aboard the vessel to visually monitor for large whales, and real-time PAM is conducted. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit route, all crew transfer vessels must travel at 10 knots or less for the remainder of that day.

Applicable to construction, operations, maintenance, and decommissioning, all vessels must travel at 10 knots or less within any DMA, with the exception of crew transfer vessels as described above. Crew transfer vessels traveling within any NMFS-designated DMA must travel at 10 knots or less, unless North Atlantic right whales are confirmed to be clear of the transit route and WDA for two consecutive days, as confirmed by either vessel-based surveys conducted during daylight hours and PAM, or, by an aerial survey conducted once the lead aerial observer determines adequate visibility. If confirmed clear by one of these measures, vessels transiting within a DMA must employ at least two visual observers on duty to monitor for North Atlantic right whales. If a North Atlantic right whale is observed within or approaching the transit route, vessels must operate at 10 knots or less until clearance of the transit route for two consecutive days is confirmed by the procedures described above.

Applicable to construction, operations, maintenance, and decommissioning, all vessels greater than or equal to 65 ft (19.8 m) in overall length must comply with the 10-knot speed restriction in any SMA (see https://www.fisheries.noaa.gov/national/endangered-species-conservation/reducing-ship-strikes-north-atlantic-right-whales)

The draft IHA that will also be consulted on may also address the vessel speed issue and is available at: https://www.fisheries.noaa.gov/webdam/download/9019150.

Please provide the Table referenced, but not included, in the August 5, 2019 BOEM response to NMFS for additional information requested by NMFS for historical vessel traffic.

Table 3.4.7-1: 2016 and 2017 AIS Vessel Traffic Data within the WDA 10-mile Analysis Area

Vessel Type [a]	Vessel Dimensions (maximum-minimum)					Number of Unique Vessels	
	Length	Beam	Draft	DWT [b]	Speed (knots)	2016	2017
Research Vessels	108–236 ft (33–72 m)	23–46 ft (7–14 m)	7–20 ft (2–6 m)	97–2,328 t (88–2,112 MT)	<1–19	1	1
Passenger Cruise Ships/Ferries	na	na	na	na	na	0	7
Commercial Fishing	36–197 ft (11–60 m)	13–49 ft (4–15 m)	13–16 ft (4–5 m)	453 t (411 MT)	<1–18	198	314
Dredging/Underwater/ Diving Operations	112–341 ft (34–104 m)	39–66 ft (12–20 m)	9–22 ft (3–7 m)	4,400 t (3,992 MT)	<1–22	2	1
Military or Military Training	141–269 ft (43–82 m)	39–43 ft (12–13 m)	11 ft (3 m)	1,820–2,250 t (1,651–2,041 MT)	3–9	4	8
Recreational (Pleasure, Sailing, Charter Fishing, High Speed Craft)	36–184 ft (11–56 m)	13–33 ft (4–10 m)	7–38 ft (2–12 m)	499 t (452 MT)	<1–58	143	178
Cargo	551–656 ft (168–200 m)	56–108 ft (17–33 m)	23–36 ft (7–11 m)	22,563 t 20,469 MT	2–8	5	13
Tug-and-barge	118–492 ft (36–150 m)	36–76 ft (11–23 m)	17–23 ft (5–7 m)	637 t (578 MT)	10–21	2	14
Other/Unspecified	na	na	na	na	na	76	147
Total						431	683

AIS = Automatic Identification System; DWT = deadweight tons; t = tons; MT = metric tons; ft = feet; m = meter; na = data not available

[a] Includes only vessels equipped with AIS (required for commercial vessels >65 feet in length)

[b] Displacement based on example vessels

Please describe vessel strike avoidance actions taken when a sea turtle is sighted.

Consistent with the requirements on all BOEM OCS leases in the Atlantic, BOEM also proposes the following protocols be required for all vessels for the Vineyard Wind Project regarding sea turtles.

- Vessel operators and crews must maintain a vigilant watch for sea turtles to avoid striking sighted protected species.
- Vessel operators must reduce vessel speed to 10 knots (18.5 mph) or less when sea turtles are observed in the path of an underway vessel, when safety permits. Vessels must route around the animals and maintain a minimum separation distance of 50 m from sea turtles whenever possible.
- Vessels underway must not divert their course to approach any protected species.
- Protected species may surface in unpredictable locations or approach slowly moving vessels. When a sea turtle is sighted in the vessel's path or within 50 m of a moving vessel, and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.