Hodge.WaterResources

95 Arlington St.
Brighton, MA 02135
617-903-0340

March 27, 2024

TECHNICAL MEMORANDUM

To:	Michael Feinblatt, TRC Companies, Inc.	Pages:	5
CC:	Kristen Bachand, TRC Companies, Inc.		
Subject:	Indian River Bay: Hydraulic Dredging Impacts		
From:	Matt Hodge PE, Hodge.WaterResources, LLC		

Hodge.WaterResources, LLC (HWR) conducted a suspended sediment transport modeling study for the Indian River Bay submarine cable installation that is part of the Maryland Offshore Wind Project (report dated March 27, 2023). TRC Companies, Inc. (TRC) has asked HWR to supplement that report with an evaluation of the impact of planned dredging operations within Indian River Bay. This memorandum provides a qualitative evaluation of the suspended sediment impacts associated with dredging relative to the impacts presented in the 2023 report. Based on the extent of dredging, the dredging methods, and the available literature on resuspension associated with dredging, HWR concludes that the likely impact of dredging will be insignificant relative to the expected impacts associated with cable installation.

Extent of Dredging

Submarine Export cables from the Maryland Offshore Wind Project are proposed to be installed from 3R's Beach in Delaware to Burton Island. These cables will be installed below the Indian River Bay floor to a specified depth using water jetting technology (i.e., jet plowing). Jet plowing will fluidize a narrow trench of sediments, lay the export cables, and allow the fluidized sediment to be deposited on top of the installed cables. Jet plowing is conducted from specialized barges. These barges are expected to have a greater draft than the water depth in Indian River Bay for two stretches of the planned cable route. Supplemental dredging will be required for each stretch prior to cable installation. Figure 1 shows the two stretches where dredging will be required. The estimated depth of dredging ranges from 1 to 6 feet (ft). The width of dredging is planned to be 250 ft (i.e., 76 meters). The total volume of dredging will be approximately 73,700 cubic yards (cy). The dredging will be completed during two different dredging campaigns. Campaign 1 will include the installation of one export cable and will dredge 45% of the total volume. The remaining three export cables will be installed during Campaign 2 which will dredge the remaining 55%.

Dredging Methods

The supplemental dredging along the cable route will be completed by means of hydraulic dredging. HWR is not aware of the specific details of the dredge apparatus, but HWR understands that plain suction dredging will be used given the relatively fine-grained material and the lack of consolidated sediments.

Available Literature on Resuspension Associated with Dredging

There is limited information about the resuspension rates associated with different types of dredging, but the United States Army Corps of Engineers (USACE) has developed Technical Guidelines for Environmental Dredging of Contaminated Sediments (Palermo et al., 2008). In the guidelines, the USACE provides a qualitative comparison of different dredging methods across various performance criteria including "sediment resuspension control" or the ability of a given dredging method to limit the amount of sediment resuspended into the water column. The qualitative comparison shown in Table 1 indicates that plain suction dredging has a "high" ability to control resuspension. That classification is equivalent to an assessment that plain suction dredging minimizes the resuspension of sediments.

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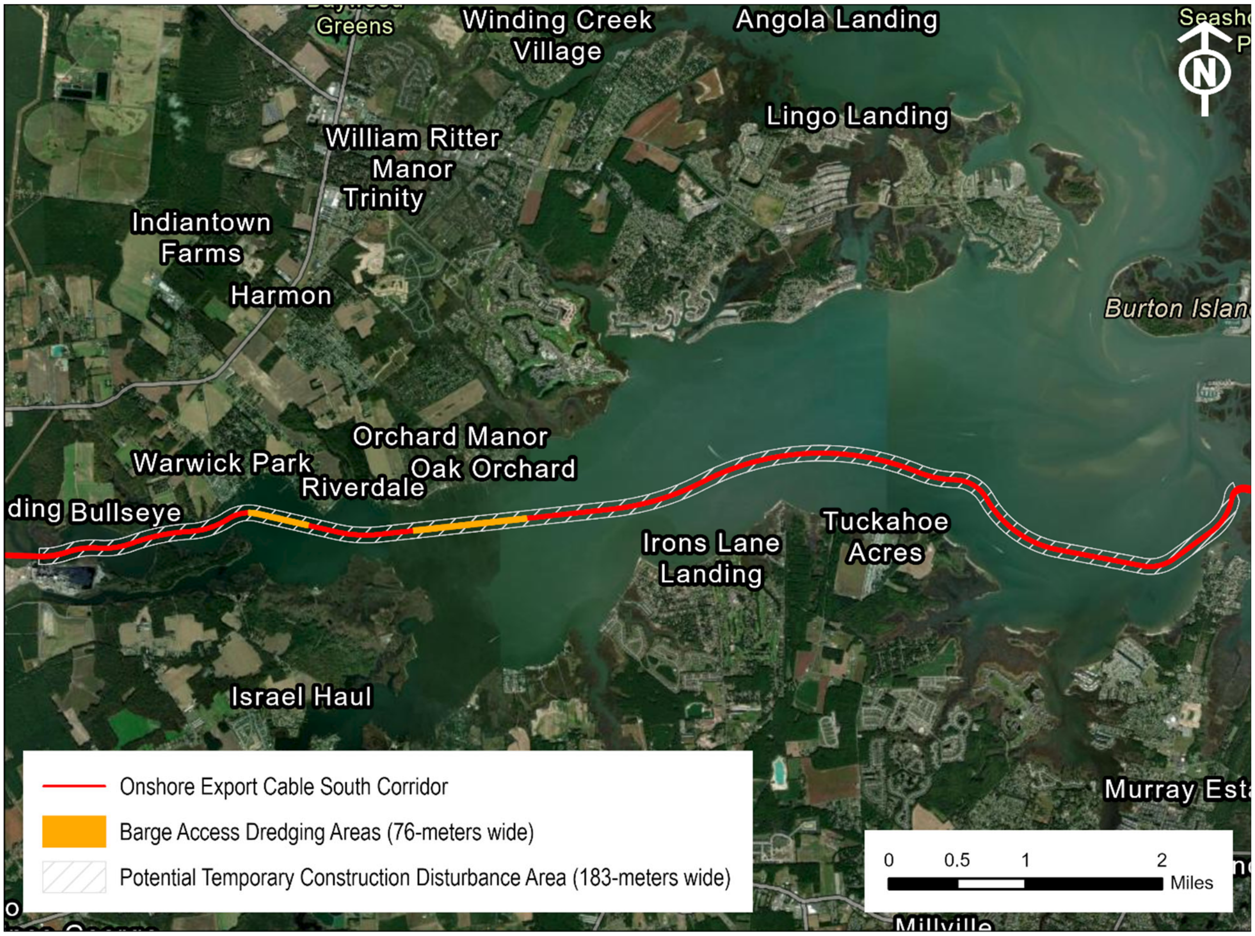

Figure 1. Proposed Dredging Areas (TRC, 2024a)

Table 1: Environmental Dredging Equipment Selection Factors
(Reproduction Table 3 from Palermo et al., 2008)

	Equipment Type[2]										
	Mechanical Dredges (2 to 8 m^3 buckets)			Hydraulic / Pneumatic Dredges (15 to 30 cm pump sizes)							Dry Excavation
Equipment Selection Factors[13]	Conventional Clamshell (Wire)[3]	Enclosed Bucket (Wire)[4]	Articulated Bucket (Fixed-arm)[5]	Conventional Cutterhead[6]	Swinging Ladder Cutterhead	Horizontal Auger[7]	Plain Suction[8]	Pneumatic[9]	Specialty[10]	Diver[11]	Mechanical Excavators[12]
Sediment Resuspension Control [14]	Low	Medium	Medium	Medium	Medium	Low to Medium	High	High	High	High	High
Contaminant Release Control[15]	Low	Low to Medium	Medium	Low to Medium	Low to Medium	Low	Medium to High	Medium to High	Medium to High	High	High
Residual Sediment/ Cleanup Levels[16]	Low	Low to Medium	Medium	Low	Low	Low	Medium to High	Medium to High	High	High	High
Transport by Pipeline[17]	Medium	Medium	Medium	High	High	High	High	High	High	High	Medium
Transport by Barge[18]	High	High	High	Low to Medium	Low to Medium	Low to Medium	Medium	Medium	Medium	Medium	High

HWR conducted a limited literature review of resuspension rates for various dredging methods, and we were not able to find any quantitative assessments of plain suction dredging. The USACE study (Palermo et al., 2008) references a study by Nakai where 10 cutterhead dredge operations were monitored. Nakai (1978) estimated the resuspension factors to be from 0.02% to 3.93%. USACE (2008) goes on to state "conservative characteristic resuspension factor for cutterhead dredges is about 0.5 percent of the fine silt and clay fraction of the sediment…." HWR elected to use a conservative estimate of the resuspension factor and uses the midpoint of the range reported by Nakai (i.e., approximately 2%) in the following discussion.

Paul Schroeder is one of the authors of the USACE guidelines. Schroeder and Susan Bailey developed a "Simplified Reevaluation of Dredging Resuspension Effects" (Bailey and Schroeder, 2014) as a part of the New York Sea Grant Dredging Windows Workshop. In their document, Schroeder and Bailey run the DREDGE model and estimate resuspension rates for cutterhead dredges given a combination of the percent fines of the sediments and the dredge size. A summary table of that work is reproduced in this memorandum as Table 2.

Table 2: Calculated Mass Loss Rate (kg/s) – Cutterhead Dredge (Reproduction Table 1a from Bailey and Schroeder, 2014)

Dredge Size (in.)	Percent Fines 2.5	5	15	45	65	77.5	100
6	0.04	0.05	0.10	0.13	0.12	0.11	0.08
10	0.10	0.14	0.26	0.36	0.34	0.30	0.23
14	0.19	0.28	0.52	0.71	0.66	0.60	0.45
19	0.35	0.52	0.95	1.32	1.22	1.10	0.82
24	0.56	0.83	1.52	2.10	1.95	1.75	1.31
30	0.88	1.30	2.38	3.28	3.05	2.74	2.05
36	1.27	1.88	3.42	4.72	4.39	3.95	2.95

Three vibracore samples (i.e., VC-IRB-05-S1, VC-IRB-05-S2, and VC-IRB-06)[1] were collected within the planned dredging area in 2016. The average percent fines for these three samples was 61%. Three sample locations (i.e., VC-S7, VC-S8, and VC-S9)[2] from the 2023 field program were also within the planned dredging area. These samples were composited prior to analysis, but the drilling logs identify the sediments as silt and silt and clay. This description is consistent with the previous vibracore samples.

US Wind has indicated that the planned dredging head will be 20 inches or smaller but recommended that the assumed head diameter be 24 inches for this evaluation. The combination of this head diameter and the average percent fines value allows for the determination of mass loss rate for a cutterhead dredge of between 1.95 and 2.10 kilograms per second (kg/s) based on Table 2.

[1] The location and details of these samples is available in the Construction and Operations Plan, Appendix II-A7 (ESS, 2019).

[2] The location and details of these samples is available in the Construction and Operations Plan, Appendix II-A8 (TRC, 2024b).

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HWR was not able to identify quantitative evaluations of plain suction dredging, but by combining the qualitative evaluation of plain suction dredging from Table 1 (ability to control resuspension: high) with the qualitative evaluation of cutterhead dredging from Table 1 (ability to control resuspension: medium), we can establish conservative upper limits for plain suction dredging. Those upper limits are a percentage loss rate of 2% and a mass loss rate of 2.10 kg/s.

Comparison to Sediment Transport Modeling for Cable Installation

HWR has established upper bounds for the impact associated with plain suction dredging. Comparing these upper bounds to the values used in the sediment transport modeling of cable installation, we can determine the relative impacts of plain suction dredging compared to cable placement by jet plowing. The upper limit loss rate for plain suction dredging is 2%. The assumed loss rate for jet plowing was 25% or 12.5 times higher than what would be expected from plain suction dredging. The upper limit mass loss rate is 2.10 kg/s for plain suction dredging. The modeled sediment production rate for cable laying was 0.19 kg/m*s. The two values are not directly comparable because the cable-laying rate includes a unit of length. The modeling for the cable laying assumed that the rate of advance of the jet plow is 100 meters per hour (m/hr). Using that value, we can develop an appropriate comparison between the two rates by calculating the total mass of sediment lost to resuspension in one hour. The upper limit mass of sediment lost from plain suction dredging is 7,560 kilograms (kg) whereas the modeling of the cable installation would result in 68,400 kg of sediment lost to resuspension or nine times higher than what is expected from dredging.

The assumed suspended sediment via resuspension in the modeling of the cable installation is significantly higher than what would be expected from plain suction dredging along the planned cable route. Suspended sediment impacts from dredging will occur, but the extent is likely to be much smaller than what was simulated for cable laying. Dredging will not occur at the same time as cable laying, and the suspended sediment impacts will not be additive. The suspended sediment from dredging will settle out of the water column prior to the generation of the cable-laying suspended sediment plume.

It is HWR's opinion that the suspended sediment impacts will be small relative to the impacts associated with cable installation and estimates the suspended sediment plume to be on the order of one-tenth as large as the suspended sediment plume generated by cable laying. HWR is confident that sediment transport modeling of dredging would predict suspended sediment concentrations much smaller than those predicted for cable laying.

HWR bases this opinion on the assumption that plain suction dredging will be the form of hydraulic dredging used and that the material dredged from Indian River Bay will not be released into the Bay. If the planning and design of the Maryland Offshore Wind Project lead to changes in the dredging approach, HWR's opinion with respect to the impact of dredging may change.

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