Technical Appendix for Oyster Reef Restoration Planning BMPs in the Phase 6 Watershed Model and CAST

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Background: This appendix covers the technical requirements for planning BMPs associated with the following management actions and nutrient removal processes:

- Nitrogen and phosphorus assimilation in oyster tissue and shell of live oysters from endorsed oyster reef restoration practices:
    - Oyster reef restoration using hatchery-produced oysters
    - Oyster reef restoration using substrate addition

- Nitrogen reductions from enhanced denitrification associated with oysters for the endorsed oyster reef restoration practices:
    - Oyster reef restoration using hatchery-produced oysters
    - Oyster reef restoration using substrate addition

Technical appendices for the full protocols and methods used to calculate nutrient reductions for oyster-related BMPs in Progress Scenarios will be included alongside the panel's forthcoming report. This technical appendix is to accompany the June 2019 memos provided to the WQGIT for consideration of planning BMPs for oyster reef restoration.

Q1: What types of oyster practices will be available for planning scenarios in the Phase 6 Model?

A1: The expert panel recommends load reductions of nutrients (TN and TP) based on the TN and TP assimilation in the tissue and shell of live oysters from these endorsed oyster reef restoration practices:

- Oyster reef restoration using hatchery-produced oysters
- Oyster reef restoration using substrate addition

Additionally, the expert panel recommends nitrogen reductions for enhanced denitrification associated with increased live oyster biomass from the same oyster reef restoration practices:

- Oyster reef restoration using hatchery-produced oysters
- Oyster reef restoration using substrate addition

For planning scenarios in CAST, nutrient reductions for these management actions can be simulated on a per-acre basis under the following BMPs:

- *Oyster reef restoration – nutrient assimilation (planning only)*: The estimated assimilation of nitrogen and phosphorus in live oyster tissue and shell that is gained through the restoration of oyster reefs in tidal areas of the Chesapeake Bay or its tributaries by one or a combination of two methods to enhance oyster biomass in areas where removal (harvest) is not permitted. Enter the area (in acres) of the reef restoration project. This version of the BMP is only eligible in planning scenarios within CAST.
- *Oyster reef restoration – enhanced denitrification (planning only)*: The positive net increase in overall microbial denitrification associated with the restoration of oyster reefs in tidal areas of the Chesapeake Bay or its tributaries by one or a combination of two methods to enhance oyster biomass in areas where removal (harvest) is not permitted. Enter the area (in acres) of the reef restoration project. This version of the BMP is only eligible in planning scenarios within CAST.

Q2: What are the nutrient reductions for these oyster reef restoration practices?

A2: The estimated per-acre nitrogen and phosphorus reductions for use in planning scenarios within CAST are summarized in Table 1. These estimates were calculated using data from the Harris Creek oyster restoration project and provide planning estimates only. Project-specific estimates derived from the panel's forthcoming report will vary.

Table 1 - Estimated TN and TP reductions for oyster reef restoration practices in CAST planning scenarios

	TN	TP
Oyster reef restoration – nutrient assimilation (planning only)	24 lbs/ac/yr	4 lbs/ac/yr
Oyster reef restoration – enhanced denitrification (planning only)	57 lbs/ac/yr	N/A

Q3: What kinds of oyster reef restoration are eligible for these BMPs? Are any oyster reef restoration management actions not endorsed?

A3: The expert panel supported nutrient reductions for oyster reef restoration when the restoration is performed in tidal areas of the Chesapeake Bay or its tributaries by one or a combination of two methods to enhance oyster biomass in areas where removal (harvest) is not permitted: (1) planting hatchery-produced oysters (e.g., spat-on-shell, single oysters) directly on the bottom or raised substrate to enhance oyster production/biomass, or; (2) planting oyster shells and/or alternative substrate directly on the bottom to attract recruitment of naturally occurring (wild) oyster larvae.

Oyster reef restoration using no harvest area designation was identified as a policy issue by the expert panel and is not available as a BMP. Therefore, the planning estimates do not apply to acres where no plantings of oysters and/or substrate occurs.

Q4: What should a state report to NEIEN to receive credit for these practices?

A4: These practices are not applicable to NEIEN, as these planning-only versions of the BMPs are not reportable for Progress Runs. The following information will be requested when entering the BMP into a CAST scenario:

- *BMP Name:* Oyster reef restoration – nutrient assimilation (planning only)
- *Measurement Name:* Acres (of restored oyster reef)
- *Load source:* Shoreline
- *Geographic Location:* Approved NEIEN geographies: Latitude, Longitude; County; County (CBWS Only); Hydrologic Unit Code (HUC12, HUC10, HUC8, HUC6, HUC4); State (CBWS Only)

- *BMP Name:* Oyster reef restoration – enhanced denitrification (planning only)
- *Measurement Name:* Acres (of restored oyster reef)
- *Load source:* Shoreline
- *Geographic Location:* Approved NEIEN geographies: Latitude, Longitude; County; County (CBWS Only); Hydrologic Unit Code (HUC12, HUC10, HUC8, HUC6, HUC4); State (CBWS Only)

Q7: How will the practices be simulated in CAST?

A7: The Phase 6 Model has an estimated nutrient load in shoreline segments that can be reduced by shoreline and tidal water practices. The pounds of nutrients reduced by this practice will be credited as a reduction to the nutrient loads in the nearest shoreline segments to the practice location. If latitude and longitude are not submitted, then the practice benefits will be distributed amongst all shoreline segments in the geography submitted.

Q8: Are these two practices additive or mutually exclusive?

A8: These practices are additive. They can be entered and simulated concurrently within a CAST planning scenario. They have been defined separately, however, with the understanding that each practice requires certain sampling and testing procedures to calculate the reductions associated with each protocol following the panel's full recommendations. As such, it may not always be feasible to seek credit for both practices in Progress runs for implemented projects.

Q9: Can this practice be submitted in non-tidal waters?

A9: No. This practice is only eligible in tidal waters.

Q10: Are these annual practices?

A10: Yes, for planning scenarios within CAST these BMPs must be entered for each annual scenario.