Adjustment to the Main Bay Segment CB4MH Deep-Channel and Deep-Water Dissolved Oxygen Criterion for Persistent Nonattainment and Removal of Chester River Deep-Channel and Patapsco River Deep-Water Restoration Variances

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Overview

The implementing regulations of the Clean Water Act provide tools for states to address specific circumstances where specified designated uses are unattainable now, or in the future. In Maryland, one such tool is a restoration variance[1], which Maryland has defined in state regulations as the percentage of allowable exceedance of a specific water quality criteria based on water quality modeling and incorporates the best available data and assumptions. Restoration variances are temporary and are reviewed at a minimum of every three years, as required by the Clean Water Act and EPA regulations, and may be modified based on new data or assumptions incorporated into the water quality model (COMAR 26.08.02.03-3C(8)(h)).

The 2010 Chesapeake Bay TMDL document (USEPA, 2010) called for an assessment in 2017 to review progress toward meeting the nutrient and sediment pollutant load reductions necessary for Bay restoration. The 2017 Midpoint Assessment (MPA) was completed in December 2017 and finalized in July 2018. The 2017 MPA measured the Chesapeake Bay Program (CBP) Partnership's progress towards having all practices and controls in place by 2025 in order to achieve the Bay's dissolved oxygen, water clarity/submerged aquatic vegetation, and chlorophyll-*a* standards. The CBP Partnership includes Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, the District of Columbia and the EPA (representing the Federal Government).

As part of the 2017 MPA, the CBP Partnership reviewed the latest science, data, modeling, and decision support tools used to measure progress in order to strengthen the CBP Partnership's decision support capabilities and to optimize the CBP Partnership's Phase 3 Watershed Implementation Plans (WIP3s).

[1] While this document reflects and continues to use Maryland's term "restoration variance" throughout, EPA now addresses the term in light of the 2015 change to EPA regulations defining "variance." The 2015 revisions to EPA's Water Quality Standards Regulation at 40 CFR 131 adopted a more specific definition and procedures for variances. Water quality standards variances under 40 CFR 131.14 are to be used for developing alternative § 402 permit limits. In contrast to the limited scope of WQS variances under the current Part 131 regulations, under current definitions, EPA considers Maryland's restoration variances to actually represent modified designated uses. As such, EPA has notified Maryland that any changes will be reviewed not as variances but as modified uses pursuant to 40 CFR 131.10 and 12. While this document continues to use Maryland's term "restoration variance to avoid confusion, EPA has recommended that Maryland consider adopting an alternate term such as 'restoration allowance' or "restoration use" to substitute for the term 'restoration variance.'

On July 9, 2018, the CBP Partnership accepted Phase III target allocations of 201.2 million pounds nitrogen and 14.2 million pounds phosphorus (PSC, 2018). As part of the target allocation decision the Principal Staff Committee (PSC), a major governing body of the Partnership, received detailed feedback from its members on required adjustments to Maryland's water quality variances to be consistent with the latest science and analysis of the 2017 MPA.

All members of the PSC unanimously supported Maryland's updating of their water quality standard regulations' existing restoration variances as described below (PSC, 2017). The EPA, the CBP Partnership, and the Maryland Department of Environment believes that the proposed variance changes are consistent with the latest science and analysis of the 2017 MPA and are fully protective of Chesapeake water quality. The proposed variances were approved by the PSC on December 19, 2017 (p94 of PSC Presentation December 19, 2017) and reaffirmed by the PSC on July 9, 2018.

Proposed Maryland Restoration Variances:

- Increase CB4MH deep-channel restoration variance from 2 percent to 6 percent.
- Decrease CB4MH deep-water restoration variance from 7 percent to 5 percent.
- Remove the lower Chester River deep-channel restoration variance of 16 percent.
- Remove the Patapsco River deep-water restoration variance of 7 percent.
- No change to the Eastern Bay deep-channel restoration variance of 2 percent.

Updates and Refinements to the 2017 Midpoint Assessment Models of the Chesapeake Watershed, Airshed, and Tidal Bay

The Chesapeake Bay Program integrated models include simulations of the airshed, watershed, estuary, living resources, and future land use. The integrated models assess effects of current and proposed watershed management on changes in nutrient and sediment loads delivered to the Bay, and the effect those changing loads have on water quality and living resources. The CBP Models have assisted CBP decision-makers for over three decades with an increasingly sophisticated model for estimating the collective actions needed by the Federal-State Partnership to achieve water quality standards necessary to restore the Bay. The CBP Models were extensively updated and refined for the 2017 MPA as described below. Together, the models of the 2017 MPA generated new insights on the deep-water dissolved oxygen (DO) and deep-channel DO variances as the accuracy and understanding of what is achievable in Chesapeake water quality standards was refined.

The 2017 MPA models involved five years of collaborative Partnership decision making on every aspect of every model from technical/scientific decisions by CBP technical workgroups to application/policy decisions by CBP decision making groups. The Partnerships decisions were augmented by extension independent scientific peer reviews of every Partnership model. In addition, multiple STAC sponsored technical workshops from soil phosphorus to Conowingo (STAC, 2014; STAC, 2016a; STAC, 2016b) supported model development with state-of-the-science information. Following development, a period of comprehensive fatal flaw review and issue resolution by the CBP Partners was completed.

PHASE 6 WATERSHED MODEL

A major improvement to the Phase 6 Watershed Model was the inclusion of a refined method for phosphorus modeling based on new science and use of new observed data on the capacity of soils to retain phosphorus (Chesapeake Bay Program, 2017). This was a key refinement in understanding how and where phosphorus is mobilized in the watershed.

Furthermore, the 2017 MPA models included shoreline erosion nutrient loads to the Bay nutrient budget, a nutrient load missing from the 2010 TMDL version (Cerco & Noel, 2019 Section 5). Simulation of the shoreline erosion of nutrients added an additional 17 percent of phosphorus load and 1 percent of nitrogen load to the tidal Bay under the WIP3 scenario conditions. While most of the shoreline erosion nutrient loads were considered uncontrollable, the influence of the increased phosphorus loads from shoreline erosion changed and more accurately reflected the nutrient balance and limitation in the tidal Bay.

In addition, a high resolution land cover dataset for the entire watershed was used. The Phase 6 Model had one meter resolution land use/land cover data compared to the previous version of the Watershed Model, Phase 5, which used a 30 meter resolution land use/land cover data set. The one meter resolution land use/land cover data was combined with the input of hundreds more BMPs that were available for crediting nutrient reductions which made the model much more capable of estimating nutrient reduction options for WIP3 development (Chesapeake Bay Program, 2017).

Also, significant new nutrient and sediment loading data was gathered from local agricultural and municipality partners and incorporated into the Phase 6 Model and other 2017 MPA decision support tools. Data incorporated into the Phase 6 Model included loading information for municipal separate storm sewer systems, combined sewer systems, surface mines, landfills, protected lands, wetlands, livestock and poultry populations, crop yields, soil phosphorus concentrations, BMPS, and many others.

Another key improvement incorporated into the Phase 6 Watershed Model was the first time representation of Conowingo Reservoir to be in a state of full capacity for sediment infill, a state called dynamic equilibrium which had considerable influence on nutrient and sediment loads to the tidal Bay (Cerco, 2016; Cerco and Noel, 2016; Linker et al., 2016; STAC, 2016b).

The Phase 6 Watershed model was calibrated and tested with three decades of monitoring data involving hundreds of monitoring stations with thousands of water quality monitoring data points (Chesapeake Bay Program, 2017). The Phase 6 Watershed Model had the best calibration with the highest fidelity to observations of any Chesapeake Bay Watershed model calibration (Chesapeake Bay Program, 2017; Principal Staff Committee, 2017; 2018).

AIRSHED MODEL: COMMUNITY MULTISCALE AIR QUALITY MODEL (CMAQ)

The Airshed Model, a national application of Community Multiscale Air Quality Model (CMAQ), predicts changes in deposition of inorganic nitrogen due to changes in emissions.

CMAQ brings together three kinds of models: 1) meteorological models to represent atmospheric and weather activities, 2) emission models to represent man-made and naturally-occurring contributions to the atmosphere, and 3) an air chemistry-transport model to predict the atmospheric fate of air pollutants under varying conditions.

The CMAQ version used in the 2017 MPA had numerous improvements to the previous 2010 TMDL version including refined estimates of emissions, updated atmospheric chemistry, and refined estimates of future wet deposition under climate change hydrology (Campbell, 2019; USEPA, 2020).

TIDAL ESTUARY MODEL: 2017 CHESAPEAKE WATER QUALITY AND SEDIMENT TRANSPORT MODEL

The 2017 Water Quality and Sediment Transport Model (WQSTM) predicts changes in tidal Bay water quality due to the changes in input loads provided by the Watershed Model and Airshed Model. Augmenting the WQSTM assessment is a water quality standard analysis system that examines model estimates of DO, chlorophyll, and water clarity to assess in time and space the attainment of the Bay living resource-based water quality standards. The water quality standard analysis system was also improved in the 2017 MPA.

The 2017 WQSTM for the first time in coastal modeling had a calibration to observed nutrient limitation. The assessment of eutrophication and hypoxia in tidal coastal waters is largely dependent on the modeled sensitivity of the dissolved oxygen (DO) response to nutrient loading, and, therefore, it is important to consider nutrient limitation sensitivity when assessing the performance of a model. Eutrophication models in coastal waters, however, are typically calibrated and validated to DO and chlorophyll (Chl) state variables rather than to DO sensitivity to nutrient limitation. Therefore, equifinality poses a challenge to evaluating success of coastal eutrophication model calibration because similar calibration statistics can be achieved through different combinations of parameter values. By conforming the WQSTM calibration to observed Chesapeake nutrient limitation in time and space the WQSTM had a better accounting of management actions and nutrient load reduction in tidal waters (Cerco & Noel, 2019 (Appendix E)).

Finally, the 2017 WQSTM for the first time simulates nutrient processing by tidal wetlands (Cerco & Noel, 2019 Section 4). The detailed wetlands module incorporated into the 2017 WQSTM focuses on wetlands processes that have management implications including nutrient removal, solids removal, and respiration.

The current variances were based largely on the 2010 WQSTM findings of the limits of effective management in the Chesapeake. The 2017 WQSTM has a quantifiably more accurate calibration and higher fidelity of model state variables to observations (Cerco & Noel, 2019 (Appendices A, B, and C)). This was also demonstrated by a careful integration of time and space hypoxia metrics that allowed for a comprehensive assessment of model performance assessment (Cerco & Noel, 2019 (Appendix F)).

Therefore, the model findings of the 2017 WQSTM have considerable standing in the adjustment of the deep-water and deep-channel uses for the mainstem segment CB4MH, the deep-channel use of the Chester River segment CSHMH, and the deep-water use of Patapsco River PATMH, with no change recommended for the Eastern Bay EASMH deep-channel subcategory use.

Recommended Changes to Maryland's Restoration Variances

A Chesapeake Bay segment may have many individual designated uses, some of which apply only for a particular season and/or a particular stratum of that segment. A TMDL sets the amount of pollutants that a water body segment can assimilate and still attain applicable water quality standards. Of the 92 segments assigned individual nitrogen, phosphorus, and sediment TMDLs in the Chesapeake Bay TMDL, EPA identified only one tidal segment, the mainstem CB4MH segment, where the Bay water quality model did not show attainment of applicable existing dissolved oxygen (DO) criteria at the 2017 MPA nutrient target. Even then, the tidal segment met applicable criteria for all designated uses except one – the DO criteria for the deep-channel seasonal refuge use[2], which applies from June 1 to September 30 (CB4MH deep-water DO was met within the current 7 percent variance). At the Bay 2017 MPA nutrient target, the WQSTM shows achievement of applicable water quality standards in the rest of the Bay's tidal waters.

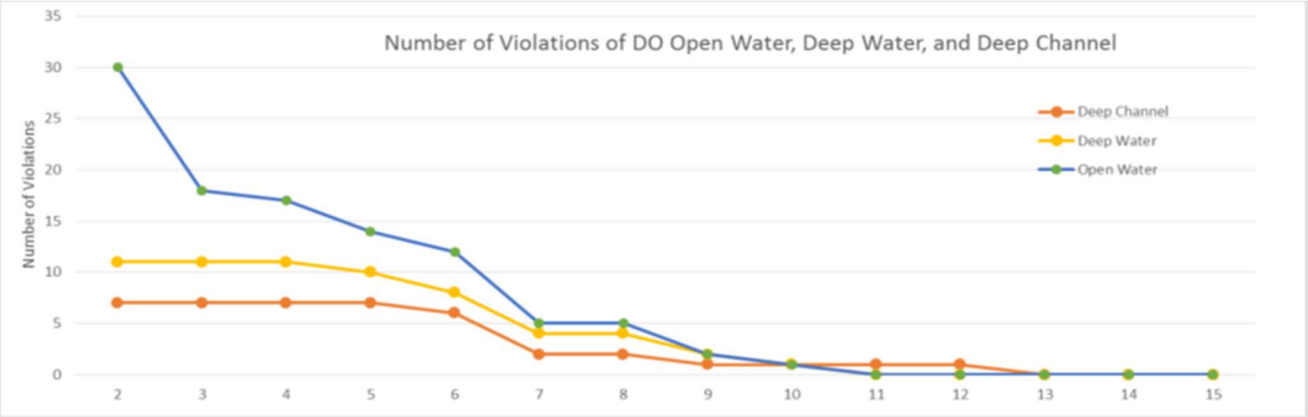
Based on extensive 2017 MPA analyses the Partnership agreed (Principal Staff Committee, 2017) to the following adjustments to Maryland's DO restoration variances:

- Increase mainstem segment CB4MH deep-channel restoration variance from 2 percent to 6 percent
- Decrease mainstem segment CB4MH deep-water restoration variance from 7 percent to 5 percent.
- Remove the lower Chester River (CHSMH) deep-channel restoration variance of 16 percent.
- Remove the Patapsco River (PATMH) deep-water restoration variance of 7 percent.
- No change recommended to the Eastern Bay (EASMH) deep-channel restoration variance of 2 percent.

Following the approaches and procedures developed in the 2010 Chesapeake TMDL, the Partnership demonstrated (PSC, 2017) that at a nutrient load level to Chesapeake tidal waters of 195 million pounds nitrogen and 13.7 million pounds phosphorus that estimated water quality standard attainment would be achieved for all designated uses except for CB4MH deep-channel (Figure 1). Further, the Partnership found that nutrient reductions beyond the target MPA WIP loads had diminishing returns, with attainment of CB4MH deep-channel DO only achieved at nutrient reduction levels approaching the impracticable levels of the limit of technology (designated E3 or Everything, By Everyone, Everywhere in Figure 1).

[2] The Eastern Bay (EASMH) DO criteria attainment was found to be unsatisfactorily simulated by the 2017 MPA models for the subcategory designated uses of deep-water and deep-channel (Chesapeake Bay Program, 2018). Therefore the DO for the Eastern Bay deep-water and deep-channel subcategory designated use was not assessed in the 2017 MPA.

Figure 1. Designated use violation count for all deep-channel, deep-water, and open-water designated uses in all CB segments. In the figure WIP2 represents the target load for the WIP3 loads adopted by the Partnership. All designated use violations are eliminated except for CB4MH deep-channel which is only eliminated when nutrient reductions are at unreachable levels.



	1985	1990	1993	2000	2010	2013	WIP+18%TN	WIP+6%TN		WIP-6%TN	WIP-11%TN		
No Action	Progress	Progress	Progress	Progress	Progress	Progress	&+12%TP	&+4%TP	WIP2	&-8%TP	&-16%TP	E3	All Forest
404TN	347TN	338TN	337TN	317TN	266TN	253TN	224TN	205TN	195TN	185TN	174TN	133TN	40TN
41.7TP	30.4TP	27.7TP	23.7TP	21.9TP	16.9TP	15.9TP	14.8TP	14.4TP	13.7TP	13.0TP	11.9TP	8.6TP	3.9TP

The PSC agreed to loads of 195 million pounds of total nitrogen (TN) and 13.7 million pounds of total phosphorus (TP) as preliminary 2017 MPA target loads from the watershed (labeled as MPA WIP Target in all figures), but also allowed for consideration of special cases put forth by jurisdictions. Consideration of special cases was factored into a four month review process following the December 2017 PSC with final decisions on accommodation of special cases made by the PSC in April 2018. Consideration of these special cases led to the Partnership agreeing to final TN and TP loads of 201.4 and 14.2 million pounds, respectively, for the Phase 3 WIPs. The additional increase in watershed loads from the special cases were offset by further reductions in other sources of nutrient loads to the Bay, primarily by further reductions in airshed nitrogen loads to the watershed, tidal Bay, and open boundary by adoption of the 2030 estimated air reductions which are expected to be implemented by 2025.

REVISION OF THE DISSOLVED OXYGEN RESTORATION VARIANCE FOR THE CHESAPEAKE BAY MAINSTEM SEGMENT 4 MESOHALINE (CB4MH) SEASONAL DEEP-CHANNEL REFUGE SUBCATEGORY USE

Maryland previously adopted, and EPA approved, a DO restoration variance of 2 percent for the deep-channel subcategory designated use of the main-Bay segment CB4MH. Using the improved assessment methods and modeling tools of the 2017 Midpoint Assessment demonstrated that the 2 percent variance was insufficient and that it was necessary to increase the variance to 6 percent. Figure 2 tabulates the estimated level of attainment for all the deep-channel designated uses in the Chesapeake for a range of nutrient loading levels including a high level of No Action Loads to a low level of All Forest Loads. Note that at the MPA WIP nutrient target level all deep-channel designated uses are achieved except for a 6 percent nonattainment of CB4MH. Achievement of the CB4MH deep-channel DO is estimated to be achieved only at

the E3 level of nutrient loads, which is an inaccessible level of nutrient managment equivalent to the application of limit of technology treatment to all sectors and lands in the Chesapeake watershed.

In Figure 2 the red font indicates nonattainment of the DO water quality standard of 1 mg/l. For CB4MH the current variance of 2 percent is used and therefore the 6 percent nonachievement of the standard is shown as a violation in red font (in the MPA WIP Target scenario).

Figure 2. Estimated level of achievement of the deep-channel water quality DO standard of 1 mg/l DO in all deep-channel designated uses in the Chesapeake Bay[1,2]. In the figure MPA WIP Target is the target load for the WIP3 loads adopted by the Partnership (PSC, 2017). At the MPA WIP Target all deep-channel designated uses violations are eliminated except for CB4MH, which is only eliminated when nutrient reductions are at unachievable levels of E3. The deep-channel DO segment of EASMH was not assessed by the 2017 MPA because the WQSTM calibration was found to be insufficient (Chesapeake Bay Program, 2018). Total nitrogen (TN) and total phosphorus (TP) loads at the head of each column are in millions of pounds.

			No	1985	1993	2013		MPA WIP			
		Base	Action	Progress	Progress	Progress	WIP + 5%	Target	WIP - 5%	E3	All Forest
Run 223		325TN	404TN	331TN	323TN	249TN	205TN	195TN	185TN	133TN	40TN
11/24/17		21.9TP	41.7TP	30.4TP	17.9TP	15.9TP	14.4	13.7TP	13.0TP	8.6TP	2.1TP
		1993-	1993-	1993-	1993-	1993-	1993-	1993-	1993-	1993-	1993-
CAST Loads		1995	1995	1995	1995	1995	1996	1995	1996	1995	1995
CB		Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep	Deep
Segment	State	Channel	Channel	Channel	Channel	Channel	Channel	Channel	Channel	Channel	Channel
CB3MH	MD	16.0%	12.7%	9.4%	7.6%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
CB4MH	MD	46.0%	53.0%	48.0%	46.2%	27.2%	8.8%	5.9%	3.4%	0.0%	0.0%
CB5MH	MD/VA	14.2%	19.6%	15.7%	14.7%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	37.4%	26.0%	20.0%	17.9%	6.2%	0.0%	0.0%	0.0%	0.0%	0.0%
POTMH	MD/VA	20.2%	21.1%	17.9%	16.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	21.3%	18.0%	17.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	25.4%	19.1%	16.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MD5MH	MD	21.7%	26.5%	23.0%	21.8%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	10.3%	5.8%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	40.3%	32.7%	23.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

[1] Under decision rules agreed to by the Partnership, up to 1.49 percent of nonachievement of DO standards is allowable (e.g., CB3MH and CB5MH under the 2013 Progress loads) because of rounding and inherent uncertainty in the assessment.

[2] This table was developed using the previous restoration variances percentage thresholds to identify violations. CHSMH previously had a 16% restoration variance. Hence, this is the reason why the 6.2% under the 2013 Progress scenario for CHSMH is shown in green instead of red font. As can be seen under the MPA WIP Target scenario the restoration variance is no longer needed for CHSMH.

REVISION OF THE DISSOLVED OXYGEN RESTORATION VARIANCE FOR THE CHESAPEAKE BAY MAINSTEM SEGMENT 4 MESOHALINE (CB4MH) SEASONAL DEEP-WATER FISH AND SHELLFISH SUBCATEGORY USE

Maryland previously adopted, and EPA approved, a DO restoration variance of 7 percent for the deep-water subcategory designated use of the main-Bay segment CB4MH. There again, using the improved assessment methods and modeling tools of the 2017 Midpoint assessment, it was determined that the 7 percent variance was larger than necessary and, as a result, should be decreased to 5 percent. Figure 3 tabulates the estimated level of attainment for all the deep-water designated uses in the Chesapeake. Note that at the MPA WIP nutrient target level adopted by the PSC in December 2017 (PSC, 2017) all deep-water designated uses are achieved except for the 5 percent nonattainment of CB4MH. Complete achievement of the CB4MH deep-water DO is estimated to be fully achieved only at the All Forest level of nutrient loads.

Figure 3. Estimated level of achievement of the deep-water water quality DO standard of 3 mg/l DO in all deep-water designated uses in the Chesapeake Bay[1,2]. In the figure MPA WIP Target is the target load for the WIP3 loads adopted by the Partnership (PSC, 2017). At the MPA WIP Target all deep-water designated use violations are eliminated except for CB4MH which is only reduced to zero when nutrient reductions are at levels of an all forested condition in the Chesapeake watershed. For CB4MH a deep-water variance of 5 percent would be sufficient for water quality protection. Currently, there is a 7% deep-water variance for CB4MH. The deep-water DO segment of SOUMH was not assessed by the 2017 MPA because the WQSTM calibration was found to be insufficient (Chesapeake Bay Program, 2018). Total nitrogen (TN) and total phosphorus (TP) loads at the head of each column are in millions of pounds.

		Base	No Action	1985 Progress	1993 Progress	2013 Progress	WIP + 5%	MPA WIP Target	WIP - 5%	E3	All Forest
Run 223		325TN	404TN	331TN	323TN	249TN	205TN	195TN	185TN	133TN	40TN
11/24/17		21.9TP	41.7TP	30.4TP	17.9TP	15.9TP	14.4	13.7TP	13.0TP	8.6TP	2.1TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1996	1993-1995	1993-1996	1993-1995	1993-1995
CAST Loads		Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water	Deep Water
CB Segment	State										
CB3MH	MD	2.1%	2.7%	1.8%	1.4%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%
CB4MH	MD	21.0%	25.2%	21.1%	19.6%	9.6%	5.6%	5.0%	4.4%	1.1%	0.0%
CB5MH	MD/VA	4.2%	4.7%	3.4%	3.2%	1.3%	0.5%	0.3%	0.1%	0.0%	0.0%
CB6PH	VA	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB7PH	VA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	25.7%	11.3%	8.3%	3.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
PAXMH	MD	6.3%	17.1%	12.1%	8.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
POTMH	MD/VA	4.1%	7.0%	4.7%	4.4%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	4.1%	7.1%	4.8%	4.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	5.9%	10.7%	6.9%	5.9%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%
SBEMH	VA	0.0%	3.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YRKPH	VA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MD5MH	MD	8.5%	9.3%	7.0%	6.5%	3.0%	1.4%	0.9%	0.6%	0.0%	0.0%
VA5MH	VA	0.5%	0.7%	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	12.4%	17.3%	9.6%	6.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SEVMH	MD	6.1%	7.8%	6.4%	6.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

[1] Under decision rules agreed to by the Partnership, up to 1.49 percent of nonachievement of DO standards is allowable (e.g., CB3MH and CB5MH under the 2013 Progress loads) because of rounding and inherent uncertainty in the assessment.

[2] This table was developed using the previous restoration variances percentage thresholds to identify violations. PATMH previously had a 7% restoration Variance. Hence, this is the reason why the 6.2% under the 1993 Progress scenario for PATMH is shown in green instead of red font. As can be seen under the MPA WIP Target scenario the restoration variance is no longer needed for PATMH.

In Figure 3 the red font indicates estimated nonattainment of the deep water DO water quality standard of 3 mg/l. For CB4MH the current deep water variance of 7 percent was used and therefore the 5 percent nonachievement of the standard is shown in the table as achieving the standard. Only the main-Bay segment of CB4MH is estimated to be in nonattainment (5 percent) of the DO criteria in the deep-water seasonal refuge use (which applies from June 1 to September 30) at the target loads (MPA WIP Target scenario in Figure 3). In Figure 3 the green font indicates estimated achievement of the deep-water DO standard.

REMOVAL OF THE DISSOLVED OXYGEN RESTORATION VARIANCE FOR LOWER CHESTER RIVER MESOHALINE (CHSMH) SEASONAL DEEP-CHANNEL REFUGE SUBCATEGORY USE

In 2012, Maryland adopted, and EPA approved, a DO restoration variance of 16 percent for the lower Chester River's Mesohaline (CHSMH) seasonal deep-channel designated use. This restoration variance recognized that the DO criterion would be achieved in only 84 percent of the combined volume and time over the June-September period in the lower river's deep-channel as estimated by the 2010 CBP Partnership models (COMAR 26.08.02.03-3(c)(8)(f)(iii)). The restoration variance reflected the best scientific understanding at that time of the DO conditions that could be achieved in the deepest section of the tidal river.

Based on the application of the refined and updated 2017 MPA models, EPA, the CBP Partnership, and Maryland has determined that a DO restoration variance for CHSMH deep-channel subcategory designated use is no longer necessary (Figure 3). Therefore, Maryland's DO restoration variance for the lower Chester River deep-water will be removed.

REMOVAL OF THE DISSOLVED OXYGEN RESTORATION VARIANCE FOR THE PATAPSCO RIVER MESOHALINE (PATMH) SEASONAL DEEP-WATER FISH AND SHELLFISH SUBCATEGORY USE

Maryland previously adopted, and EPA approved, a restoration variance of 7 percent for the Patapsco River's (PATMH) seasonal deep-channel refuge designated use (COMAR 26.08.02.03-3(c)(8)(e)(vi)).

Based on the application of the refined and updated 2017 MPA models, EPA, the CBP Partnership, and Maryland determined that a DO restoration variance for PATMH deep-water fish and shellfish subcategory designated use is no longer necessary. Therefore, Maryland's DO restoration variance for the lower Patapsco River seasonal deep-water use will be removed.

NO CHANGE TO THE DISSOLVED OXYGEN RESTORATION VARIANCE FOR THE EASTERN BAY MESOHALINE (EASMH) SEASONAL DEEP-CHANNEL REFUGE SUBCATEGORY USE

The Eastern Bay (EASMH) DO criteria attainment was found to be unsatisfactorily simulated by the 2017 MPA models for the subcategory designated uses of deep-water and deep-channel (Chesapeake Bay Program, 2018). Therefore the DO for the Eastern Bay deep-water and deep-channel subcategory designated uses was not assessed in the 2017 MPA and, as a result, no change is recommended for the deep-channel DO restoration variance of 2 percent.

Conclusions:

Based on compelling evidence of an improved 2017 assessment of DO water quality standards in the deep-channel and deep-water subcategory designated uses, and further confirmed with monitoring and research data, the Chesapeake Bay Program Partnership, including EPA, agreed at the December 2017 PSC meeting (PSC, 2017) to support Maryland in the revision of their existing DO restoration variances to:

- Change the Chesapeake Bay Mainstem Segment 4 Mesohaline (CB4MH) deep-channel refuge restoration variance from 2 percent to 6 percent.
- Change the Chesapeake Bay Mainstem Segment 4 Mesohaline (CB4MH) deep-water fish and shellfish restoration variance from 7 percent to 5 percent.
- Remove the lower Chester River Mesohaline (CHSMH) deep-channel refuge restoration variance of 16 percent.
- Remove the Patapsco River Mesohaline (PATMH) deep-water fish and shellfish restoration variance of 7 percent.
- No recommended change to the Eastern Bay Mesohaline (EASMH) deep-channel refuge restoration variance of 2 percent.

The proposed variance changes are fully protective of the Chesapeake deep-channel and deep-water designated uses and form the basis and foundation of the CBP Partnership's Phase 3 WIPs.

Citations:

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