Planning for Using All Readily Available Data to Support Chesapeake Bay DO Criteria Assessments

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Background

- There are **eleven** DO criteria applicable to the tidal waters of the Chesapeake Bay and its tributaries.

- Since their adoption into regulation in 2005, only **four** of these criteria have been assessed.

- A complete evaluation of the success of the Bay TMDL cannot be done until all DO criteria/designated uses are assessed.

Chesapeake Bay dissolved oxygen water quality criteria

Designated Use	Criteria Concentration/Duration	Protection Provided	Temporal Application
Migratory fish spawning and nursery use	7-day mean ≥ 6 mg/L (tidal habitats with 0-0.5 salinity)	Survival/growth of larval/juvenile tidal-fresh resident fish; protective of threatened/endangered species	February 1-May 31
	Instantaneous minimum ≥ 5 mg/L	Survival and growth of larval/juvenile migratory fish; protective of threatened/endangered species	
	Open-water fish and shellfish designated use criteria apply		June 1-January 31
Shallow - water bay grass use	Open–water fish and shellfish designated criteria apply		Year-round
Open-water fish and shellfish use[1]	30-day mean ≥ 5.5 mg/L (tidal habitats with ≤0.5 salinity)	Growth of tidal-fresh juvenile and adult fish; protective of threatened/endangered species	Year-round
	30-day mean ≥ 5 mg/L (tidal habitats with >0.5 salinity)	Growth of larval, juvenile and adult fish and shellfish; protective of threatened/endangered species	
	7-day mean ≥ 4 mg/L	Survival of open-water fish larvae	
	Instantaneous minimum ≥ 3.2 mg/L	Survival of threatened/endangered sturgeon species[1]	
Deep-water seasonal fish and shellfish use	30-day mean ≥ 3 mg/L	Survival and recruitment of bay anchovy eggs and larvae	June 1-September 30
	1-day mean ≥ 2.3 mg/L	Survival of open-water juvenile and adult fish	
	Instantaneous minimum ≥ 1.7 mg/L	Survival of bay anchovy eggs and larvae	
	Open-water fish and shellfish designated-use criteria apply		October 1-May 31
Deep channel seasonal refuge use	Instantaneous minimum ≥ 1 mg/L	Survival of bottom-dwelling worms and clams	June 1-September 30
	Open-water fish and shellfish designated use criteria apply		October 1-May 31

1. When water column temperatures are greater than 29 ºC, an open water dissolved oxygen criterion for the instantaneous minimum of 4.3 mg/L is applied to protect habitat for survival of shortnose sturgeon.

Currently assessed using the CFD

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Chesapeake Bay dissolved oxygen water quality criteria

- Virginia's Water Quality Standards also contain language pertaining to Chesapeake Bay Criteria implementation
- An amendment to the language has recently been initiated through a fast-track rulemaking

Virginia's Fast Track Rulemaking

9VAC25-260-185 Criteria to protect designated uses from the impacts of nutrients and suspended sediment in the Chesapeake Bay and its tidal tributaries

D. Implementation

3. Attainment of these criteria shall be assessed through any scientifically defensible assessment methods, which may include a comparison of the generated cumulative frequency distribution (CFD) of the monitoring data to the applicable criteria reference curve for each designated use. ~~If the monitoring data cumulative frequency curve is completely contained inside the reference curve, then the segment is in attainment of the designated use.~~ The reference curves and CFD procedures ~~to be followed~~ are published in the USEPA, Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries, EPA 903-R-03-002, April 2003 and the 2004 (EPA 903-R-03-002 October 2004), 2007 (CBP/TRS 285/07, EPA 903-R-07-003), 2007 (CBP/TRS 288/07, EPA 903-R-07-005), 2008 (CBP/TRS 290-08, EPA 903-R-08-001), 2010 (CBP/TRS 301-10, EPA 903-R-10-002), and 2017 (CBP/TRS 320-17, EPA 903-R-17-002) addenda. ~~An exception to this requirement is in measuring attainment of the SAV and water clarity acres, which are compared directly to the criteria.~~

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Flexibility with Bay DO Assessment Methods Would:

- Allow assessment of all Bay DO criteria
- Maximize the use of all available datasets
- Reduce the need for enhanced monitoring in all segments ($)
- Simplify procedures - making them easier to implement and communicate to the general public
- Use decision rules that are already in practice in the world of 303(d)/305(b) assessments nationally
- Allow reporting on incremental progress towards meeting DO criteria

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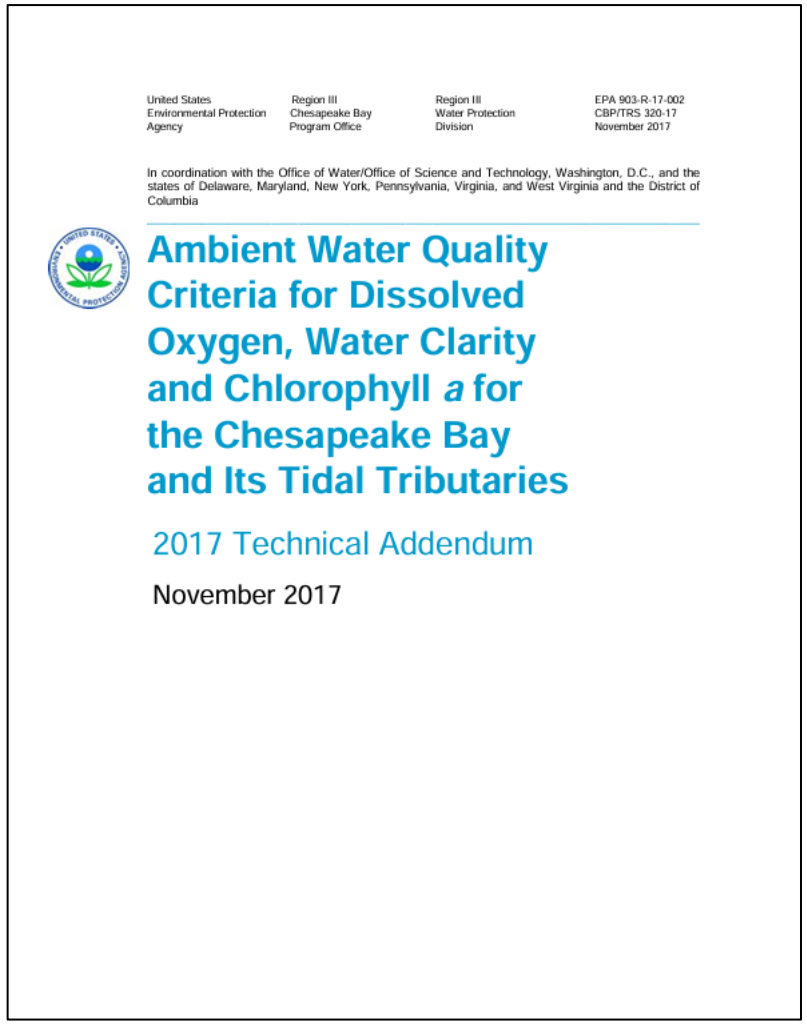
Assessing All DO Criteria

Alternative Bay DO assessment methods have been developed by the CAP workgroup for some of the criteria, as presented in USEPA (2017).

- Conditional probability analysis, which allows an inference to be made about attainment of a 7-day mean criterion using Interpolator 30-day mean concentrations.
- Subsegmentation of segments, to allow for “piecemeal” criteria assessments via enhanced monitoring outside of the CFD framework.


United States Environmental Protection Agency | Region III Chesapeake Bay Program Office | Region III Water Protection Division | EPA 903-R-17-002 CBP/TRS 320-17 November 2017

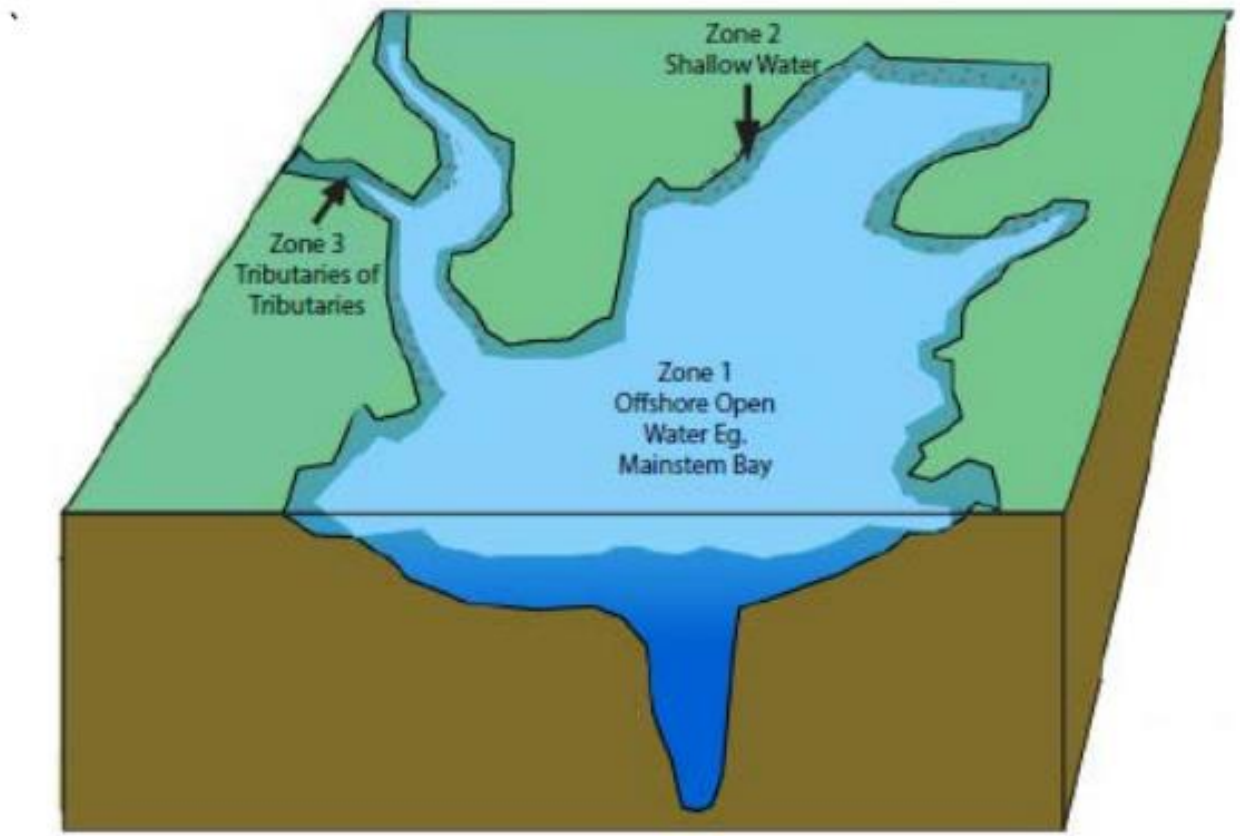
In coordination with the Office of Water/Office of Science and Technology, Washington, D.C., and the states of Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia and the District of Columbia

Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll *a* for the Chesapeake Bay and Its Tidal Tributaries

2017 Technical Addendum

November 2017

Chesapeake Bay open-water habitats



Applicable criteria assessment procedures for the three zones

Zone	Zone Description	Applicable Criteria Assessment Procedures
1	Open, well-mixed mainstem Bay and tidal tributary waters	• CFD-based assessment of the 30-day mean • CFD-based assessment of the 7-day mean with enhanced temporal frequency of monitoring • Conditional attainment assessment of the 7-day mean • Continuous monitoring-based assessment of the instantaneous minimum
2	Shallow-water waters	• Continuous monitoring-based assessment of the instantaneous minimum
3	Tributaries of tributaries off of the mainstem Chesapeake Bay and its tidal tributaries	• Discrete sampling-based assessment of the instantaneous minimum

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Additional Reasons for the Implementation Language Modification

- The implementation language in 9VAC25-260-185.D must be modified before DEQ can use the alternative assessment procedures in USEPA (2017).

- DEQ wants to enhance these procedures to enable all DO criteria to be assessed using all readily available data—a requirement under federal code.

Assessing All Available Data
Federal Reporting Requirements

§ 130.7 Total maximum daily loads (TMDL) and individual water quality-based effluent limitations

(5) Each State shall assemble and evaluate all existing and readily available water quality-related data and information to develop the list required by §§ 130.7(b)(

(6) Each State shall provide documentation to the Regional Administrator to support the State's determination to list or not to list its waters as required by §§ 130.7(b)(1) and 130.7(b)(2). This documentation shall be submitted to the Regional Administrator together with the list required by §§ 130.7(b)(1) and 130.7(b)(2) and shall include at a minimum:

(i) A description of the methodology used to develop the list; and

(ii) A description of the data and information used to identify waters, including a description of the data and information used by the State as required by § 130.7(b)(5); and

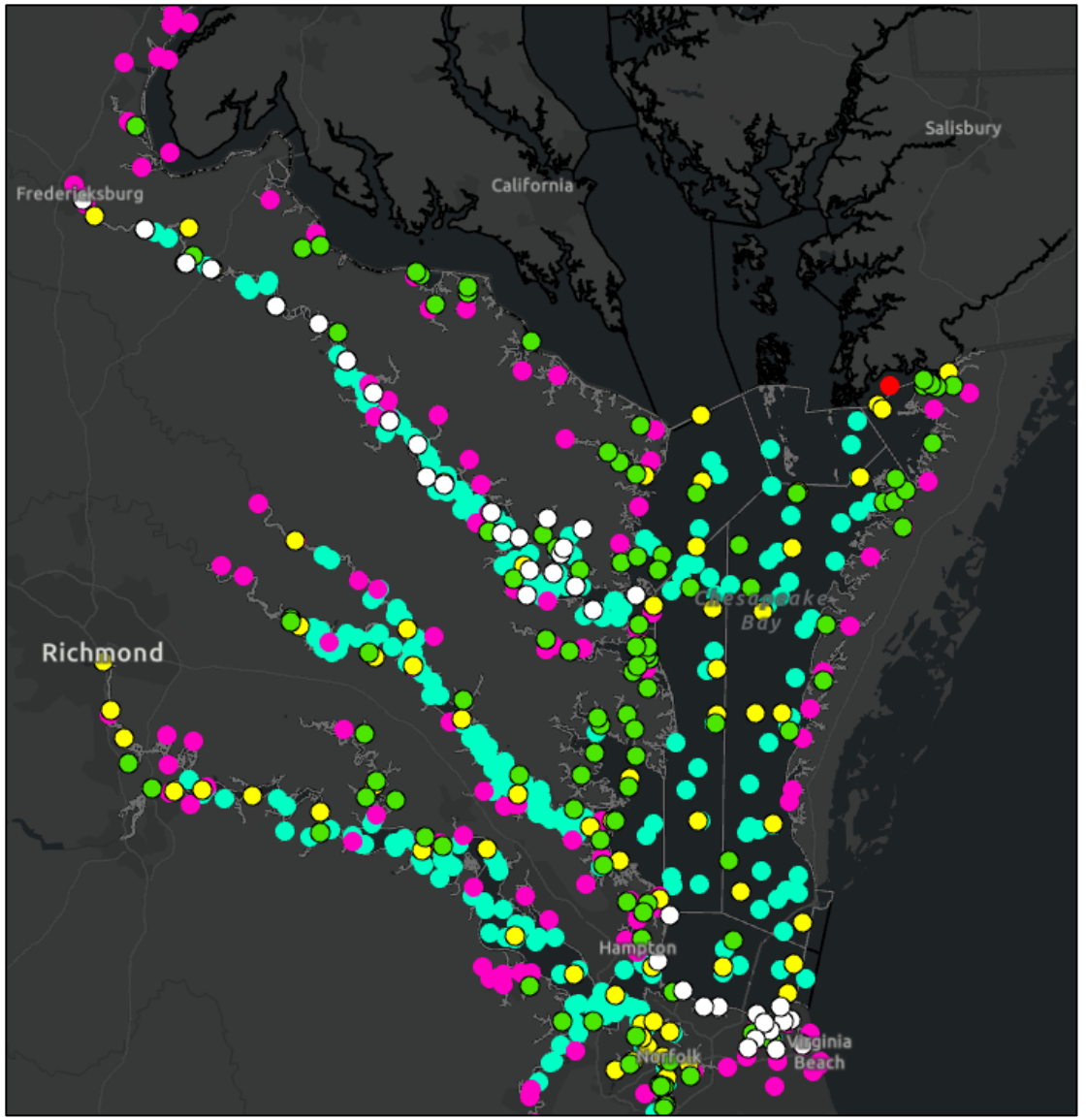
(iii) A rationale for any decision to not use any existing and readily available data and information for any one of the categories of waters as described in § 130.7(b)(5); and

(iv) Any other reasonable information requested by the Regional Administrator. Upon request by the Regional Administrator, each State must demonstrate good cause for not including a water or waters on the list. Good cause includes, but is not limited to, more recent or accurate data; more sophisticated water quality modeling; flaws in the original analysis that led to the water being listed in the categories in § 130.7(b)(5); or changes in conditions, e.g., new control equipment, or elimination of discharges.

How much data are we talking about?

Virginia's DO Monitoring Effort for the 2024 Integrated Report

- CBP Stations (n=21,163)
- DEQ Stations (n=1,698)
- ODU-BEN Stations (n=352)
- DEQ Estuarine ProbMon Stations (n=456)
- VIMS Stations (n=4,350)
- CMC Stations (n=46)



Total # of VA Bay DO observations assessed for 2024IR = **28,065**

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DEQ staff have developed a tentative plan for assessing the eleven Bay DO criteria.

Interpolator/CFD Assessment

- The Interpolator/CFD assessment will continue to be the default assessment method and considered the first line of evidence in assessment decisions.

Tentative Bay DO assessment approach using multiple lines of evidence

Currently, Bay DO assessments have been based on a single data type (discrete) and one assessment procedure (Interpolator/CFD).

But we have multiple data types:

- Discrete data and Continuous Monitoring (ConMon) data (shallow water, profilers, arrays, etc.)

And we could process the discrete data in different ways:

- Using the Interpolator/CFD Assessment
- Or a Screening Value Assessment

Screening Value Assessment

- A screening value is used in risk assessment to determine with high confidence where there is low probability of adverse risks.
- They allow for the rapid detection of sites where further investigation should be conducted (e.g., enhanced monitoring).
- Screening values are applied to instantaneous data rather than spatially or temporally-aggregated data.

Bay DO Criteria

Designated Use	Criteria Concentration/Duration	Temporal Application
Migratory fish spawning and nursery	7-day mean 6 mg/l (tidal habitats with 0-0.5 ppt salinity)	February 1 - May 31
	Instantaneous minimum 5 mg/l	
Open water[1]	30-day mean 5.5 mg/l (tidal habitats with 0-0.5 ppt salinity)	year-round[2]
	30-day mean 5 mg/l (tidal habitats with > 0.5 ppt salinity)	
	7-day mean 4 mg/l	
	Instantaneous minimum 3.2 mg/l at temperatures < 29°C Instantaneous minimum 4.3 mg/lat temperatures 29°C	
Deep water	30-day mean 3 mg/l	June 1 - September 30
	1-day mean 2.3 mg/l	
	Instantaneous minimum 1.7 mg/l	
Deep channel	Instantaneous minimum 1 mg/l	June 1 - September 30

[1]In applying this open water instantaneous criterion to the Chesapeake Bay and its tidal tributaries where the existing water quality for dissolved oxygen exceeds an instantaneous minimum of 3.2 mg/l, that higher water quality for dissolved oxygen shall be provided antidegradation protection in accordance with 9VAC25-260-30 A 2.

[2]Open-water dissolved oxygen criteria attainment is assessed separately over two time periods: summer (June 1- September 30) and nonsummer (October 1-May 31) months.

Screening Values

- Turn criteria into screening values by ignoring durations
- Results in a much more conservative approach and sets a higher bar for attainment

Designated Use	Criteria Concentration/Duration	Temporal Application
Migratory fish spawning and nursery	6 mg/l (tidal habitats with 0-0.5 ppt salinity)	February 1 - May 31
	Instantaneous minimum 5 mg/l	
Open water[1]	5.5 mg/l (tidal habitats with 0-0.5 ppt salinity)	year-round[2]
	5 mg/l (tidal habitats with > 0.5 ppt salinity)	
	4 mg/l	
	Instantaneous minimum 3.2 mg/l at temperatures < 29°C Instantaneous minimum 4.3 mg/lat temperatures 29°C	
Deep water	3 mg/l	June 1 - September 30
	2.3 mg/l	
	Instantaneous minimum 1.7 mg/l	
Deep channel	Instantaneous minimum 1 mg/l	June 1 - September 30

[1]In applying this open water instantaneous criterion to the Chesapeake Bay and its tidal tributaries where the existing water quality for dissolved oxygen exceeds an instantaneous minimum of 3.2 mg/l, that higher water quality for dissolved oxygen shall be provided antidegradation protection in accordance with 9VAC25-260-30 A 2.

[2]Open-water dissolved oxygen criteria attainment is assessed separately over two time periods: summer (June 1- September 30) and nonsummer (October 1-May 31) months.

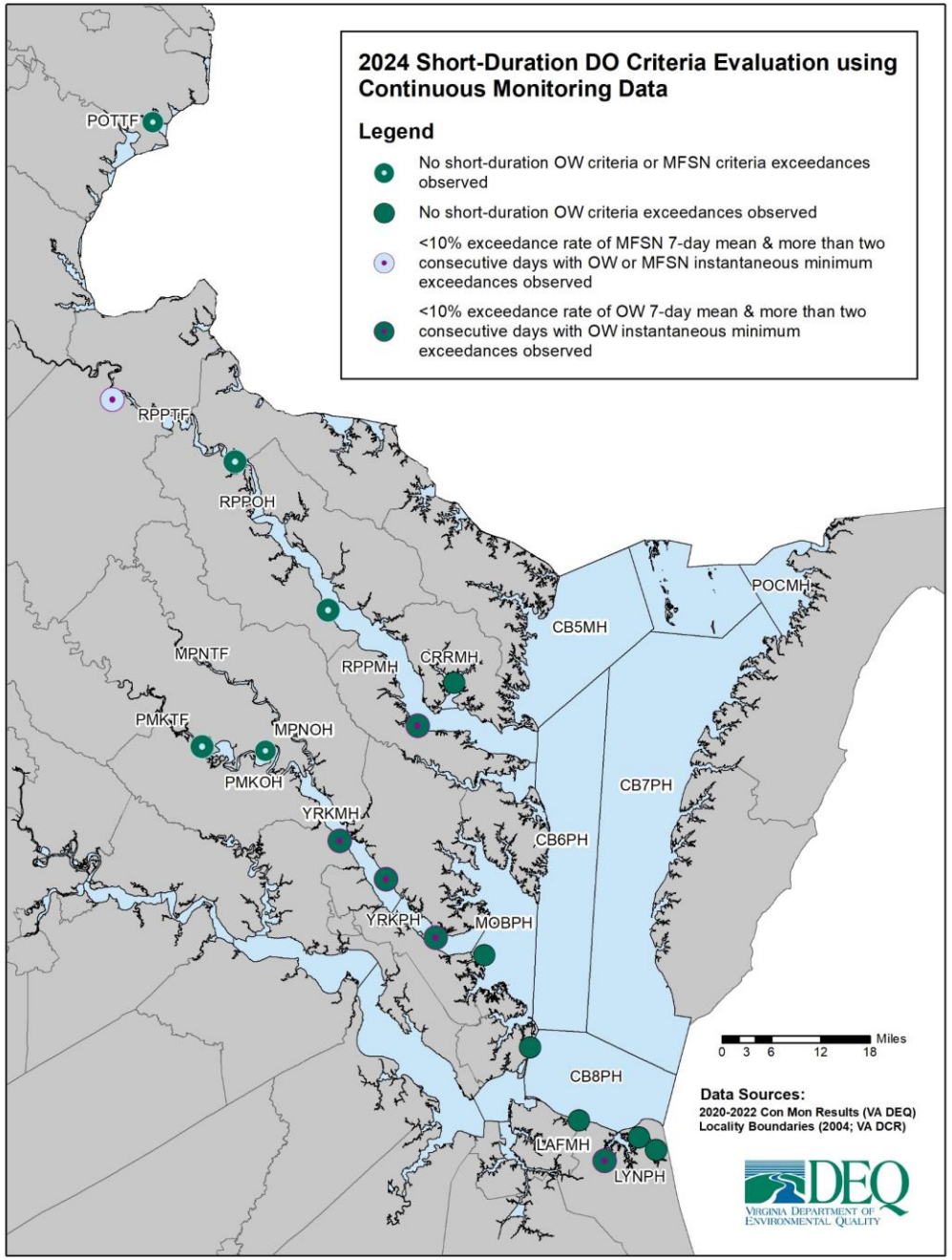
ConMon Data Assessment

- Largely follows procedures in USEPA (2017), which establishes assessment procedures outside of the CFD framework

- Virginia does not currently have continuous monitoring datasets to assess Deep Water or Deep Channel segments, only shallow waters.

- DEQ is looking to integrate shallow water ConMon data with other lines of evidence to make assessment decisions.

ConMon data evaluation in Virginia's 2024 IR



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This hypothetical segment would be assessed as meeting all applicable DO criteria.

Designated Use	Criterion	Interpolator/CFD Nonattainment Rate	Screening Value Exceedance Rate	Shallow Water ConMon Exceedance Rate
Migratory Fish Spawning Nursery	6 mg/L (7-Day Mean)	Not Available	0%	2% (rolling 7-day means)
	5 mg/L (Instant Min)	Not Available	0%	0% (daily minimums)
Open Water ROY Jan-May,Oct-Dec	5.5 mg/L (30-Day Mean)	0%	0%	0% (rolling 30-day means)
	4 mg/L (7-Day Mean)	Not Available	0%	0% (rolling 7-day means)
	3.2 or 4.3 mg/L (Instant Min)	Not Available	0%	0% (daily minimums)
Open Water Summer July-September	5.5 mg/L (30-Day Mean)	0%	0%	0% (rolling 30-day means)
	4 mg/L (7-Day Mean)	Not Available	0%	1% (rolling 7-day means)
	3.2 or 4.3 mg/L (Instant Min)	Not Available	0%	5% (daily minimums)

This hypothetical segment would NOT be assessed as meeting all applicable DO criteria.

Designated Use	Criterion	Interpolator/CFD Nonattainment Rate	Screening Value Exceedance Rate	Profiler ConMon Exceedance Rate
Open Water ROY Jan-May,Oct-Dec	5.5 mg/L (30-Day Mean)	0%	0%	Not Available
	4 mg/L (7-Day Mean)	Not Available	0%	Not Available
	3.2 or 4.3 mg/L (Instant Min)	Not Available	0%	Not Available
Open Water Summer July-September	5.5 mg/L (30-Day Mean)	0%	0%	0% (rolling 30-day means)
	4 mg/L (7-Day Mean)	Not Available	0%	1% (rolling 7-day means)
	3.2 or 4.3 mg/L (Instant Min)	Not Available	0%	1% (daily minimums)
Deep Water July-September	3 mg/L (30-Day Mean)	**0.1%**	10%	8% (rolling 30-day means calculated at each depth)
	2.3 mg/L (1-Day Mean)	Not Available	6%	5% (rolling 1-day means calculated at each depth)
	1.7 mg/L (Instant Min)	Not Available	9%	10% (daily minimum across all depths)

Benefit of an integrated assessment approach

Useful when all evidence has some level of uncertainty.

- Discrete data – weak in the temporal dimension
- Interpolator/CFD assessment – not good at distinguishing marginally attaining/non-attaining segments
  - Currently not used for short-duration criteria assessments
- ConMon data – weak in the spatial dimension

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Key Take-Aways

- DEQ is not abandoning the CFD.
- DEQ will assess segments as impaired if any line of evidence indicates criteria nonattainment.
- DEQ will assess segments as not meeting a designated use if any line of evidence indicates criteria nonattainment.

Efforts working with the Chesapeake Bay Partnership

- Fully committed to Partnership and attending CAP meetings regularly
- Multiple meetings with CBP/EPA Region 3/MD
- August 2024/December 2024 CAP Meetings
- Planning to brief STAR/WQGIT in early 2025

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2026 Water Quality Assessment Guidance Timeline

- Virginia Code requires procedures for listing waters to be published for public comment.
- Draft Guidance Public Comment Period Planned for Spring 2025
- 2026 IR Bay DO Assessment based on data collected between 2022-2024
- Draft 2026 IR released in early 2026

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Questions/Comments?

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