Progress report on Phase 7 criteria assessment – Water clarity

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modeling team

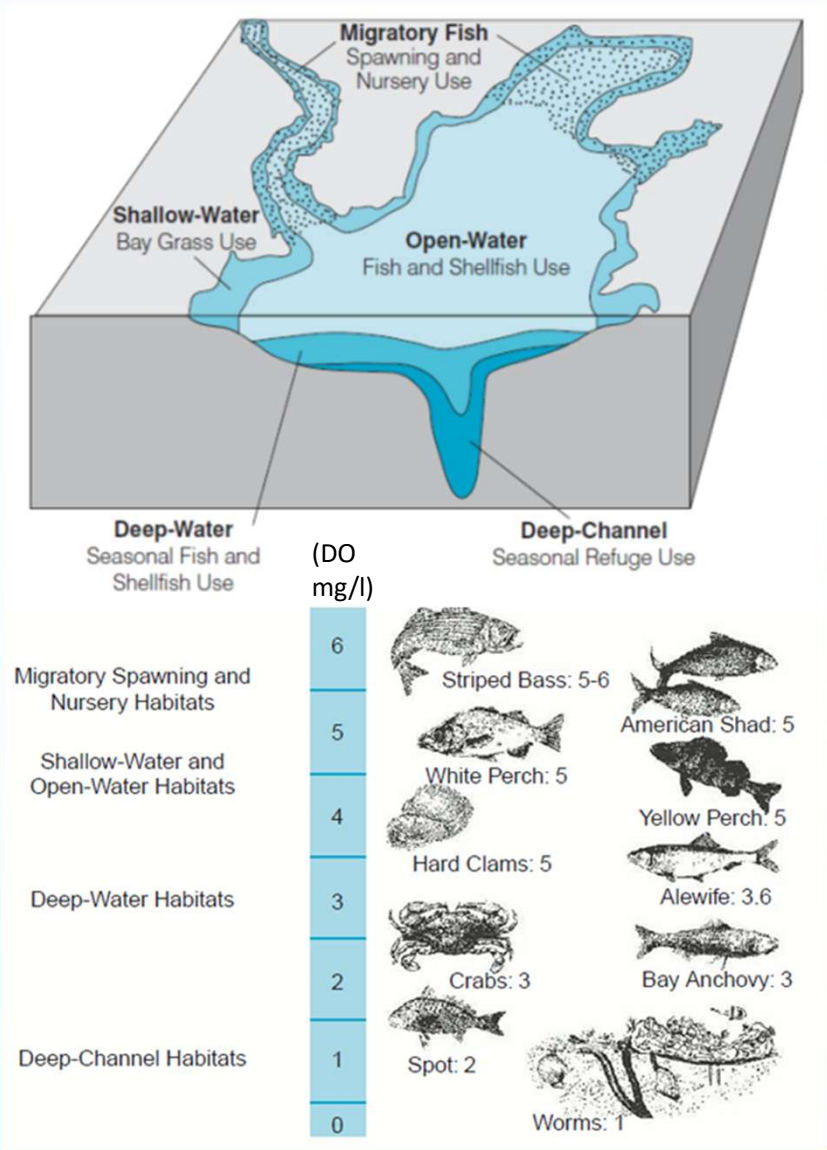
Modeling Quarterly Review Meeting

Annapolis, April. 08, 2026

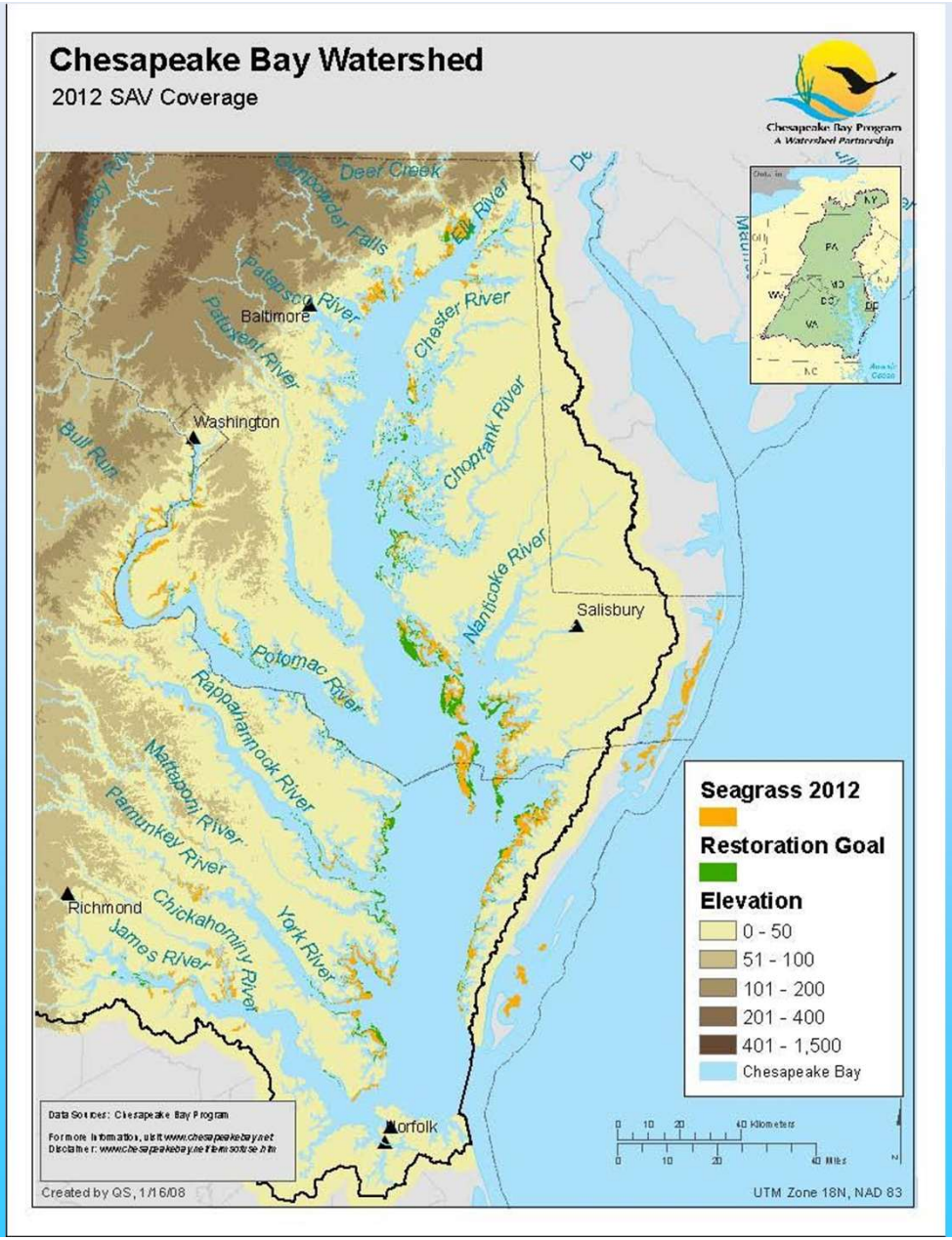
Designated Uses (DUs)

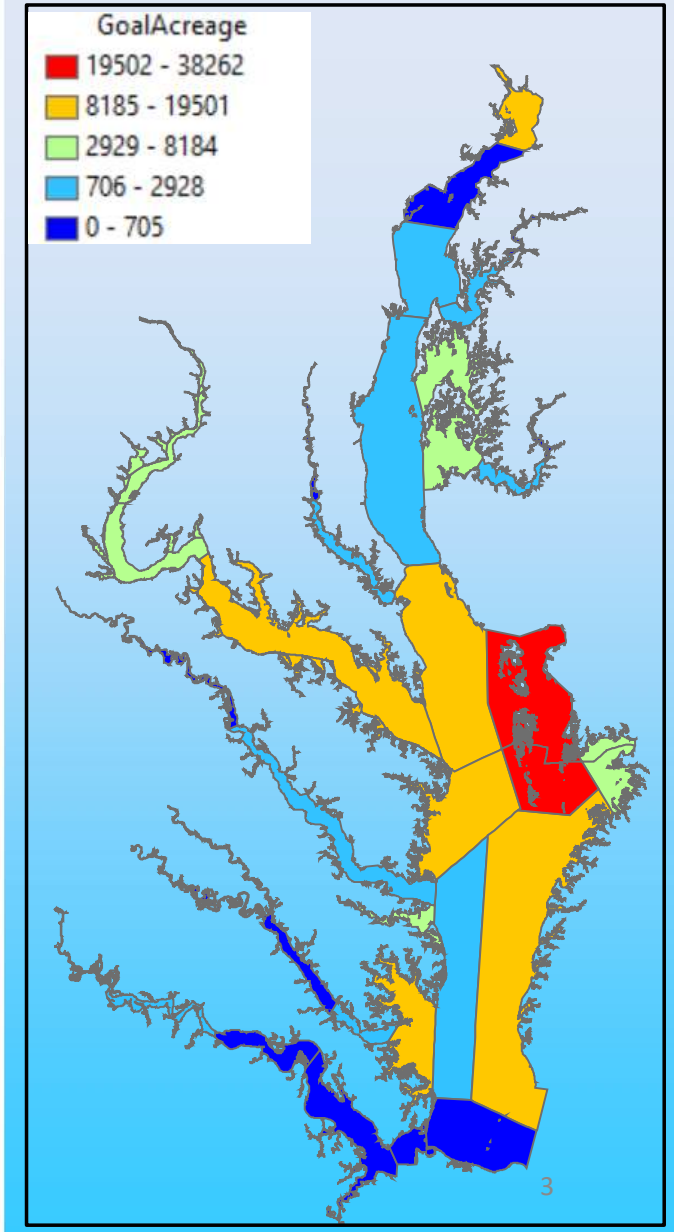
Six DUs:

- **DO DC: deep channel.**
- **DO DW: deep water.**
- **DO OW: open water.**
- **DO MSN: migratory fish spawning and nursery.**
- **Chlorophyll: James and Anacostia rivers.**
- **SAV and Water clarity: Shallow waters.**



SAV restoration goal





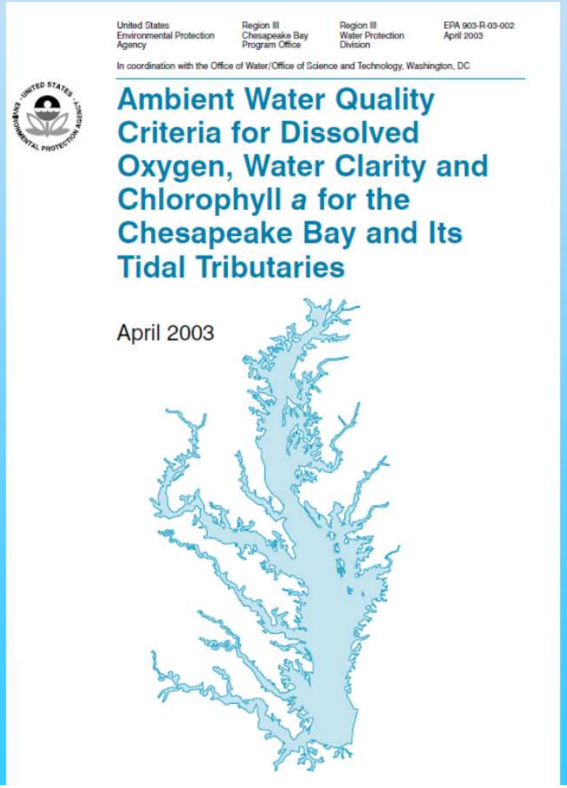
Assessment methods

- **Level 1 assessment: Largest SAV acreage of 3yr rolling period >= restoration goal acreage.**
- **Level 2 assessment: Largest attained water clarity acreage of 3yr rolling period >= 2.5 x restoration goal.**
- **Level 3 assessment: The sum of SAV and attained water clarity acreage >= 2.5 x restoration goal.**

(Model application can only do level 2 assessment at this point)

Water clarity assessment based on the percent light-through-water (PLW) and percent light-at-the-leaf (PLL)

For Phase 7, bathymetry was interpolated to the cells and the critical Kd was computed at each cell.



United States Environmental Protection Agency | Region III Chesapeake Bay Program Office | Region III Water Protection Division | EPA 903-R-03-002 April 2003

In coordination with the Office of Water/Office of Science and Technology, Washington, DC

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

April 2003

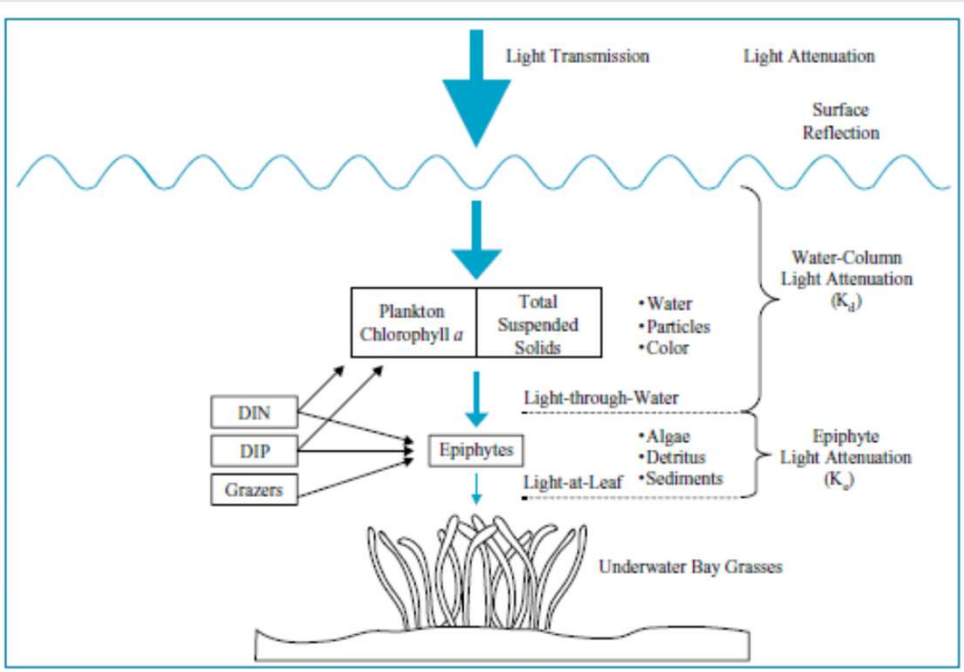


Figure 3. Availability of light for underwater bay grasses is influenced by water-column and at-the-leaf surface light attenuation processes. DIN = dissolved inorganic nitrogen and DIP = dissolved inorganic phosphorus.

Table IV-1. Summary of Chesapeake Bay water clarity criteria for application to shallow-water bay grass designated use habitats (application depths given in 0.25 meter depth intervals.[2]

Salinity Regime	Water Clarity Criteria as Percent Light-through-Water	Water Clarity Criteria as Secchi Depth								Temporal Application
		Water Clarity Criteria Application Depths								
		0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0	
		Secchi Depth (meters) for above Criteria Application Depth								
Tidal-fresh	13 %	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.4	April 1 - October 31
Oligohaline	13 %	0.2	0.4	0.5	0.7	0.9	1.1	1.2	1.4	April 1 - October 31
Mesohaline	22 %	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	April 1 - October 31
Polyhaline	22 %	0.2	0.5	0.7	1.0	1.2	1.4	1.7	1.9	March 1 - May 31, September 1 - November 30

[2]Base on application of Equation IV-1, PLW = $100\exp(-K_dZ)$, the appropriate PLW criterion value and the selected application depth are inserted and the equation is solved for K_d. The generated K_d value is then converted to Secchi depth (in meters) using the conversion factor $K_d = 1.45/\text{Secchi depth}$.

Application depth of water clarity criteria

United States Environmental Protection Agency | Region III Chesapeake Bay Program Office | EPA 903-R-03-004 October 2003

Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability

Table IV-13. The single best year and maximum depth interval for applying the water clarity criteria used in determining the Chesapeake Bay Program segment-specific shallow-water underwater bay grass designated use boundary depths.

Chesapeake Bay Program (CBP) Segment Name	CBP Segment	Single Best Year	Maximum Depth Interval Application of the Water Clarity Criteria (meters) 0–0.5	0.5–1	1–2	Recommended Shallow-Water Designated Use Depth (meters)
Northern Chesapeake Bay	CB1TF	Historical			▲	2
Upper Chesapeake Bay	CB2OH	Historical	o			0.5
Upper Central Chesapeake Bay	CB3MH	1978	▲			0.5
Middle Central Chesapeake Bay	CB4MH	Historical			▲	2
Lower Central Chesapeake Bay	CB5MH	Historical			▲	2
Western Lower Chesapeake Bay	CB6PH	Historical		▲		1
Eastern Lower Chesapeake Bay	CB7PH	Historical			▲	2
Mouth of the Chesapeake Bay	CB8PH	1996	o			0.5
Bush River	BSHOH	Historical	o			0.5
Gunpowder River	GUNOH	2000			▲	2
Middle River	MIDOH	Historical			▲	2
Back River	BACOH	*	o			0.5
Patapsco River	PATMH	Historical		▲		1
Magothy River	MAGMH	Historical		▲		1
Severn River	SEVMH	1999		▲		1
South River	SOUMH	Historical		▲		1
Rhode River	RHDMH	Historical	o			0.5
West River	WSTMH	Historical	▲			0.5
Upper Patuxent River	PAXTF	1996	▲			0.5
Western Branch (Patuxent River)	WBRTF	*	o			0.5
Middle Patuxent River	PAXOH	2000	o			0.5
Lower Patuxent River	PAXMH	Historical		▲		1
Upper Potomac River	POTTF	1991			❖	2
Anacostia River	ANATF	1991	o			0.5
Piscataway Creek	PISTF	1987			▲	2
Mattawoman Creek	MATTF	2000		▲		1
Middle Potomac River	POTOH	1998			❖	2

continued

Table IV-13. The single best year and maximum depth interval for applying the water clarity criteria used in determining the Chesapeake Bay Program segment-specific shallow-water underwater bay grass designated use boundary depths *(cont.)*.

Chesapeake Bay Program (CBP) Segment Name	CBP Segment	Single Best Year	Maximum Depth Interval Application of the Water Clarity Criteria (meters) 0–0.5	0.5–1	1–2	Recommended Shallow-Water Designated Use Depth (meters)
Lower Potomac River	POTMH	Historical		▲		1
Upper Rappahannock River	RPPTF	2000	o			0.5
Middle Rappahannock River	RPPOH	*	o			0.5
Lower Rappahannock River	RPPMH	Historical		▲		1
Corrotoman River	CRRMH	Historical		▲		1
Piankatank River	PIAMH	Historical			▲	2
Upper Mattaponi River	MPNTF	1998	o			0.5
Lower Mattaponi River	MPNOH	*	o			0.5
Upper Pamunkey River	PMKTF	1998	o			0.5
Lower Pamunkey River	PMKOH	*	o			0.5
Middle York River	YRKMH	Historical	o			0.5
Lower York River	YRKPH	Historical		▲		1
Mobjack Bay	MOBPH	Historical			▲	2
Upper James River	JMSTF	Historical	o			0.5
Appomattox River	APPTF	Historical	▲			0.5
Middle James River	JMSOH	1998	o			0.5
Chickahominy River	CHKOH	2000	o			0.5
Lower James River	JMSMH	Historical	o			0.5
Mouth of the James River	JMSPH	Historical		▲		1
Western Branch Elizabeth River	WBEMH	*	❖	❖	❖	*
Southern Branch Elizabeth River	SBEMH	*	❖	❖	❖	*
Eastern Branch Elizabeth River	EBEMH	*	❖	❖	❖	*
Lafayette River	LAFMH	*	❖	❖	❖	*
Mouth to mid-Elizabeth River	ELIPH	*	o			0.5
Lynnhaven River	LYNPH	1986	o			0.5
Northeast River	NORTF	Historical	o			0.5
C&D Canal	C&DOH	1978	o			0.5

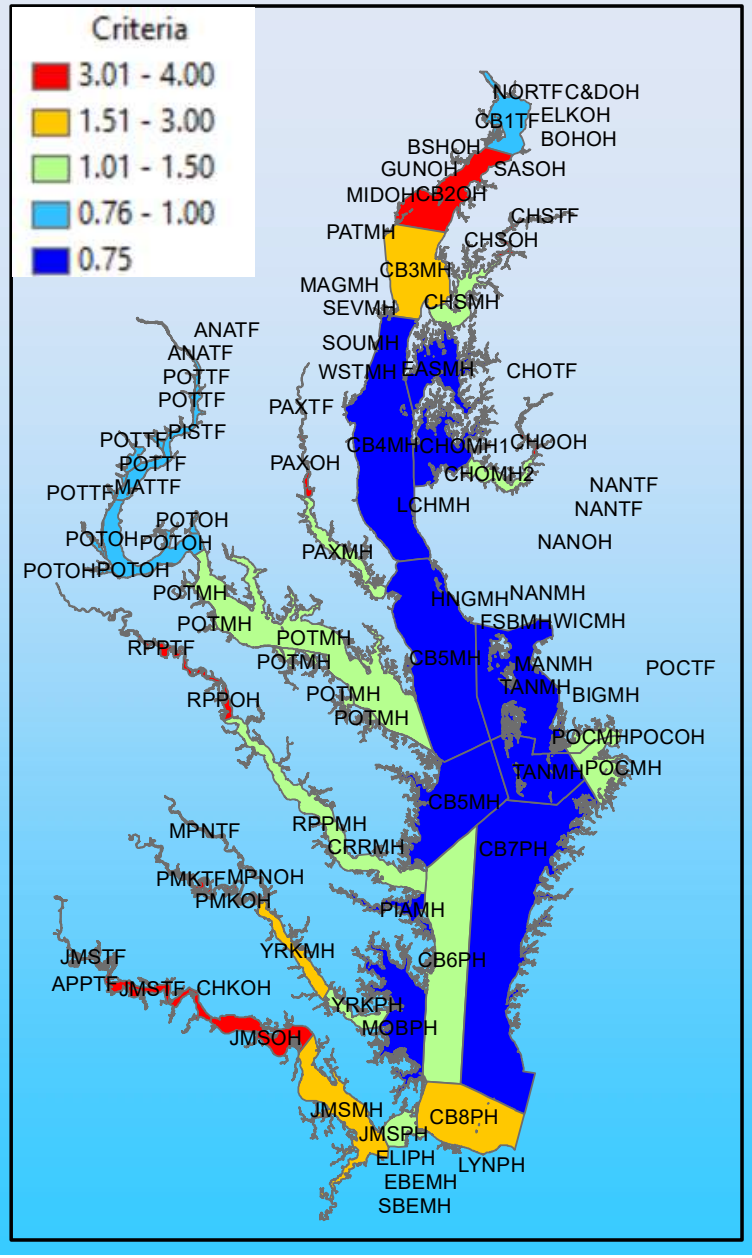
continued

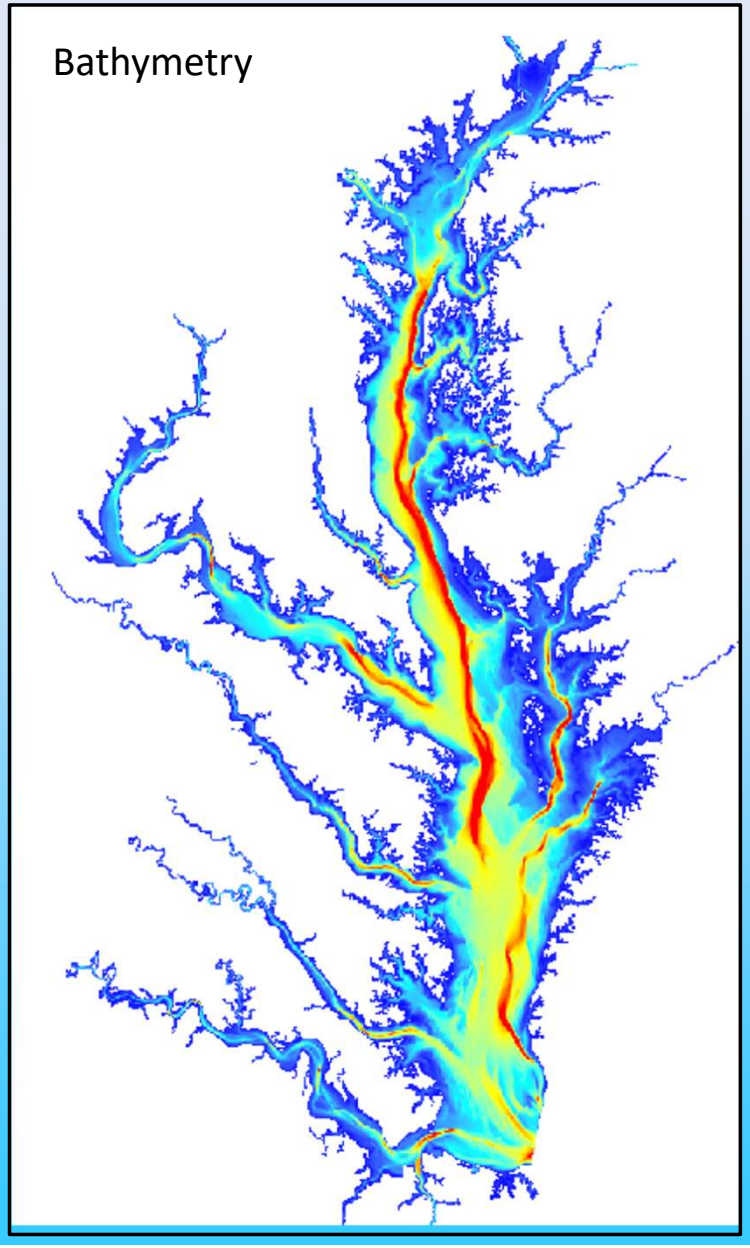
Table IV-13. The single best year and maximum depth interval for applying the water clarity criteria used in determining the Chesapeake Bay Program segment-specific shallow-water underwater bay grass designated use boundary depths *(cont.)*.

Chesapeake Bay Program (CBP) Segment Name	CBP Segment	Single Best Year	Maximum Depth Interval Application of the Water Clarity Criteria (meters) 0–0.5	0.5–1	1–2	Recommended Shallow-Water Designated Use Depth (meters)
Bohemia River	BOHOH	2000	o			0.5
Elk River	ELKOH	2000			▲	2
Sassafras River	SASOH	2000		▲		1
Upper Chester River	CHSTF	*	o			0.5
Middle Chester River	CHSOH	Historical	o			0.5
Lower Chester River	CHSMH	Historical		▲		1
Eastern Bay	EASMH	Historical			▲	2
Upper Choptank River	CHOTF	*	❖	❖	❖	*
Middle Choptank River	CHOOH	Historical	o			0.5
Lower Choptank River	CHOMH2	Historical		▲		1
Mouth of the Choptank River	CHOMH1	Historical			▲	2
Little Choptank River	LCHMH	Historical			▲	2
Honga River	HNGMH	Historical			▲	2
Fishing Bay	FSBMH	Historical	o			0.5
Upper Nanticoke River	NANTF	*	o			0.5
Middle Nanticoke River	NANOH	Historical	o			0.5
Lower Nanticoke River	NANMH	Historical	o			0.5
Wicomico River	WICMH	Historical	o			0.5
Manokin River	MANMH	Historical			▲	2
Big Annemessex River	BIGMH	Historical			▲	2
Upper Pocomoke River	POCTF	*	❖	❖	❖	*
Middle Pocomoke River	POCOH	*	o			0.5
Lower Pocomoke River	POCMH	Historical		▲		1
Tangier Sound	TANMH	Historical			▲	2

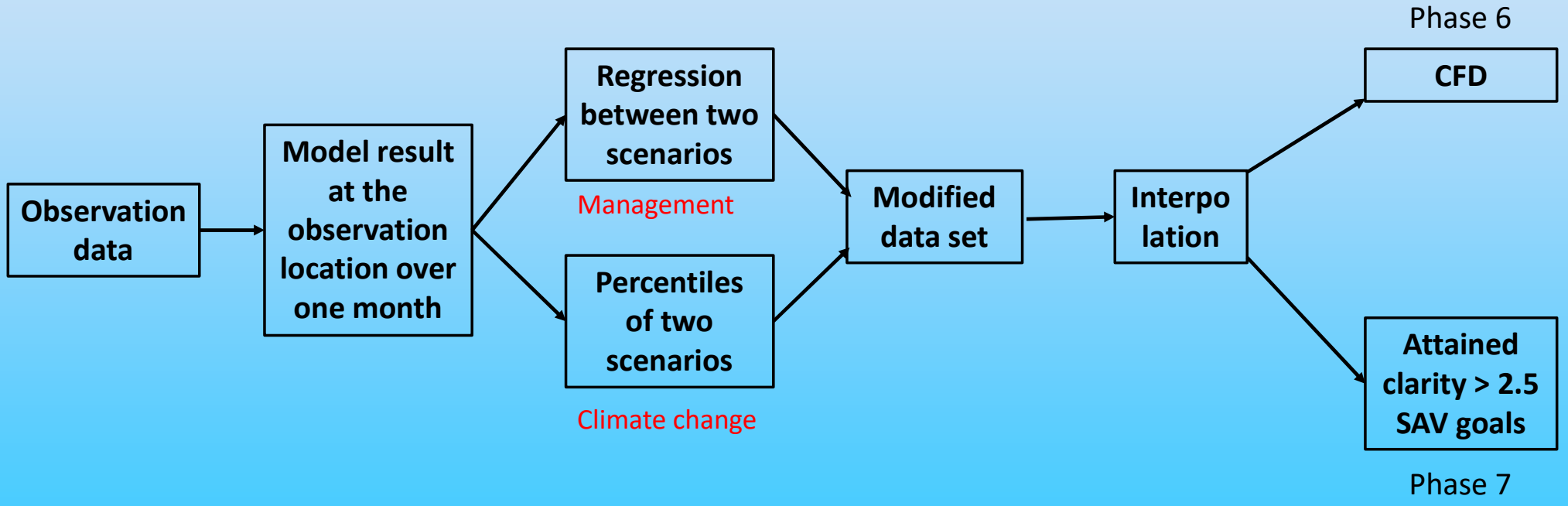
o Decision rules not met – default depth interval of 0-0.5 meters applies.
▲ Single best year percent of total potential habitat is 20 percent.
❖ Percent of total potential habitat is 10-19.9% and underwater bay grasses are persistent (1978–2000).
❖ Chesapeake Bay Program segment completely within the underwater bay grass no-grow zone.
*Denotes no data available or no underwater bay grasses mapped (1930s-2000).

Water clarity (Kd) criteria (m^{-1})





Water clarity assessment methods for modelling scenarios



Comparison of KD assessment in mesohaline regions

Scenario	name	Cal	WIP	WIP
				WIP3AAPT_2019 1001L25CYXXN OCNGENOCNG
Run	name	RUN14v	RUN14vwip	EN_sav
Nitrogen	loading	325TN	195TN	195TN
Phosphorous	loading	21.9TP	13.7TP	13.5TP
Start	End	1993_1995	1993_1995	1993_1995
Cbseg	State	KD_M_Doct2	KD_M_Doct2	KD_M_Doct
CB1TF	MD	87.34%	82.50%	86.86%
CB2OH	MD	2.26%	3.14%	0.00%
CB3MH	MD	5.33%	0.74%	0.82%
CB4MH	MD	83.53%	66.63%	72.40%
CB5MH	MD_VA	77.88%	52.61%	61.89%
CHOMH1	MD	81.66%	76.66%	80.13%
CHOMH2	MD	70.52%	59.40%	58.28%
CHOOH	MD	8.91%	2.13%	0.00%
CHSTF	MD	87.34%	87.34%	73.75%
CHSOH	MD	79.64%	78.35%	33.12%
CHSMH	MD	28.18%	40.88%	25.31%
EASMH	MD	81.19%	85.44%	78.56%
JMSMH	VA	7.30%	4.58%	3.83%
JMSOH	VA	14.03%	1.01%	3.69%
JMSTF	VA	0.00%	0.00%	0.00%
JMSTFL	VA	0.00%	0.00%	0.00%
JMSTFU	VA	0.00%	0.00%	0.00%
MPNOH	VA	15.19%	8.96%	3.10%
MPNTF	VA	0.00%	0.00%	0.00%
PAXMH	MD	53.16%	83.03%	31.05%
PAXOH	MD	39.18%	21.30%	25.08%
PAXTF	MD	23.60%	11.03%	20.49%
PIAMH	VA	82.44%	82.44%	72.96%
PMKOH	VA	20.39%	40.92%	17.59%
PMKTF	VA	0.00%	0.00%	0.00%
POCMH	MD_VA	61.94%	57.16%	56.14%
MPCMH	MD	67.24%	61.77%	63.01%
VPCMH	VA	66.66%	57.52%	53.62%
POTMH	MD_VA	31.43%	48.56%	15.85%

Table continue

POTOH	MD_VA	87.34%	87.34%	87.34%
POTTF	MD_VA_DC	87.06%	87.34%	86.66%
RPPMH	VA	39.90%	36.16%	16.46%
RPPOH	VA	17.93%	9.55%	9.66%
RPPTF	VA	15.24%	3.38%	9.85%
TANMH	MD	84.59%	82.33%	81.61%
YRKMH	VA	26.39%	35.03%	22.04%
VA5MH	VA	64.99%	42.74%	52.87%
MD5MH	MD	83.37%	56.91%	67.39%

WC assessment in the mesohaline regions based on 2.5 x SAV goals

Scen	Segment	Type	DU	Start	End	Calibration	WIP
RUN14v	CB1TF	WC	mes	1993	1995	68.11%	72.27%
RUN14v	CB2OH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CB3MH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CB4MH	WC	mes	1993	1995	0.00%	0.00%
RUN14v	CB5MH	WC	mes	1993	1995	42.20%	42.20%
RUN14v	MD5MH	WC	mes	1993	1995	41.44%	41.44%
RUN14v	VA5MH	WC	mes	1993	1995	25.09%	25.09%
RUN14v	CHOMH	WC	mes	1993	1995	44.44%	44.44%
RUN14v	CHOMH	WC	mes	1993	1995	57.32%	55.80%
RUN14v	CHOOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CHSTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CHSOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CHSMH	WC	mes	1993	1995	29.95%	55.27%
RUN14v	EASMH	WC	mes	1993	1995	23.59%	40.70%
RUN14v	JMSMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	JMSOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	JMSTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	JMSTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	JMSTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	MPNOH	WC	mes	1993	1995	0.00%	0.00%
RUN14v	MPNTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	PAXMH	WC	mes	1993	1995	59.17%	75.80%
RUN14v	PAXOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	PAXTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	PIAMH	WC	mes	1993	1995	59.14%	59.14%
RUN14v	PMKOH	WC	mes	1993	1995	0.00%	0.00%
RUN14v	PMKTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	POCMH	WC	mes	1993	1995	50.81%	35.84%
RUN14v	MPCMH	WC	mes	1993	1995	54.93%	43.66%
RUN14v	VPCMH	WC	mes	1993	1995	65.03%	44.57%
RUN14v	POTMH	WC	mes	1993	1995	27.64%	46.82%
RUN14v	POMMH	WC	mes	1993	1995	21.91%	45.61%
RUN14v	POVMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	POTOH	WC	mes	1993	1995	89.09%	94.83%
RUN14v	PO1OH	WC	mes	1993	1995	83.97%	98.22%
RUN14v	PO2OH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	PO3OH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	POVOH	WC	mes	1993	1995	85.21%	91.78%

Scen	Segment	Type	DU	Start	End	Calibration	WIP
RUN14v	POTTF	WC	mes	1993	1995	96.79%	98.93%
RUN14v	PISTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	MATTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	DCATF	WC	mes	1993	1995	79.41%	71.17%
RUN14v	MDPTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	POVTF	WC	mes	1993	1995	94.10%	98.82%
RUN14v	DCPTF	WC	mes	1993	1995	93.55%	100.00%
RUN14v	RPPMH	WC	mes	1993	1995	32.94%	28.35%
RUN14v	RPPOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	RPPTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	TANMH	WC	mes	1993	1995	45.18%	55.69%
RUN14v	TAMMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	TAMMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	TAVMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	YRKMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CRRMH	WC	mes	1993	1995	34.04%	36.45%
RUN14v	APPTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CHKOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	MANMH	WC	mes	1993	1995	83.79%	75.33%
RUN14v	BIGMH	WC	mes	1993	1995	68.45%	43.64%
RUN14v	NANOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	NANMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	WICMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	FSBMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	LCHMH	WC	mes	1993	1995	38.16%	37.56%
RUN14v	HNGMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	CNDOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	NORTF	WC	mes	1993	1995	100.00%	100.00%
RUN14v	BOHOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	ELKOH	WC	mes	1993	1995	86.64%	84.21%
RUN14v	SASOH	WC	mes	1993	1995	98.41%	87.31%
RUN14v	BSHOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	GUNOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	MIDOH	WC	mes	1993	1995	72.60%	43.79%
RUN14v	JMSPH	WC	mes	1993	1995	1.81%	50.91%
RUN14v	BACOH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	PATMH	WC	mes	1993	1995	0.00%	0.00%
RUN14v	MAGMH	WC	mes	1993	1995	47.74%	40.27%
RUN14v	SEVMH	WC	mes	1993	1995	14.50%	0.00%
RUN14v	SOUMH	WC	mes	1993	1995	8.23%	0.00%
RUN14v	RHDMH	WC	mes	1993	1995	100.00%	100.00%
RUN14v	WSTMH	WC	mes	1993	1995	100.00%	100.00%

Message

At the current phase of development, it seems that neither models have predicted significant improvement of water clarity assessment under WIP conditions