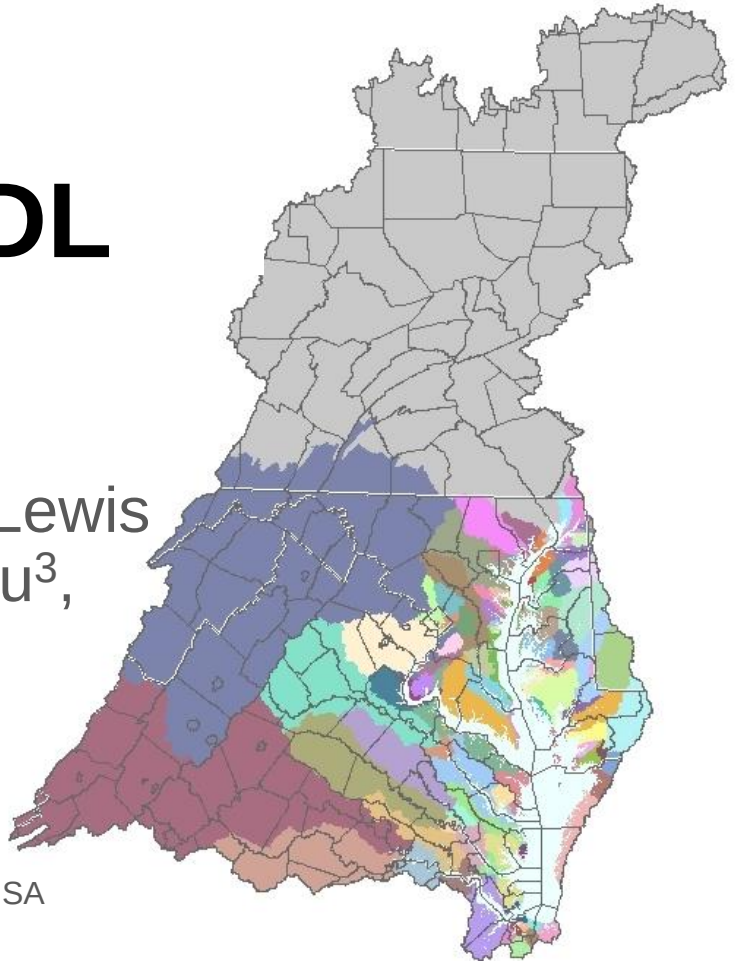
Components of the Chesapeake Bay TMDL



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National Conference on Ecosystem Restoration

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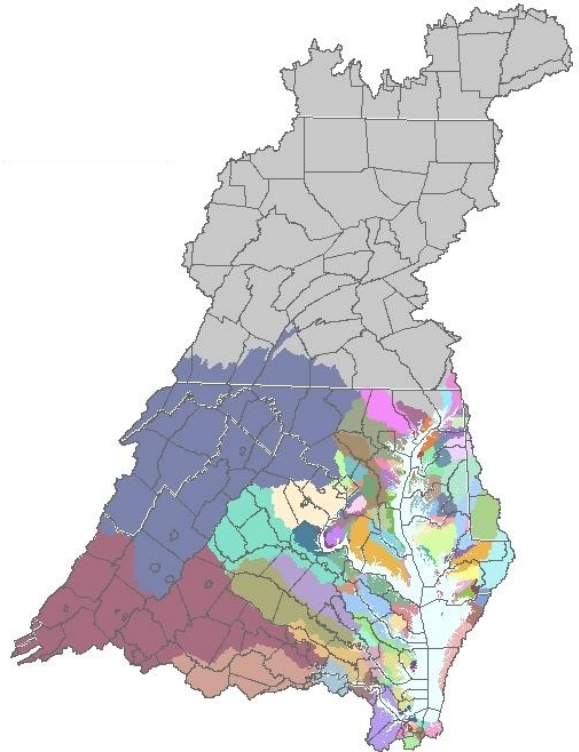
What is a TMDL

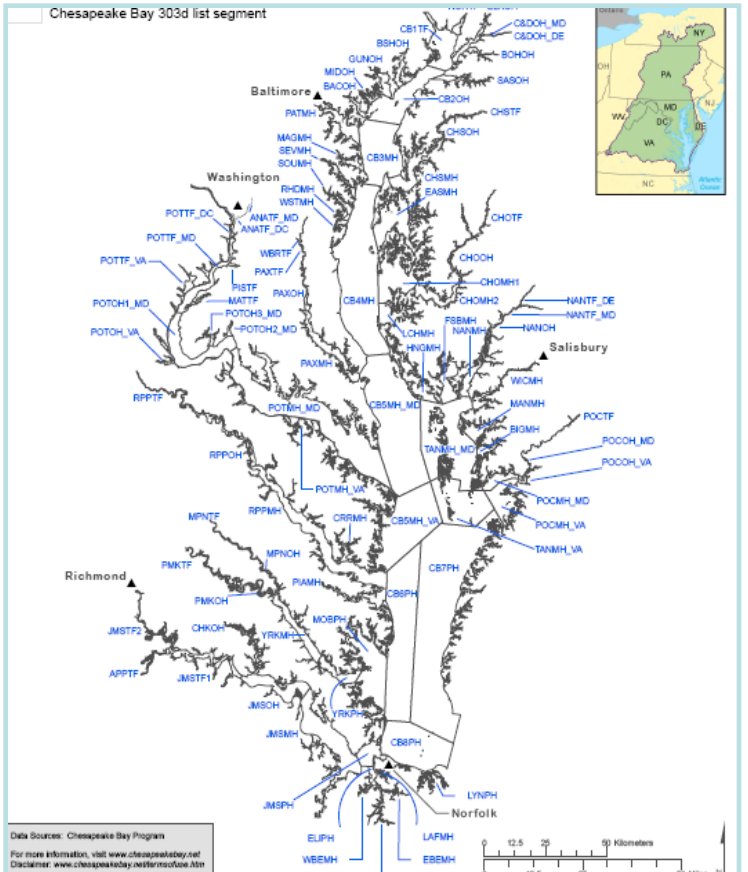
- **A Calculation of a Pollutant Load that assures that if Implemented, an Impaired Segment will Attain and Maintain all Applicable Water Quality Standards**
  - **Calculation** – estimate of assimilative capacity of the impaired segment. Must consider **seasonal variability, critical conditions,** and a **margin of safety**
  - **Pollutant Load** – linked to use attainment. Expression is daily, but can also be simultaneously expressed on alternative time scale.
  - **Implemented** – reasonable assurance of implementation
  - **Impaired Segment** – Physical area of a water body determined to be in non-attainment of water quality standards
  - **Attain/Maintain** – Calculation demonstrates that WQS will be achieved if a particular pollutant load is achieved
  - **Applicable WQS** – the combination of designated uses, narrative and numeric criteria, and the anti-degradation policy assigned to each of the state's waters/segments

Slide adapted from Mike Haire, EPA

Challenging Scale

- 6 States plus Washington DC
- 92 tidal water segments, each with several designated uses





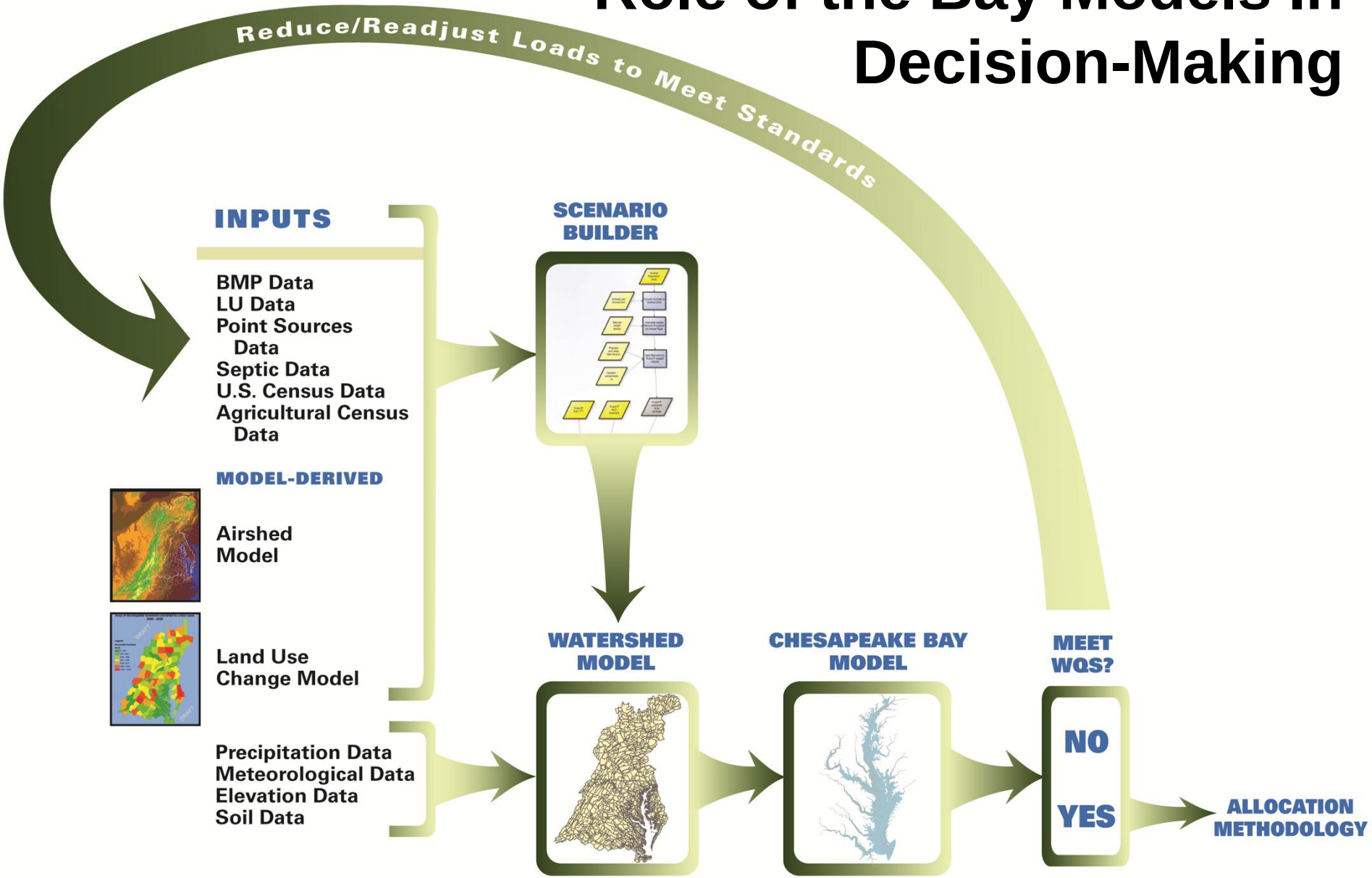
Components of the Chesapeake TMDL

- ✓ Hydrologic Period
- ✓ Critical Period
- ✓ Seasonal Variability
- ✓ Assess All Standards
- ✓ Daily Loads
- ✓ Margin of Safety
- ✓ Stakeholder Input

} **This presentation**

- ✓ Calculation of Loads – Jeni Keisman
- ✓ Accountability Framework
  - Katherine Antos
  - Jennifer Volk

Role of the Bay Models In Decision-Making

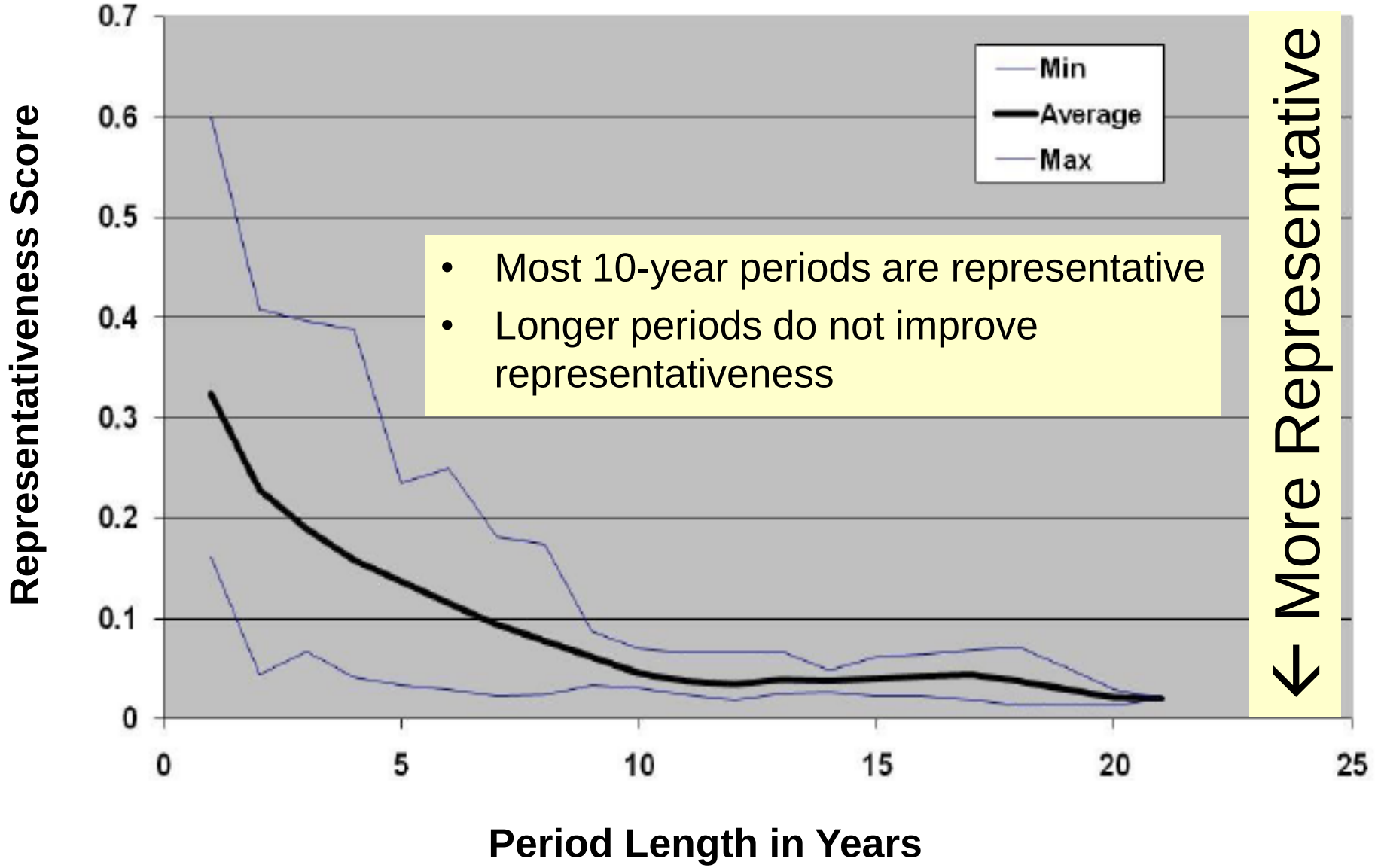


Hydrologic Averaging Period

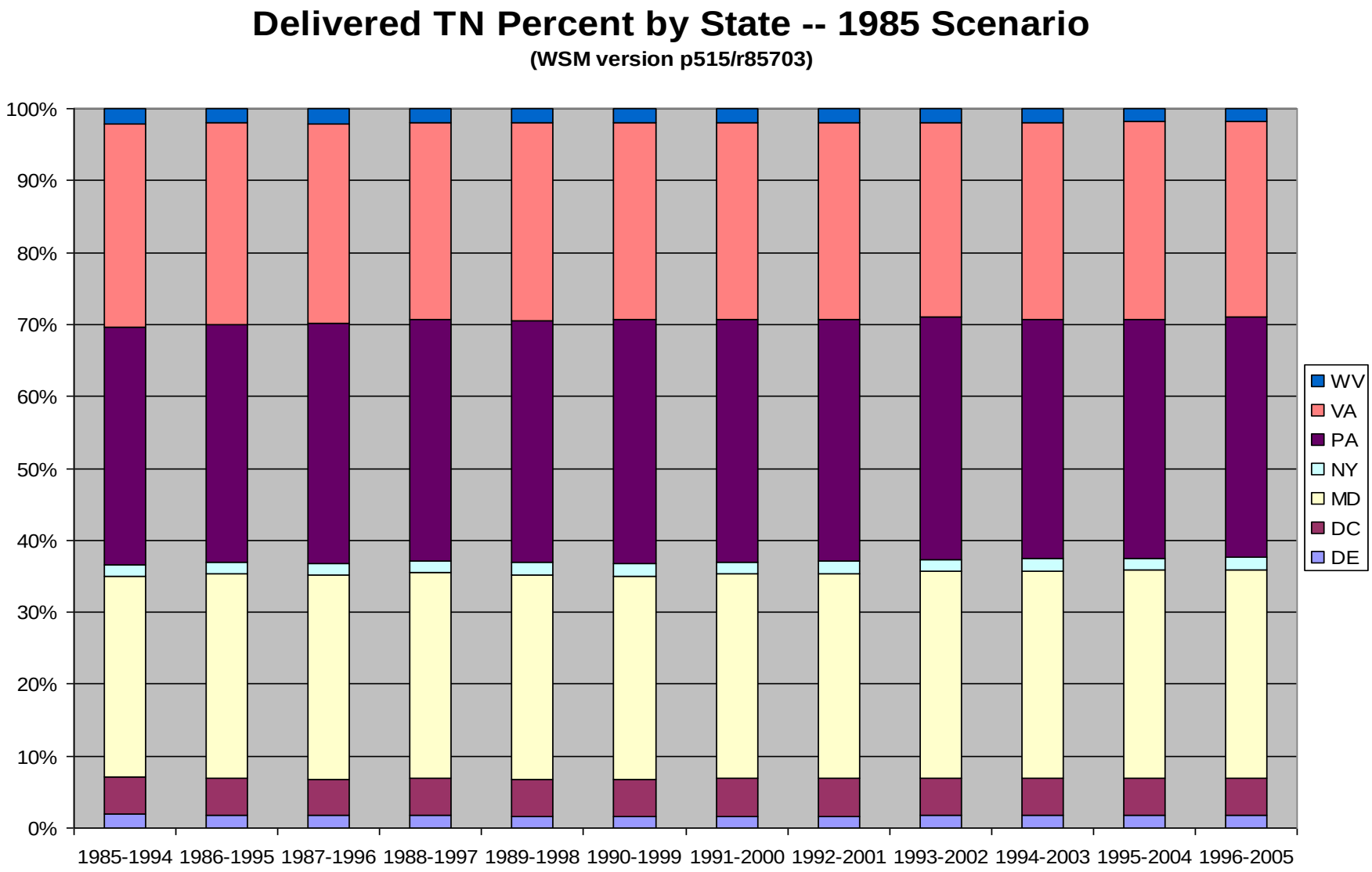
- Modeling period representing long-term climactic mean and variability.
  - Long enough to ensure representativeness
  - Short enough so that data exist and models run in a reasonable time.
- Ensures even treatment across basins, jurisdictions, and sectors.
- Examined long-term monitoring of 9 USGS river input stations
  - Mean
  - Variance
  - Frequency distribution

Representativeness of Flow for Periods of Different Length

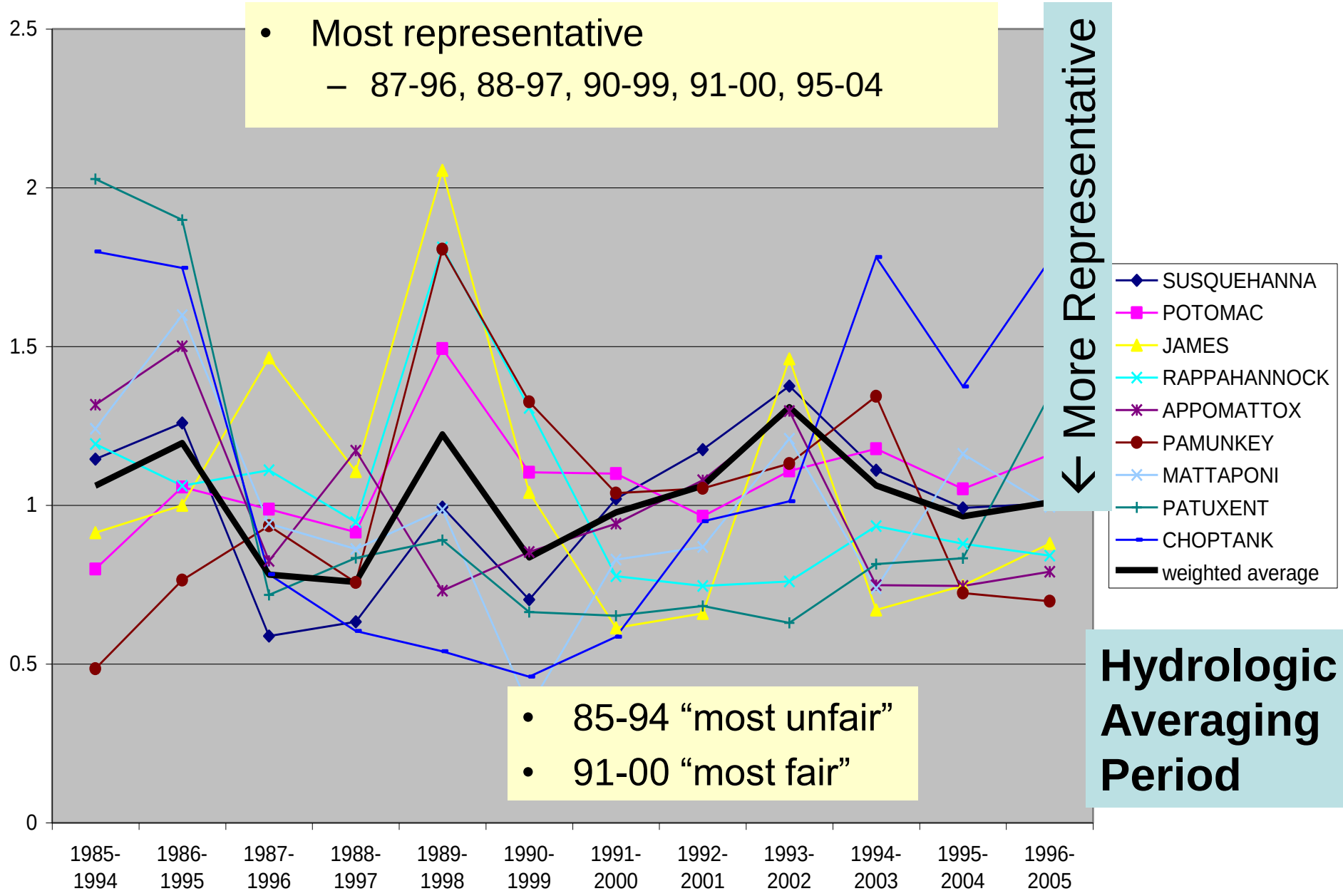
Hydrologic Averaging Period



Hydrologic Averaging Period Assessment

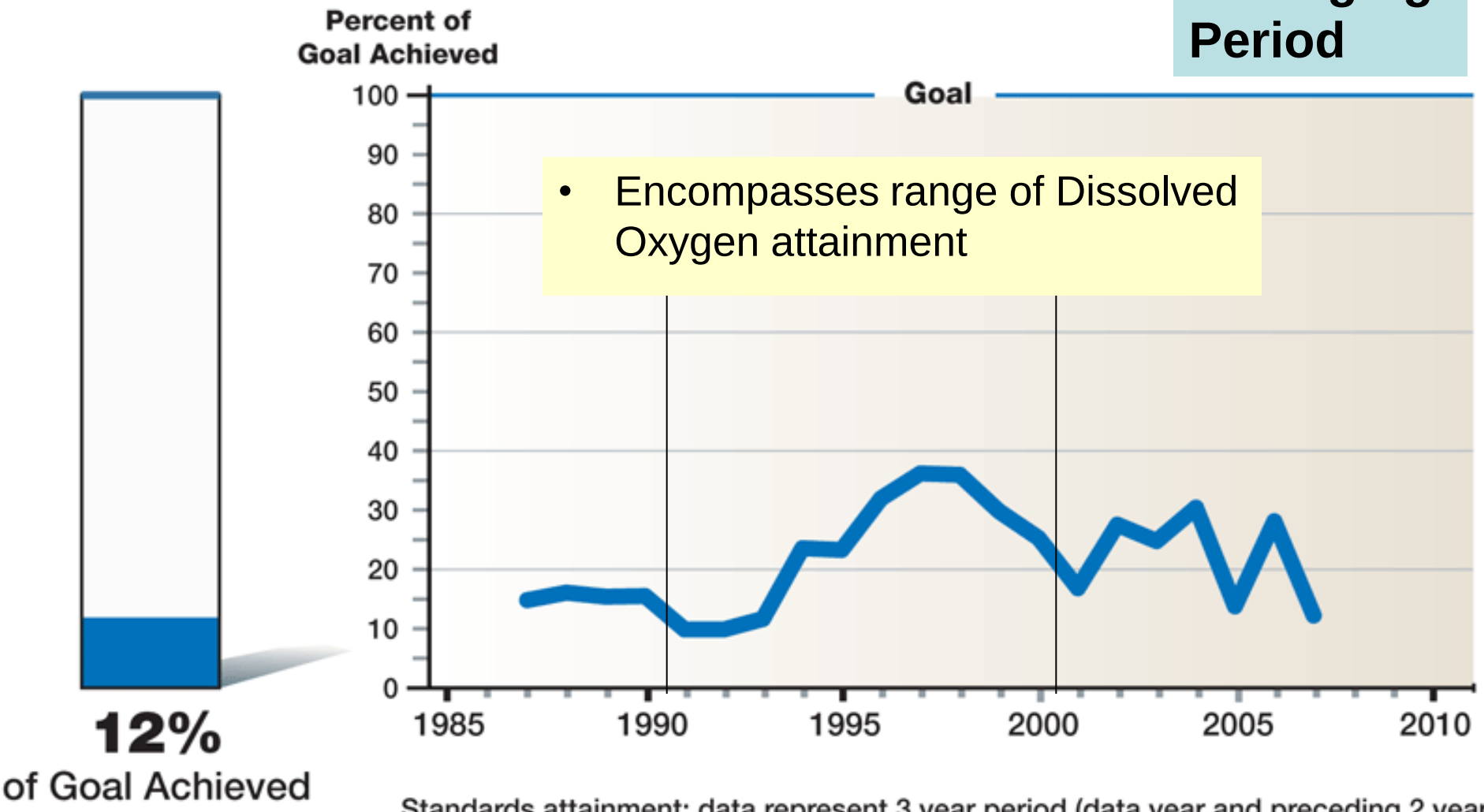


Representativeness of Flow for Periods for Different Basins



Dissolved Oxygen Standards Attainment

Hydrologic Averaging Period



- Encompasses range of Dissolved Oxygen attainment

Standards attainment: data represent 3 year period (data year and preceding 2 years)
Data and Methods: www.chesapeakebay.net/status_dissolvedoxygen.aspx

Critical Period

- Approvable TMDLs must meet water quality standards during critical conditions, variously defined as:
  - Time period of data availability
  - Worst on record
  - Combination of high, average, and low flow
  - 10-year return period
- Chesapeake water quality standards are based on analysis of three consecutive years

Critical Period

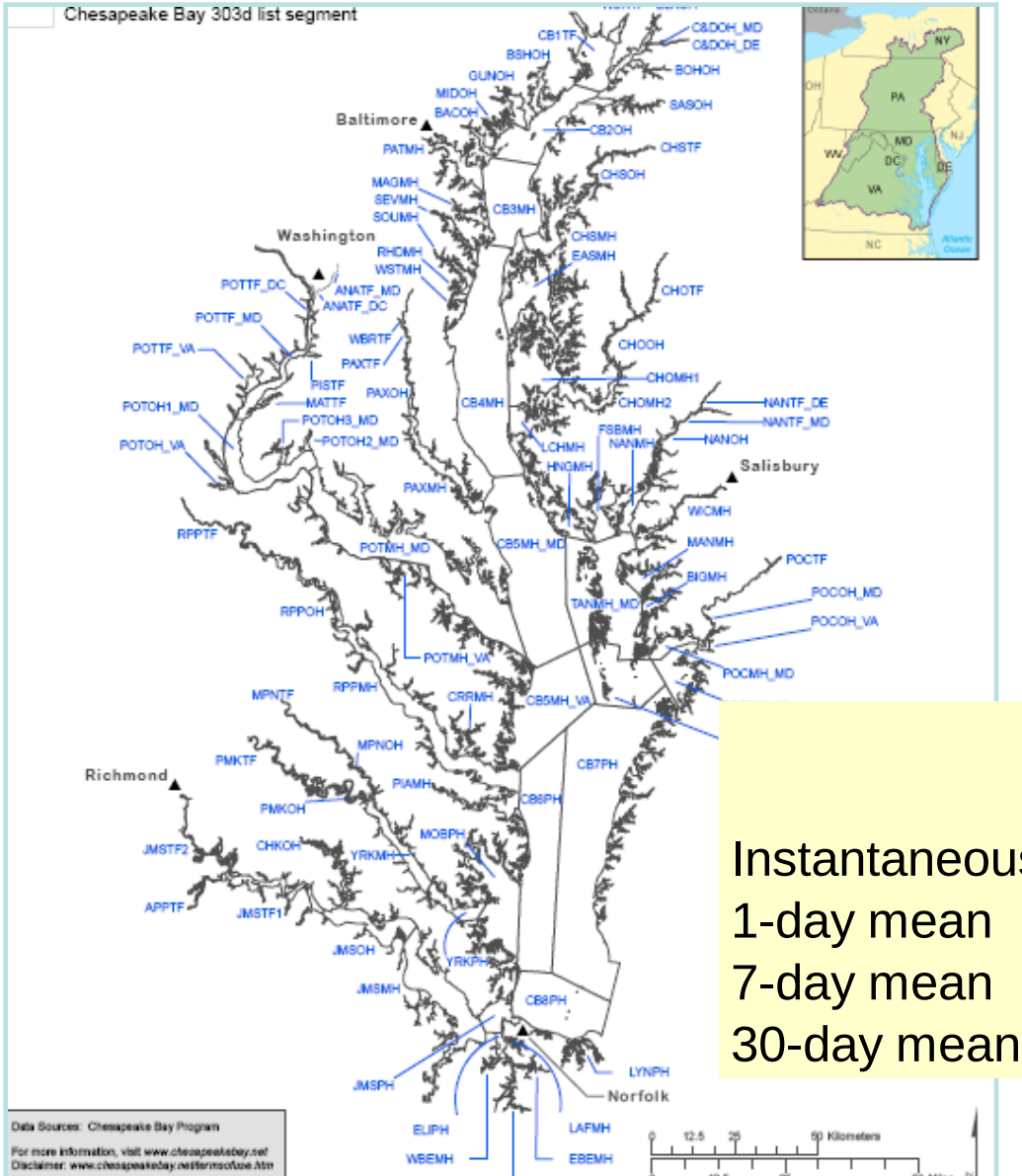
- Search for 3-year period within 1991-2000 with approximate return period of 10 years

	All tributaries (1978–2009)		Potomac + Susquehanna (1930–2009)		
	Without multiplier	With multiplier	With multiplier	With multiplier	With multiplier
	No de-trending	No de-trending	No De-trending	De-trended (Linear regression)	De-trended (LOWESS)
Year	1993–1995				
Median (High r^2)	7.53	7.48	7.27	6.34	8.92
Mean (High r^2)	6.84	6.99	7.39	5.97	8.35
Median (All monthly spans)			9.31	6.62	9.07
Mean (All monthly spans)			11.28	8.05	11.26
Overall range 1993–1995	**5.97–11.28**				
Year	1996-1998				
Median (High r^2)	18.95	16.02	17.56	11.3	16.66
Mean (High r^2)	18.82	14.87	15.24	11.78	16.26
Median (All monthly spans)			19.26	14.35	18.26
Mean (All monthly spans)			21.63	15.57	21.05
Overall range 1996–1998	**11.30–21.63**				

Seasonal Variability

- Water quality standards apply to specific seasons
- Models are generally on hourly time steps and simulate seasonal variability
- Model and data analysis have shown that summer anoxia responds to annual rather than seasonal loads. Seasonal designated uses are protected through loads expressed annually.

Assess All Standards - DO

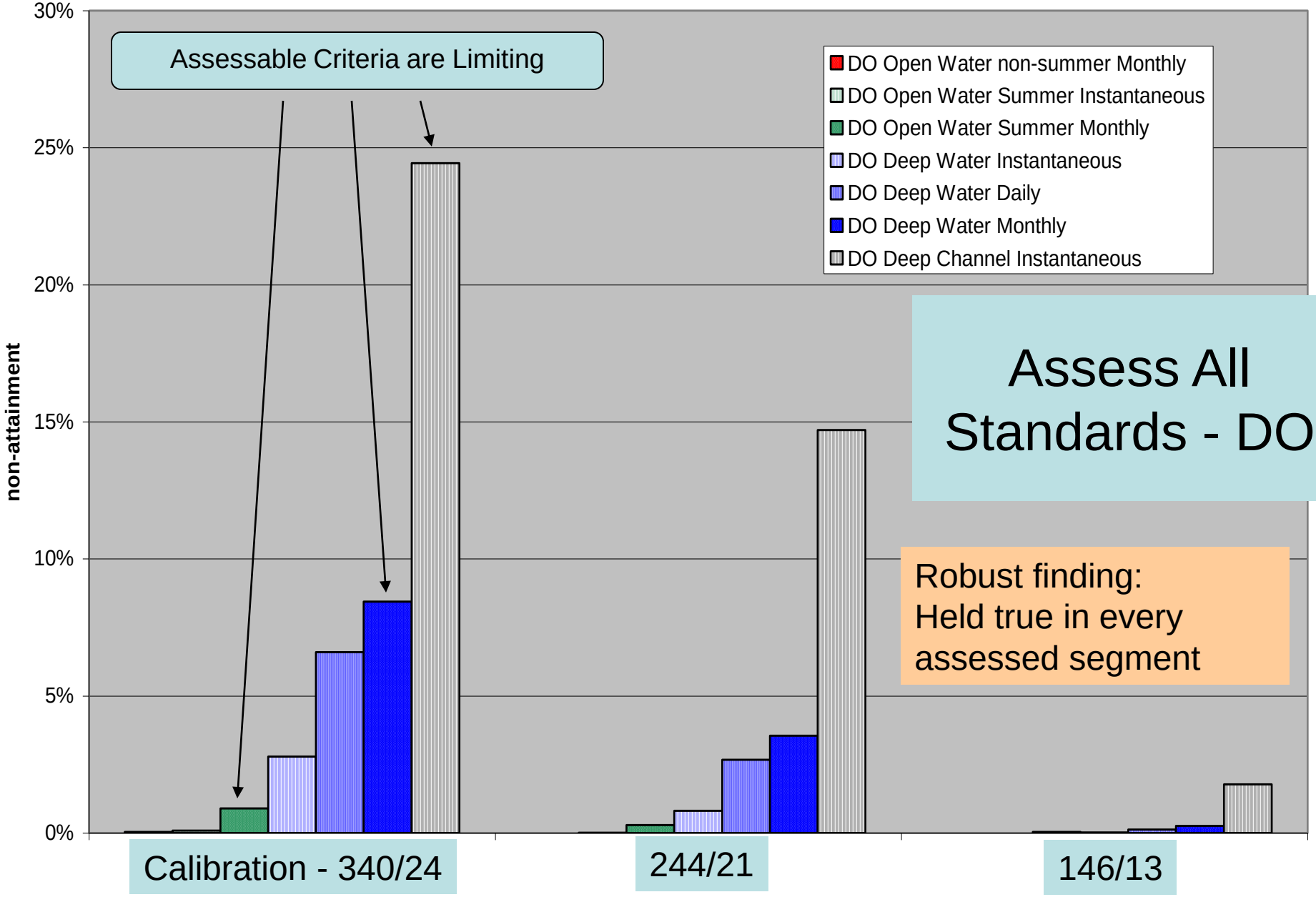


Current methods and data are sufficient to assess only 3 of 7 standards

	Open Water	Deep Water	Deep Channel
Instantaneous	No Data	No Data	Evaluated
1-day mean	NA	No Data	NA
7-day mean	No Data	NA	NA
30-day mean	Evaluated	Evaluated	NA

MODEL ONLY -- Various Scenarios -- Non-Attainment Mainstem Average

1996-1998 – Phase 5.1 watershed model / Estuarine Model



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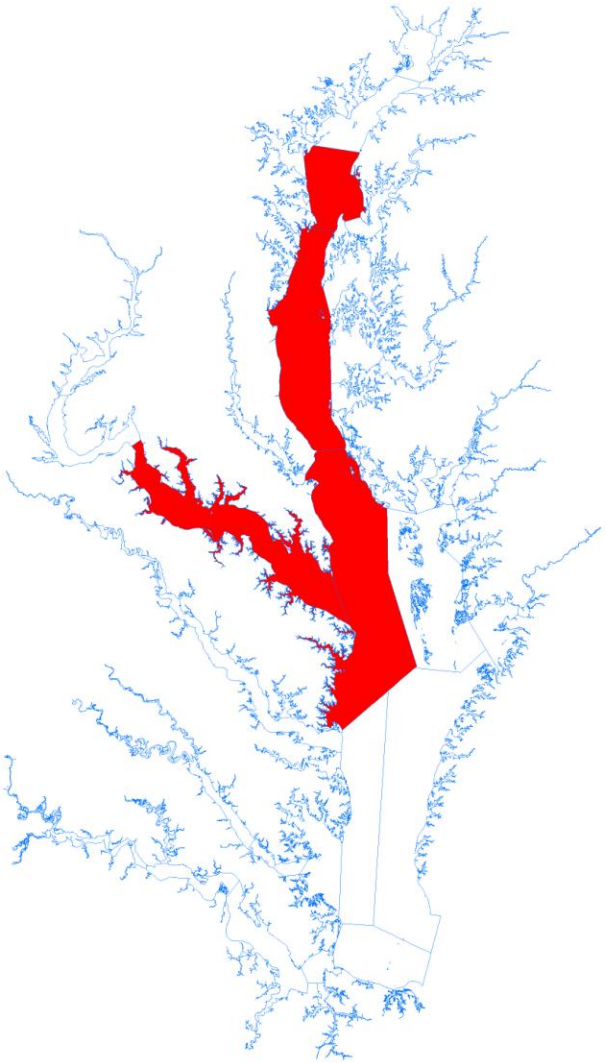

Examined Attainment of WQS under various loading scenarios

Determined that deeper sections of the mainstem bay and the lower Potomac were the most impaired

Therefore these are generally protective of the other uses.

Daily Loads

- TMDLs require Daily Loads
- Chesapeake WQS respond to loads on semi-annual to decadal time scales.
- Using the watershed model, developed multipliers to convert annual loads to 95th percentile daily and seasonal loads.
- Specified in the TMDL that NPDES permits should still be issued using annual limits

Margin of Safety

- Can be implicit (conservative modeling assumptions) or explicit (additional reduction)
- Chesapeake TMDL – implicit MOS
  - Highly developed modeling
  - TMDL based on the most restrictive standards at the most restrictive location
  - Reductions in atmospheric deposition and loads from up-current estuaries would change the concentrations at the ocean interface. This effect has not been quantified.

Stakeholder Input

- Hundreds of meetings related to TMDL
  - Appendix C of the TMDL documentation
- Public Meetings: 18-stop tour of the watershed
- Models developed with extensive stakeholder input. Current version development began in 1999.
  - Modeling Workgroup, Scientific and Technical Advisory Committee, Water Quality Goal Implementation Team, Watershed Technical Workgroup, Agricultural Workgroup, Forestry Workgroup, Urban Stormwater WG, Waste Water Workgroup

Stakeholder Input

These are the federal, state, and regional agency, academic institution, non-governmental organization and agricultural industry contributors to <u>just</u> the two-year effort to evaluate and revised the best management practice efficiencies:

Mid-Atlantic Water Program, U.S. Department of Agriculture-Natural Resources Conservation Service, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, Pennsylvania State Conservation Commission, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Department of Environmental Protection, Maryland Department of Agriculture, Maryland Department of Natural Resources, Maryland Department of the Environment, University of Maryland Cooperative Extension, University of Maryland-College Park, Delaware Department of Agriculture, Delaware Department of Natural Resources and Environmental Control, Delaware Maryland Agribusiness Association, West Virginia Department of Agriculture, West Virginia Department of Environmental Protection, Cacapon Institute - West Virginia, New York Department of Environmental Conservation, Upper Susquehanna Coalition, American Farmland Trust, Chesapeake Bay Commission, U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Environmental Protection Agency, Keith Campbell Foundation for the Environment, Pinchot Institute, Piedmont Environmental Council

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Questions?

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