CHESAPEAKE BAY PROGRAM UPDATE

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WRTC Meeting
Nov. 5, 2021

Seeking WRTC Feedback

- Updates to modeling framework
  - Potential changes to CAST
  - Potential Potomac tidal water model

Note: Preliminary positions shown in diagonal shaded text

Note: graphics and text mostly derived from Bay Program presentations by Gary Shenk and Lewis Linker; exceptions shown in purple text

Gearing Up for 2025

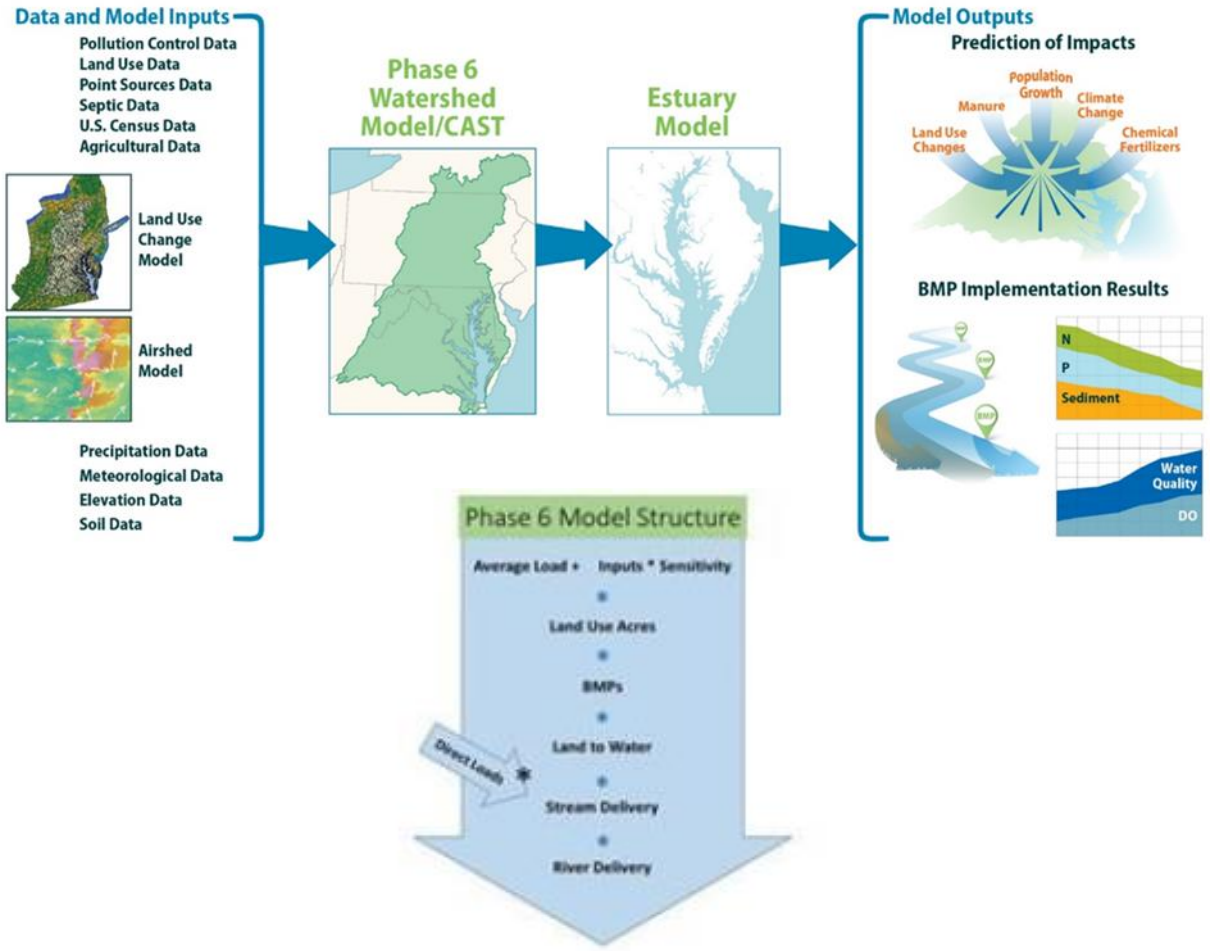
- Under the TMDL – Bay Partners agreed to full implementation of WIPs that meet planning targets
  - TMDL accountability framework based on 2024-2025 milestones
  - What happens if planning targets not met?
- Reassessment of climate change through 2035

			2018 Planning Targets approved by PSC		2019 Planning Targets with Exchanges and Sediment			2020 Climate Adjustments		2020 Planning Targets with Climate	
Major	State										
Major	State	StateBasin	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Sediment	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Potomac	DC	DC Potomac	2.42	0.130	2.42	0.130	41.9	0.01	0.001	2.42	0.129
Eastern Shore	DE	DE Eastern Shore	4.55	0.108	4.55	0.108	26.7	0.04	0.003	4.51	0.105
Eastern Shore	MD	MD Eastern Shore	15.21	1.286	15.60	1.290	2903.4	0.37	0.032	15.23	1.258
Patuxent	MD	MD Patuxent	3.21	0.301	3.21	0.300	437.7	0.11	0.019	3.09	0.281
Potomac	MD	MD Potomac	15.30	1.092	15.80	1.090	1928.0	0.21	0.033	15.59	1.057
Susquehanna	MD	MD Susquehanna	1.18	0.053	1.60	0.050	113.8	0.14	0.007	1.46	0.043
Western Shore	MD	MD Western Shore	10.89	0.948	9.63	0.950	2959.9	0.31	0.020	9.32	0.929
Susquehanna	NY	NY Susquehanna	11.53	0.587	11.53	0.587	532.7	0.40	0.044	11.13	0.543
Eastern Shore	PA	PA Eastern Shore	0.45	0.025	0.46	0.022	27.4	0.05	0.005	0.41	0.017
Potomac	PA	PA Potomac	6.11	0.357	6.14	0.338	295.5	0.04	0.008	6.11	0.330
Susquehanna	PA	PA Susquehanna	66.59	2.661	66.87	2.544	1838.2	1.72	0.082	65.14	2.462
Western Shore	PA	PA Western Shore	0.02	0.001	0.02	0.001	0.3	0.00	0.000	0.02	0.001
Eastern Shore	VA	VA Eastern Shore	1.43	0.164	1.83	0.152	473.3	0.01	0.000	1.82	0.152
James	VA	VA James	25.92	2.731	21.81	2.241	2015.2	0.30	0.143	21.51	2.097
Potomac	VA	VA Potomac	16.00	1.892	16.51	1.823	1929.7	0.56	0.073	15.95	1.750
Rappahannock	VA	VA Rappahannock	6.85	0.849	7.09	0.819	1505.1	0.54	0.102	6.54	0.717
York	VA	VA York	5.52	0.556	5.71	0.548	949.1	0.17	0.018	5.54	0.530
James	WV	WV James	0.04	0.005	0.05	0.006	13.0	0.00	0.000	0.05	0.006
Potomac	WV	WV Potomac	8.18	0.427	8.18	0.427	595.9	0.00	0.008	8.18	0.418

Why There May Be New Planning Targets

- Different results from new watershed model or new calibration of phase 6
  - Theoretically + or -, but most likely lower (harder to achieve)
- Different results from new estuarine model
  - Theoretically + or -, but most likely lower (harder to achieve)
- A change in the equity rules governing the planning target calculation
- Some new resolution of PA and Conowingo WIP situation
  - Highly unlikely to achieve enough BMP implementation to meet current targets
- Climate change reassessment

Bay Program's Modeling Suite



Constrained Schedule for WSM Phase 7

Phase 4
Combined phase 2 and phase 3 functionality
Longer simulation
Recalibration

- 1995 Development
- 1996 Development
- 1997 P4.1 application
- 1998 Development
- 1999 Development
- 2000 P4.3 application

Restructuring, Resegmentation, Automated calibration

- 2000 Ideation
- 2001 Development
- 2002-2004 WQS
- 2005 Development
- 2006 Development
- 2007 Development
- 2008 Development
- 2009 Development
- 2010 Review/application

Phase 6
Radical restructuring

- 2011 Ideation
- 2012 Priorities
- 2013 Development
- 2014 Development
- 2015 Development
- 2016 Development
- 2017 Review
- 2018 Apply

Phase 7
???

May be extended

- 2019 Climate
- 2020 Climate
- 2021 Ideation
- 2022 Development
- 2023 Development
- 2024 Review
- 2025 Apply

Watershed Model (CAST) Potential Changes

- What model changes are needed to assist the Bay Program Partnership in 2025 and beyond?
- List of changes to be prioritized into four bins
  - Complete by 2023
  - Work on for some future incorporation into model
  - Encourage research, but no definite model incorporation
  - No, don't do

For details:
watershed_modeling_workplan_options_for_2025_v2021_08_26_clean.pdf (chesapeakebay.net)

Watershed Model – Potential Changes

Scale

- Finer-scale modeling
- Spatially explicit CAST

Model Analysis

- Uncertainty quantification
- Co-benefits and ecosystem services
- Water quality standards assessment

Model Accuracy

- Physical process simulation
- Improve climate change modeling

Transparency

Not covering these

- Nutrient application calculation
- BMP reporting transparency

Watershed Model – Potential Changes

Uncertainty Quantification

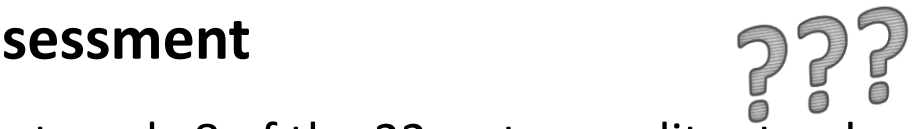
- Long sought by STAC and other parties
- How certain are we that we are getting the reduction we estimate?
- What parts of the model have the largest impact on the nutrient load estimation?

Co-Benefits and Ecosystem Services

- Develop models of living resource response via literature reviews and coordination with researchers
- Co-benefits include tree canopy (via land use) , fish habitat (via BIBI scores)
- Ecosystem services include carbon sequestration, harmful algal blooms

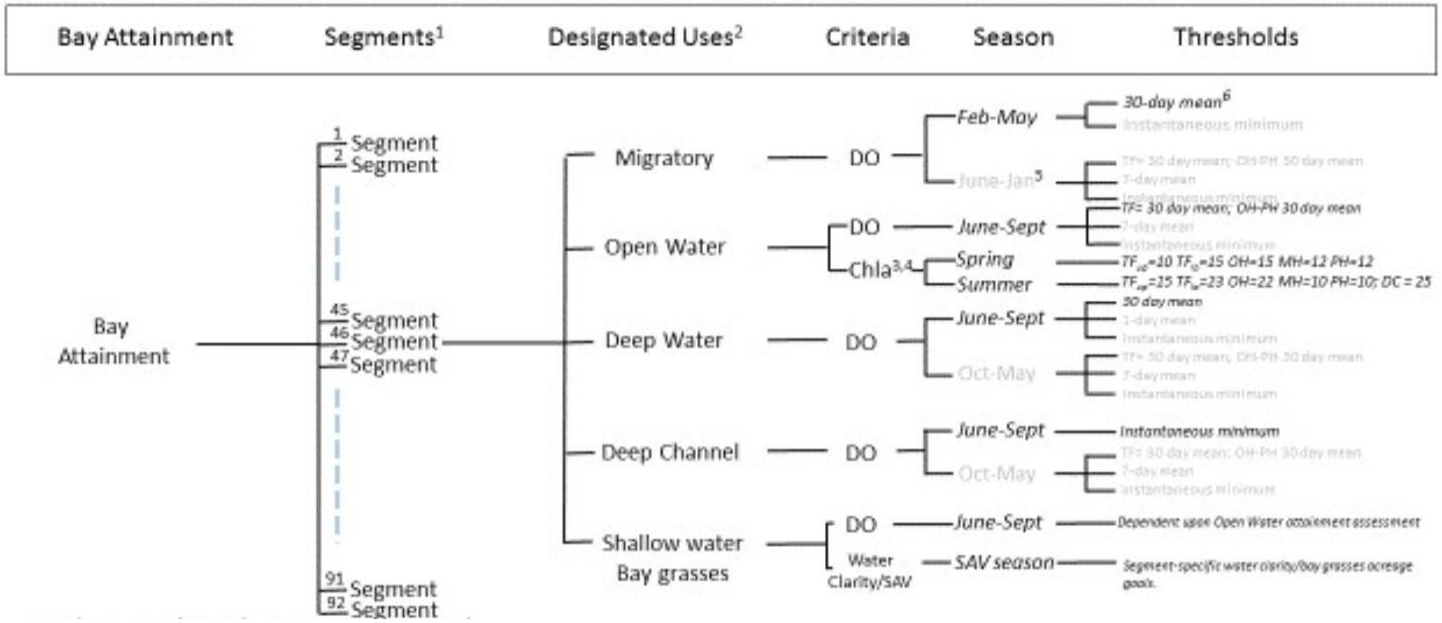
Watershed Model – Potential Changes

Water Quality Standards Assessment



- Currently able to directly evaluate only 8 of the 22 water quality standards
  - Hence no segment can be delisted for all relevant criteria
  - Will need more monitoring and data analysis

INDICATOR Water Quality Standards Attainment Assessment for Chesapeake Bay DO, Water Clarity and Chlorophyll a



Watershed Model – Potential Changes

Physical Process Improvement could include:

- New P simulation in urban area
  - Current fertilizer applications based on faulty data
- Revised sediment dynamics
  - Will affect nutrient loads; could use better data from USGS
- Revisions to nutrient inputs
  - Nutrient speciation
- Potential temperature simulation

Watershed Model – Potential Changes

- Bay Program committed to doing a 2035 **climate change assessment** in 2025
- Do we need a new model to do this or just use current models?

Climate Change improvements to include

- Temperature simulation
- Revised stream erosion process
- New data from research
  - Unlikely to have data to change BMP effectiveness

Watershed Model – Potential Changes

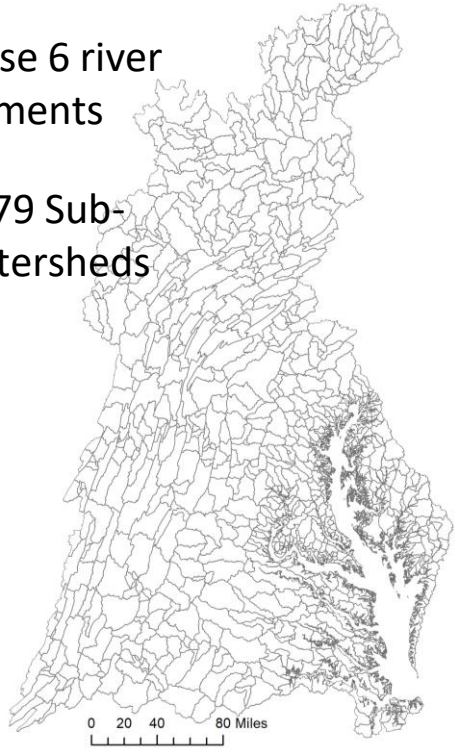
Finer Scale Modeling

- Greater calibration accuracy, potential finer scale targeting of BMPs, needed for some co-benefits

oppose

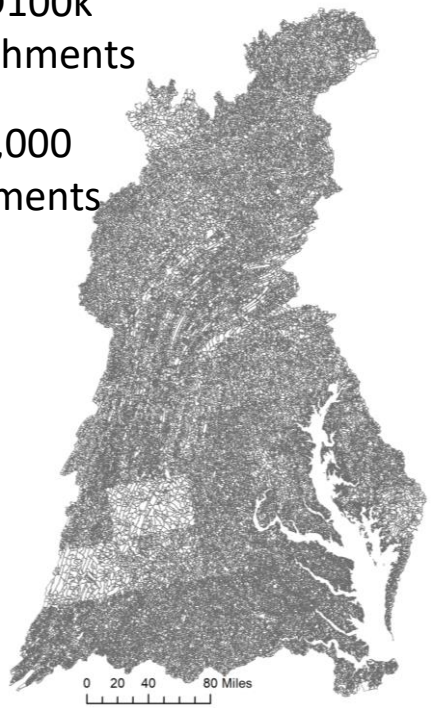
Phase 6 river segments

979 Sub-watersheds

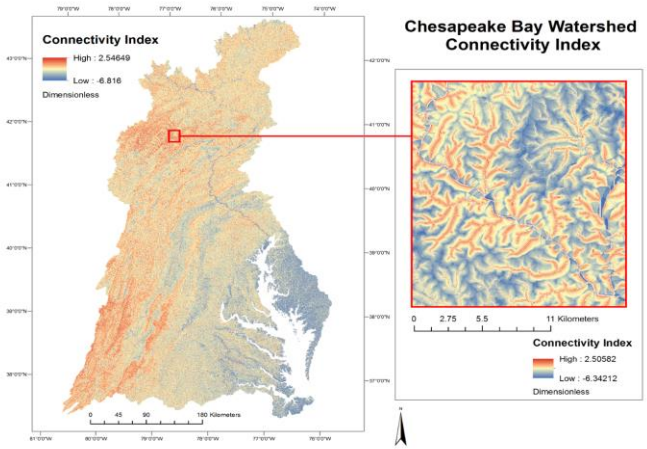


NHD100k Catchments

> 80,000 Catchments



Transport information on a 10-meter scale



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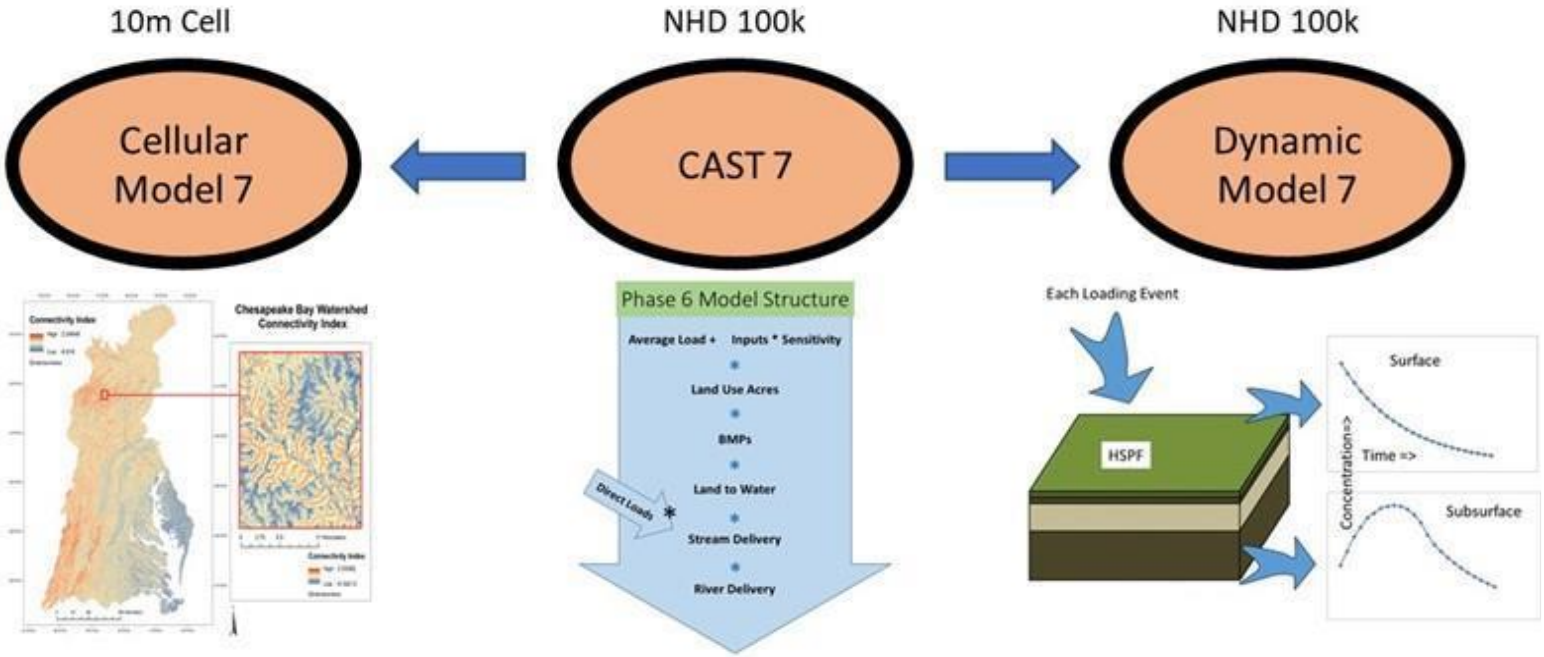
Watershed Model – Potential Changes

Finer Scale Modeling

- Concern with potential to set TMDL allocations at finer scales

oppose



The Cellular model could potentially support BMP targeting

CAST determines CBP official scenario loads

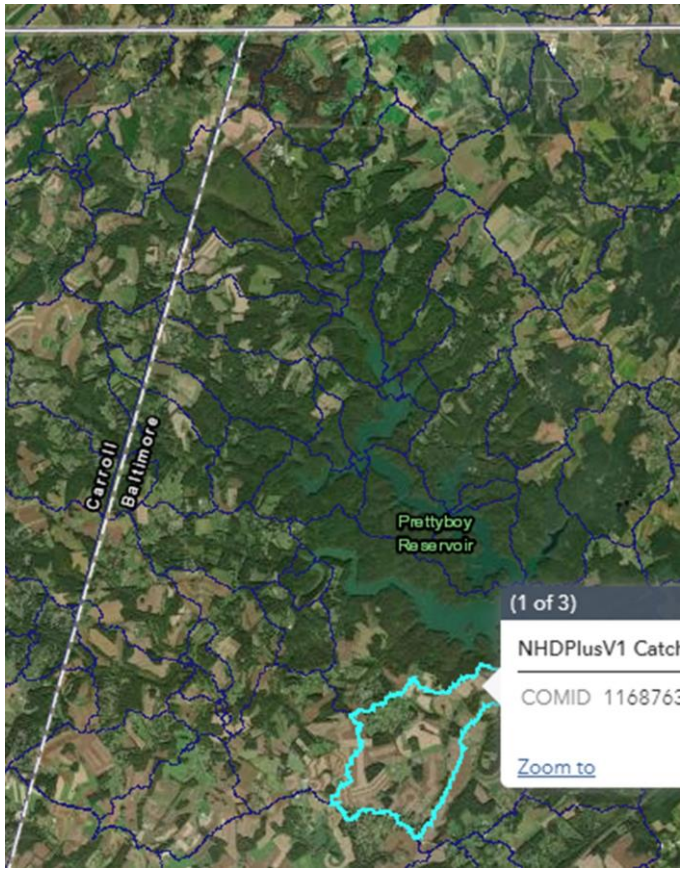
The Dynamic Model temporally downscales CAST results

Watershed Model – Potential Changes

Spatially Explicit CAST

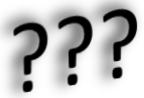
- With or without finer scale modeling
- Enable load calculations at finer scales than current land-river segments – using either current model loads or finer scale model loads

???



Water Quality Model Potential Changes

- New main bay estuarine model already being developed (RFP issued)
  - To replace old WQSTM
  - Unstructured grid to allow better simulation of shallow water dynamics



- Proposed development of multiple tidal tributary models (RFP proposed for early 2022)
  - To be coordinated with new main Bay model
  - To provide better simulation of water quality dynamics in shallow water of tributaries

For details: [estuarine_modeling_options_for_2025_draft_clean_8-27-21.pdf (chesapeakebay.net)]

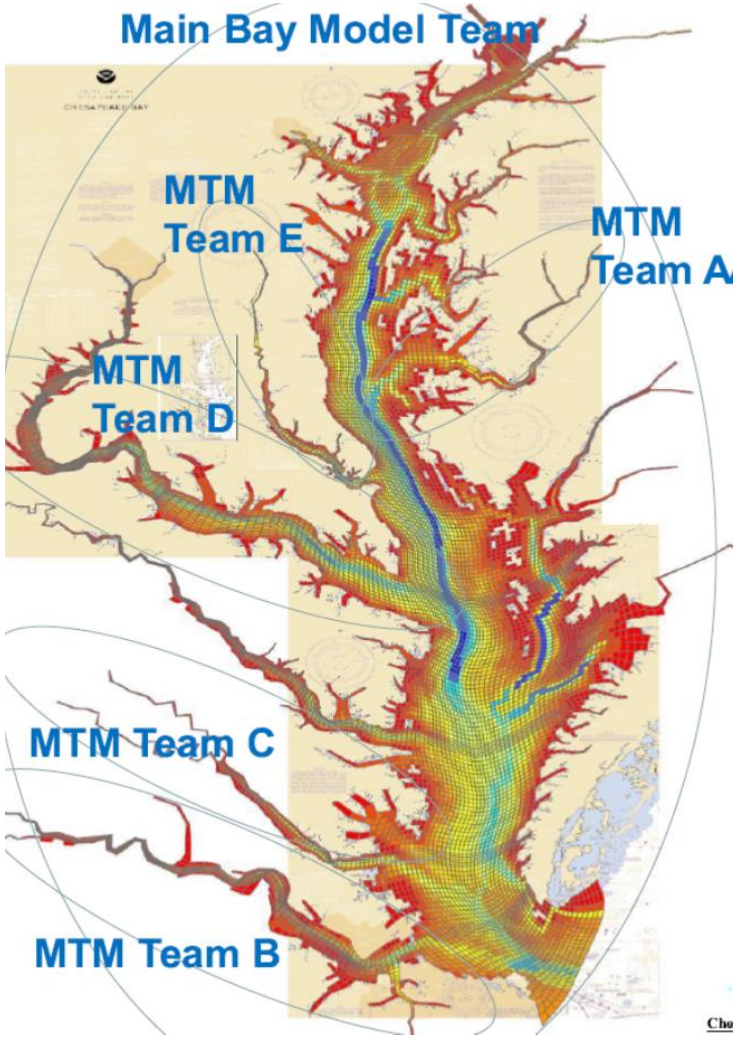
Water Quality Model Potential Changes

New Main Bay Model covering all tidal waters

- Will integrate findings from multiple trib models
- Will assess attainment of management scenarios

Potential multiple trib model teams

- Develop 3 or more trib models
- Work collaboratively with main Bay model team



Water Quality Model Potential Changes

Potential tributary model candidates

- James, with emphasis on chlorophyll-A simulation and the Lynnehaven, Lafayette and Elizabeth rivers
- Potomac, with emphasis on Anacostia DC waters and selected Virginia embayments
- Patuxent (Md)
- York and Mobjeck (Va)
- Choptank (Md)
- Rappahannock (Va)
- Chester and Corsica (Md)
- Patapsco and Back River (Md)

Seeking WRTC Feedback

Watershed Model/CAST

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- Spatially explicit CAST
- Uncertainty quantification
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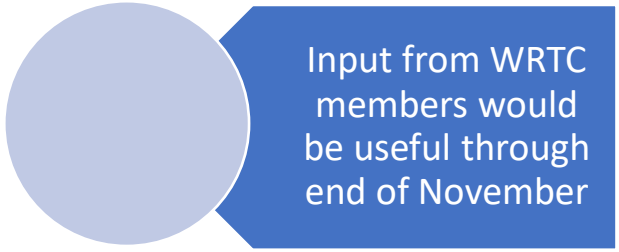
- Improve climate change modeling



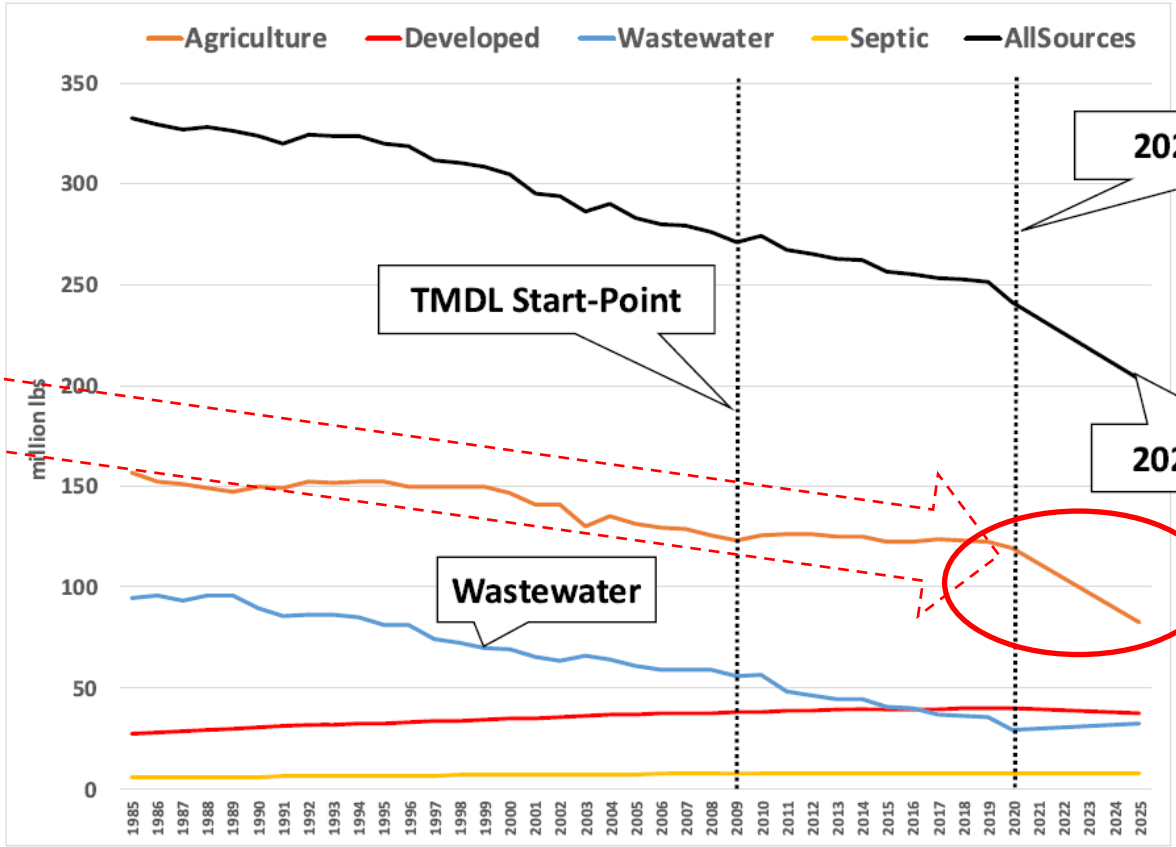
Water quality model

- Tributary models in general
- Tributary model for Potomac, tidal Anacostia

Future Preview – Modeled Loads

CBW Nitrogen Loads Delivered to CB

Achieving WIP implementation goals primarily dependent on reductions from ag sector



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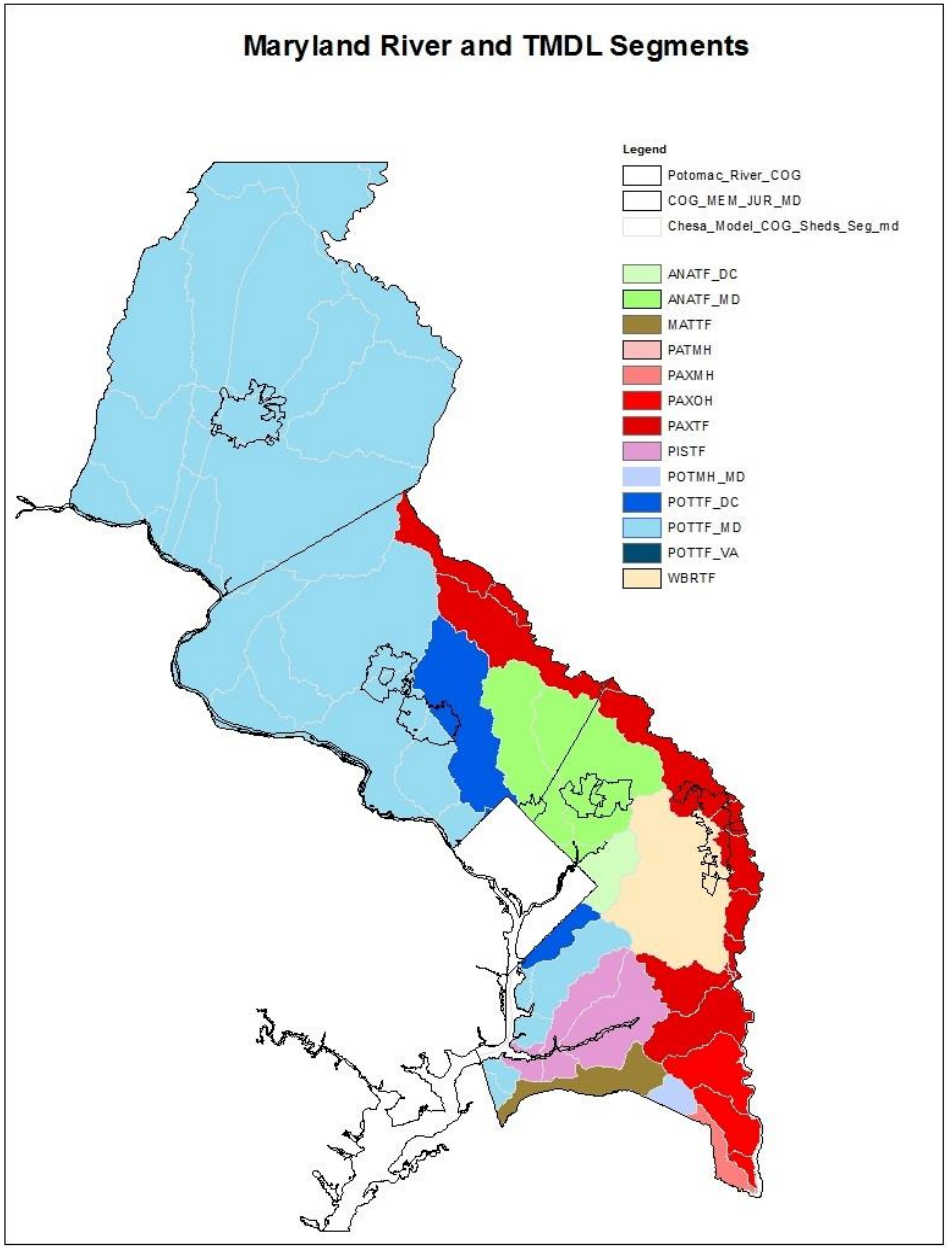
Extra Slides

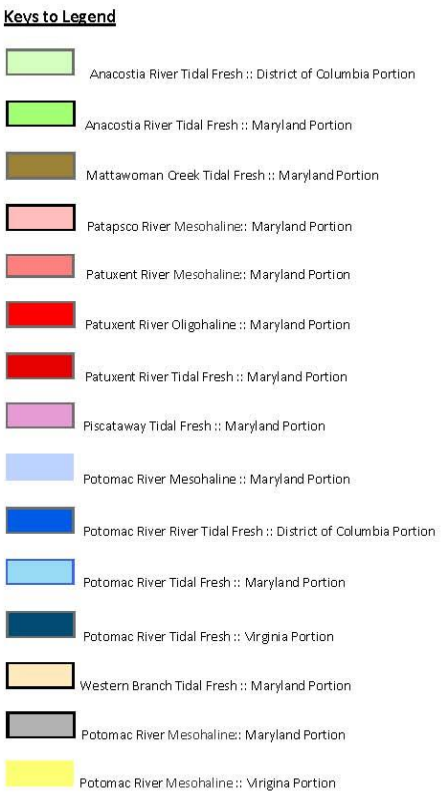
Segment-sheds in COG region

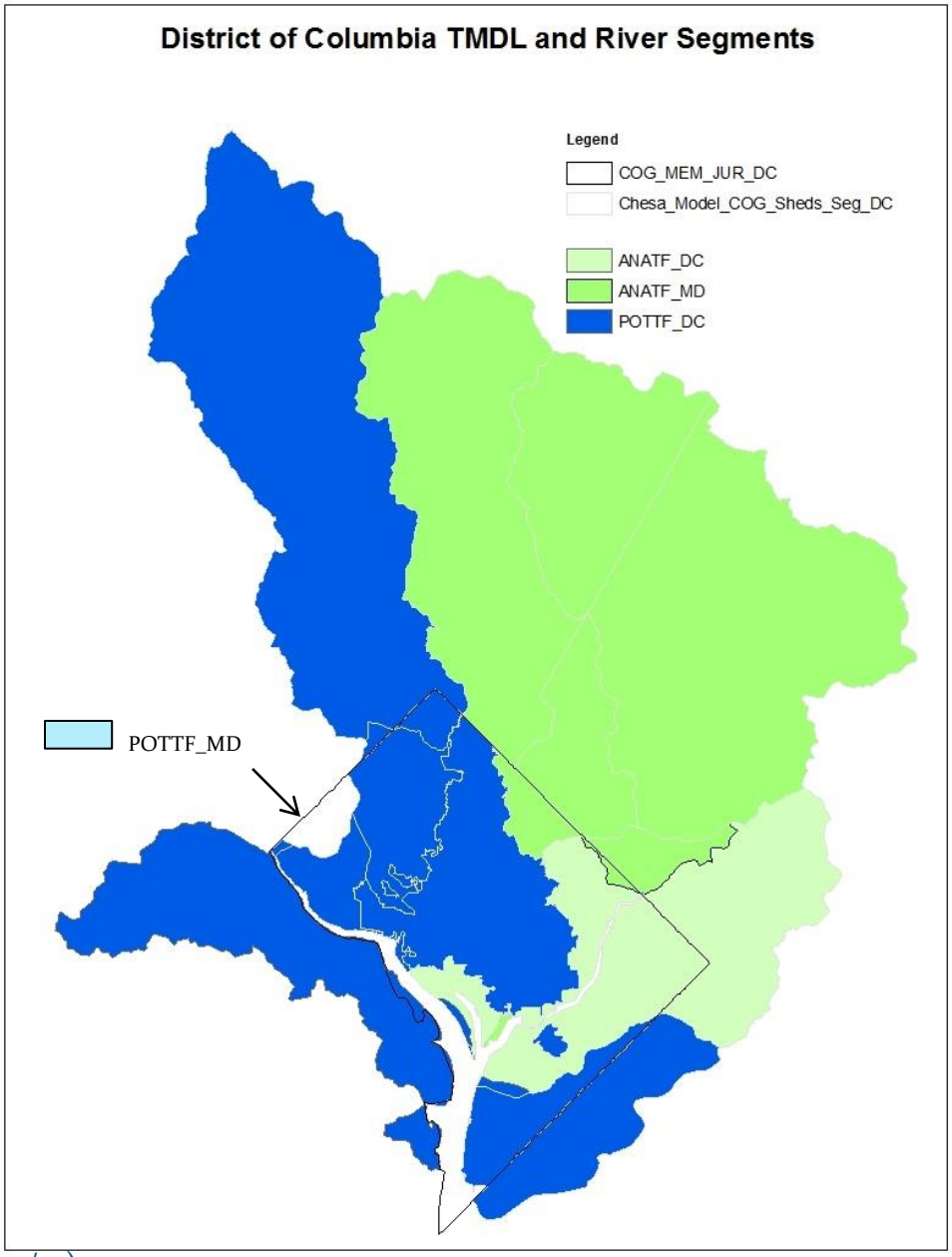
Keys to Legend

- Anacostia River Tidal Fresh :: District of Columbia Portion
- Anacostia River Tidal Fresh :: Maryland Portion
- Mattawoman Creek Tidal Fresh :: Maryland Portion
- Patapsco River Mesohaline:: Maryland Portion
- Patuxent River Mesohaline:: Maryland Portion
- Patuxent River Oligohaline :: Maryland Portion
- Patuxent River Tidal Fresh :: Maryland Portion
- Piscataway Tidal Fresh :: Maryland Portion
- Potomac River Mesohaline :: Maryland Portion
- Potomac River River Tidal Fresh :: District of Columbia Portion
- Potomac River Tidal Fresh :: Maryland Portion
- Potomac River Tidal Fresh :: Virginia Portion
- Western Branch Tidal Fresh :: Maryland Portion
- Potomac River Mesohaline:: Maryland Portion
- Potomac River Mesohaline :: Virigina Portion



Segment-sheds in COG region





Segment-sheds in COG region

Keys to Legend

- Anacostia River Tidal Fresh :: District of Columbia Portion
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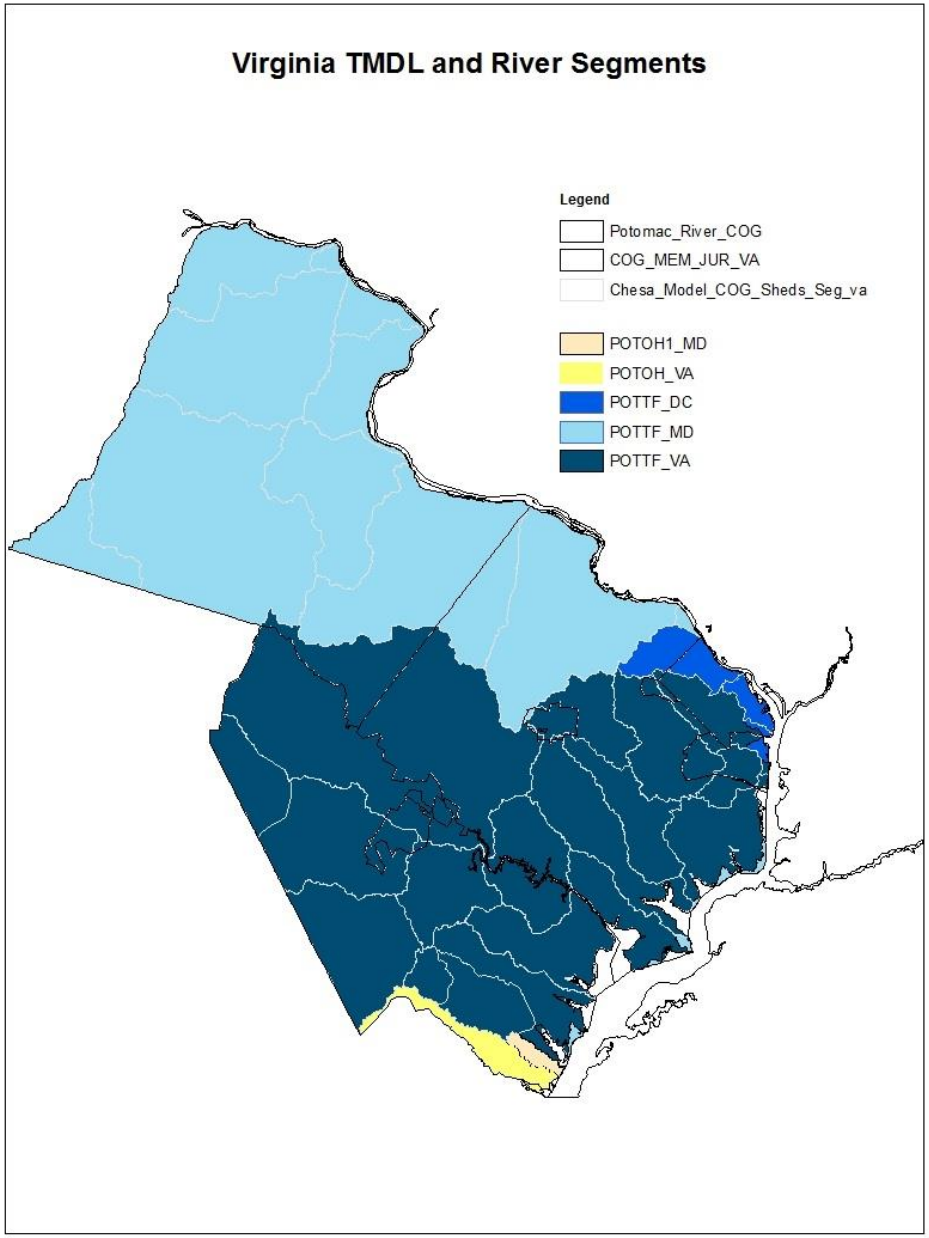
- Patapsco River Mesohaline:: Maryland Portion
- Patuxent River Mesohaline:: Maryland Portion
- Patuxent River Oligohaline :: Maryland Portion
- Patuxent River Tidal Fresh :: Maryland Portion
- Piscataway Tidal Fresh :: Maryland Portion
- Potomac River Mesohaline :: Maryland Portion
- Potomac River River Tidal Fresh :: District of Columbia Portion
- Potomac River Tidal Fresh :: Maryland Portion
- Potomac River Tidal Fresh :: Virginia Portion
- Western Branch Tidal Fresh :: Maryland Portion
- Potomac River Mesohaline:: Maryland Portion
- Potomac River Mesohaline :: Virigina Portion



Segment-sheds – COG Region

- Defined by impaired water-segments and its contributing watersheds
- TMDLs defined for each segment-shed
- Counties/District generally have multiple segment-sheds, e.g.,
  - District (4)
  - Montgomery (5)
  - Prince George's (7)

Segment-sheds	DC	MD	VA
ANATF_DC	X	X	
ANATF_MD	X	X	
POTTF_DC	X	X	X
POTTF_MD	X	X	X
POTTF_VA		X	X