

Chesapeake Bay TMDL 2017 Midpoint Assessment: Policy Options and Implementation Considerations for Addressing Climate Change in Jurisdictions' Phase III Watershed Implementation Plans



**WATER QUALITY GOAL IMPLEMENTATION TEAM
SEPTEMBER 26, 2017**

**MARK BENNETT, USGS
CHAIR, CLIMATE RESILIENCY WORKGROUP**

**ZOE JOHNSON, NOAA
COORDINATOR, CLIMATE RESILIENCY WORKGROUP**

**LEW LINKER, EPA-CBO
MODELING COORDINATOR**



Chesapeake Bay Program
Science. Restoration. Partnership.

Climate Change & the TMDL Mid-Point Assessment

2

Assessment Procedures

(PSC approved 12/13/16)

Assess how climate change may affect current water quality standards (i.e., nutrient and sediment source loads over time and attainment)

- Precipitation change (increased volume and intensity)
- Temperature increase (air and water)
- Sea level rise (hydrodynamics and impacts to beneficial resources (i.e., wetlands))

Guiding Principles

(PSC approved 12/13/16)

- WIP Development
 - Capitalize on Co-Benefits
 - Reduce vulnerability
- WIP Implementation
 - Monitor performance
 - Adaptability

Policy Components

(under consideration)

- Quantitative
 - Factor climate change impacts into Phase III WIP Base Conditions
- Qualitative
 - Adaptively Manage Phase III WIP BMP Implementation

Estimated Influence of Historical Trends of Precipitation, Temperature, and Sea Level Rise on Chesapeake Tidal Water Quality Standards: Results of the CBP Climate Change Analysis

Water Quality Goal Implementation Team
September 26, 2017

Lee Currey, MDE and Dave Montali, Tetra Tech with
Lew Linker, EPA-CBPO, Gary Shenk, USGS-CBPO and the Modeling Team

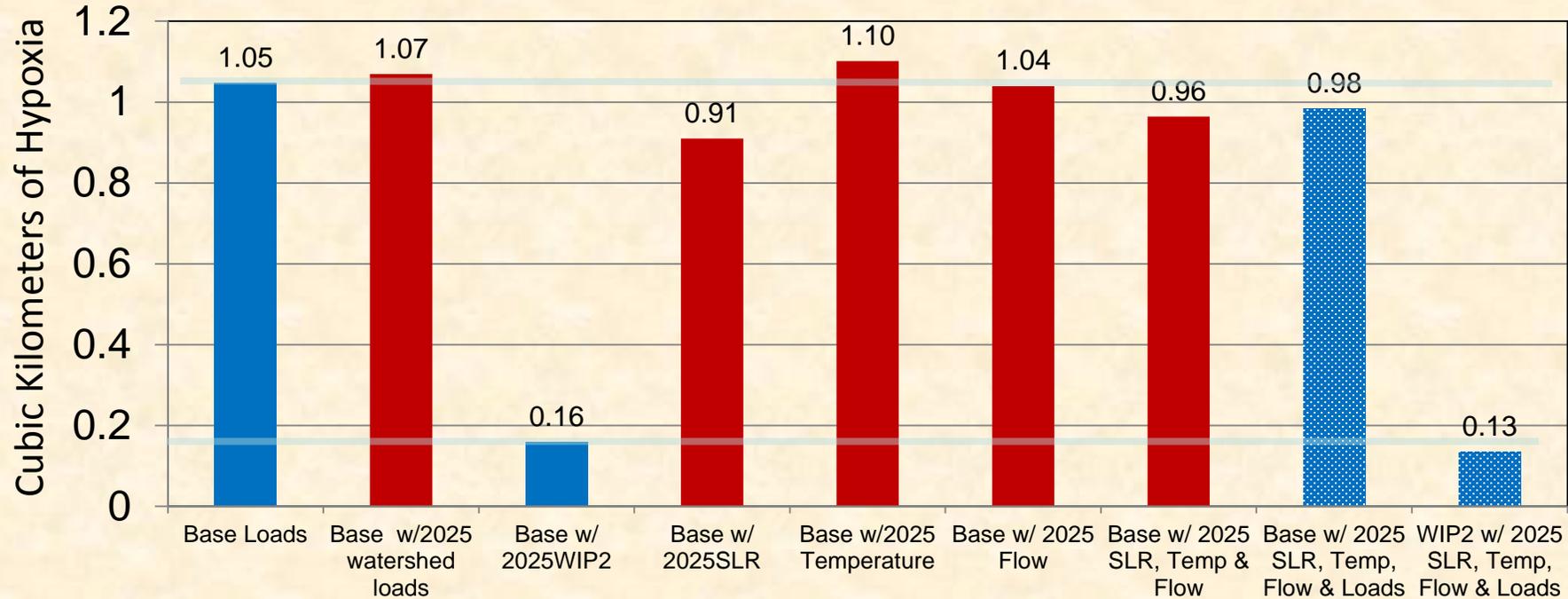


Chesapeake Bay Program
Science, Restoration, Partnership



Chesapeake Bay Program
Science, Restoration, Partnership

Hypoxic volume (DO <1 mg/l) in CB4MH (Model estimate in summer 1991-2000)

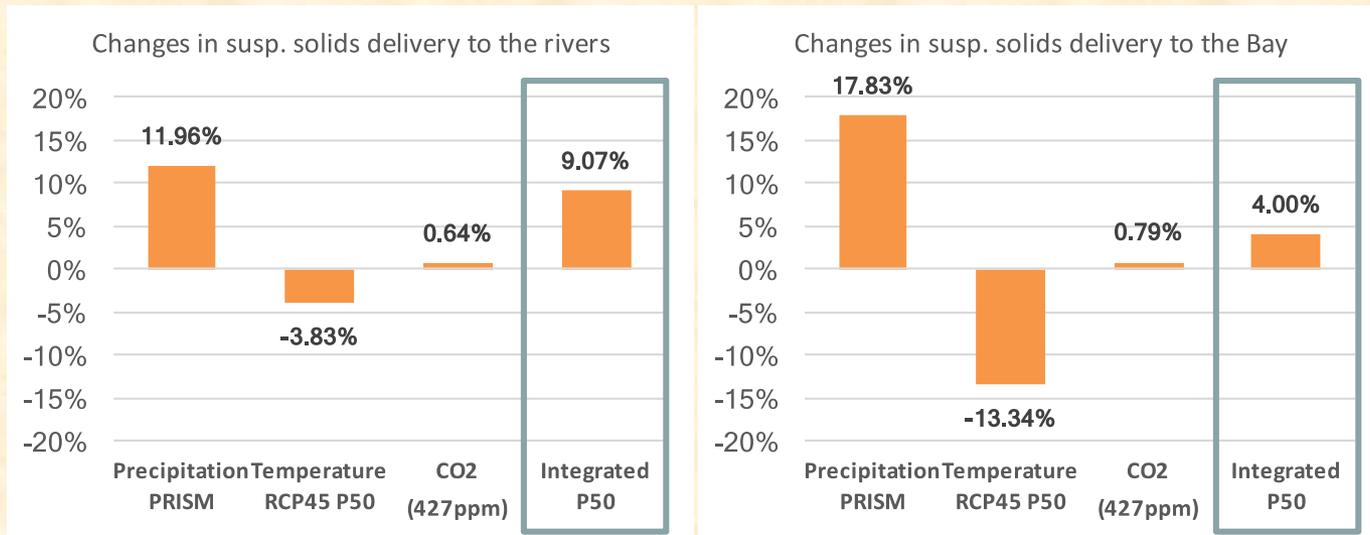


DO <1 mg/l annual average daily hypoxia from 1991 to 2000 over the summer hypoxic season of May through September.

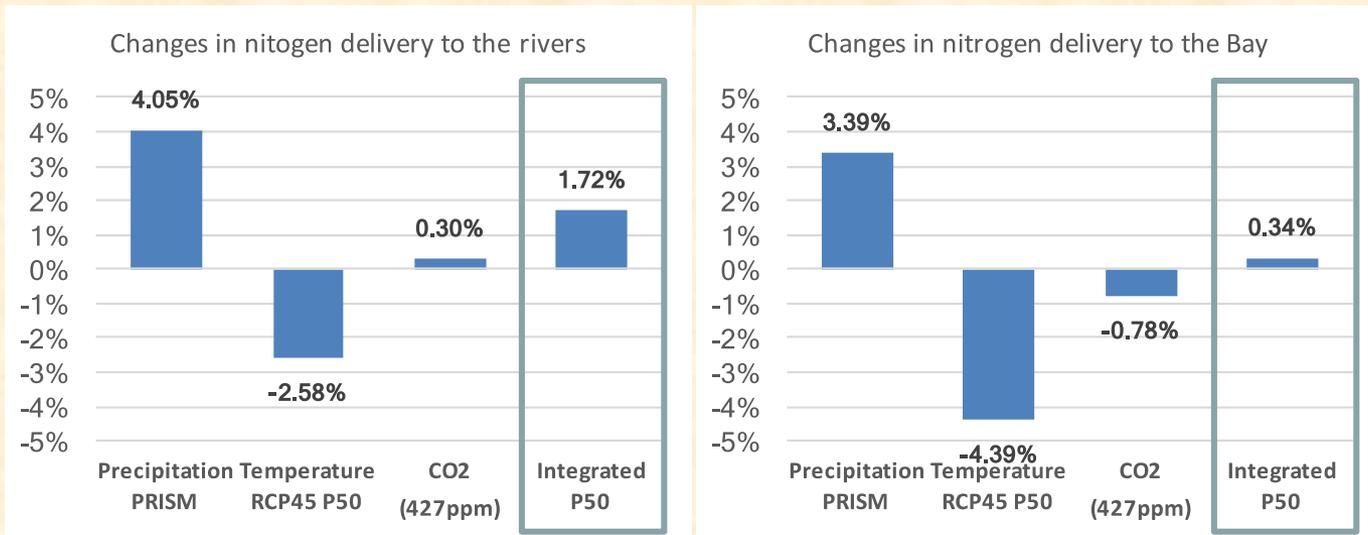
solid blue = key scenario, solid red = sensitivity scenario, stippled blue = 2025 climate scenario

This work used the Draft August Phase 6 Watershed Model and WQSTM to provide the best estimate of relative 2025 hypoxia under different temperature, sea level rise (SLR), and watershed flow and load conditions assuming a 0.3 m SLR condition. We need to run the analysis on the final Watershed and WQSTM models and with a 0.17 m estimated SLR for 2025.

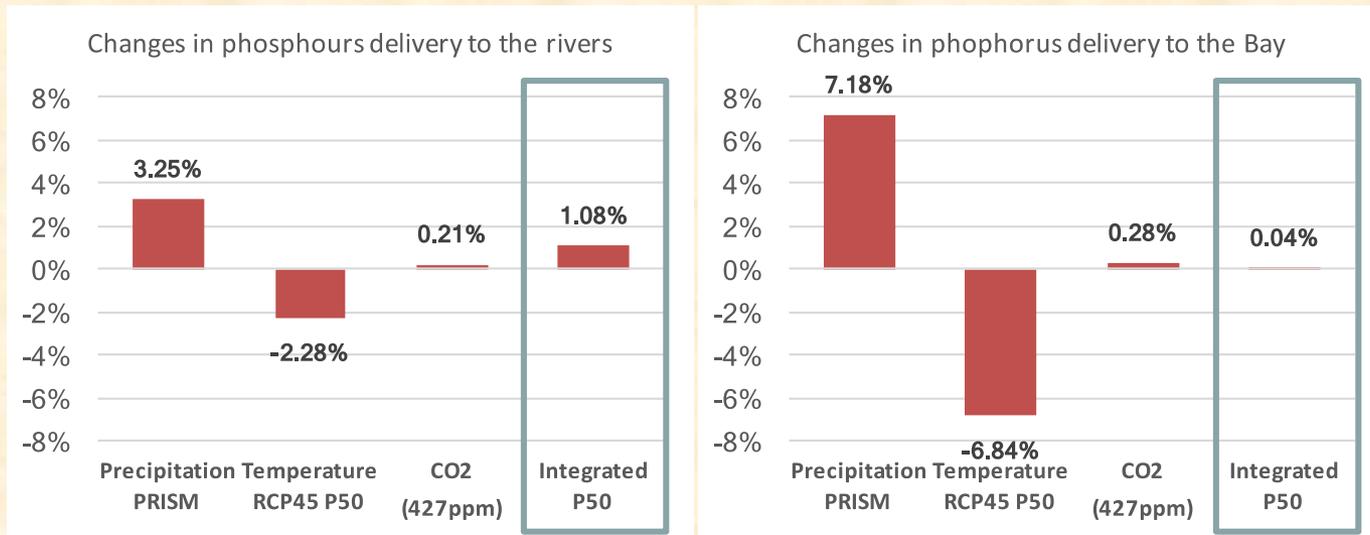
Model results: *suspended solids to rivers and the Bay*



Model results: *nitrogen to rivers and the Bay*

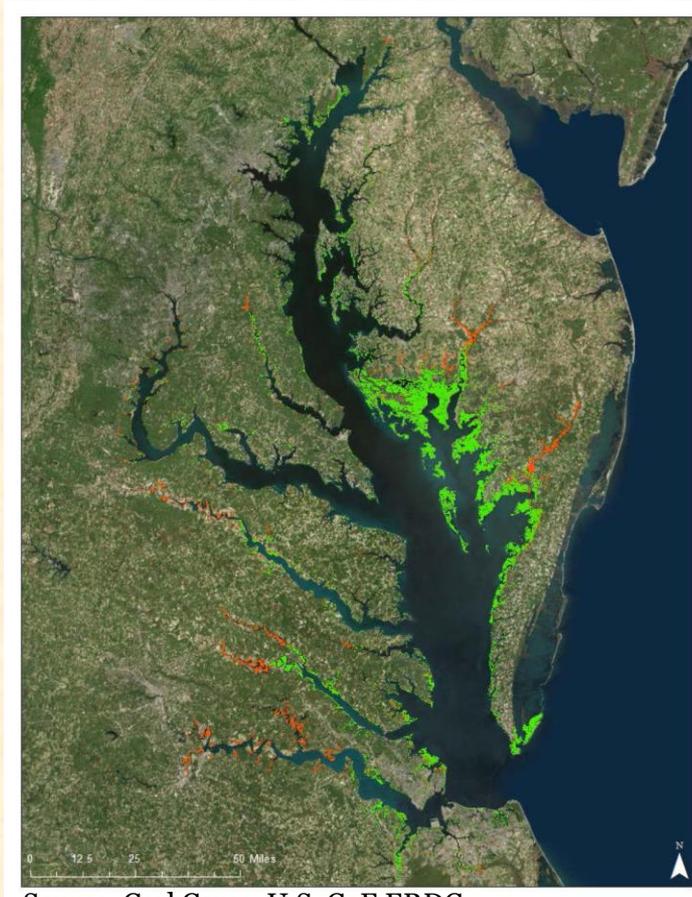


Model results: *phosphorus to rivers and the Bay*





Chesapeake Bay Tidal Wetlands

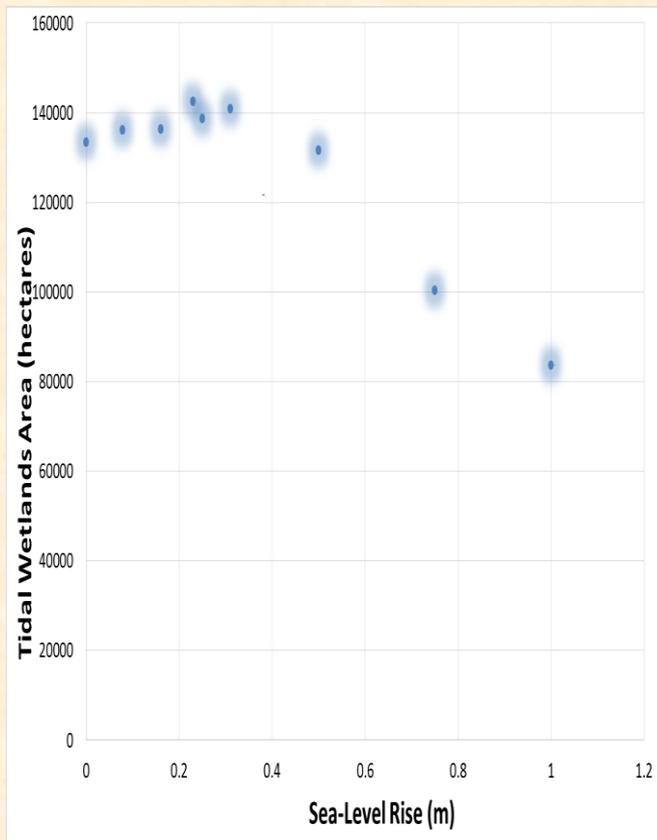


Source: Carl Cerco, U.S. CoE ERDC

- The extent from National Wetlands Inventory is determined largely from vegetation perceived via aerial photography.
- 190,000 hectares of estuarine (green) and tidal fresh (red) wetlands.
- A tidal wetlands module is now fully operational in the WQSTM. The module incorporates functions of sediment and particulate nutrient removal and burial, denitrification, and respiration. The loss of wetland function due to sea level rise and inundation will be accounted for explicitly.



Influence of Estimated 2025 (0.3 m) and 2050 (0.5 m) Sea Level Rise on Tidal Wetland Attenuation



There is little change in estimated total tidal wetland area for 2025 (0.3 m) and 2050 (0.5 m) which equates to negligible changes in tidal wetland attenuation.

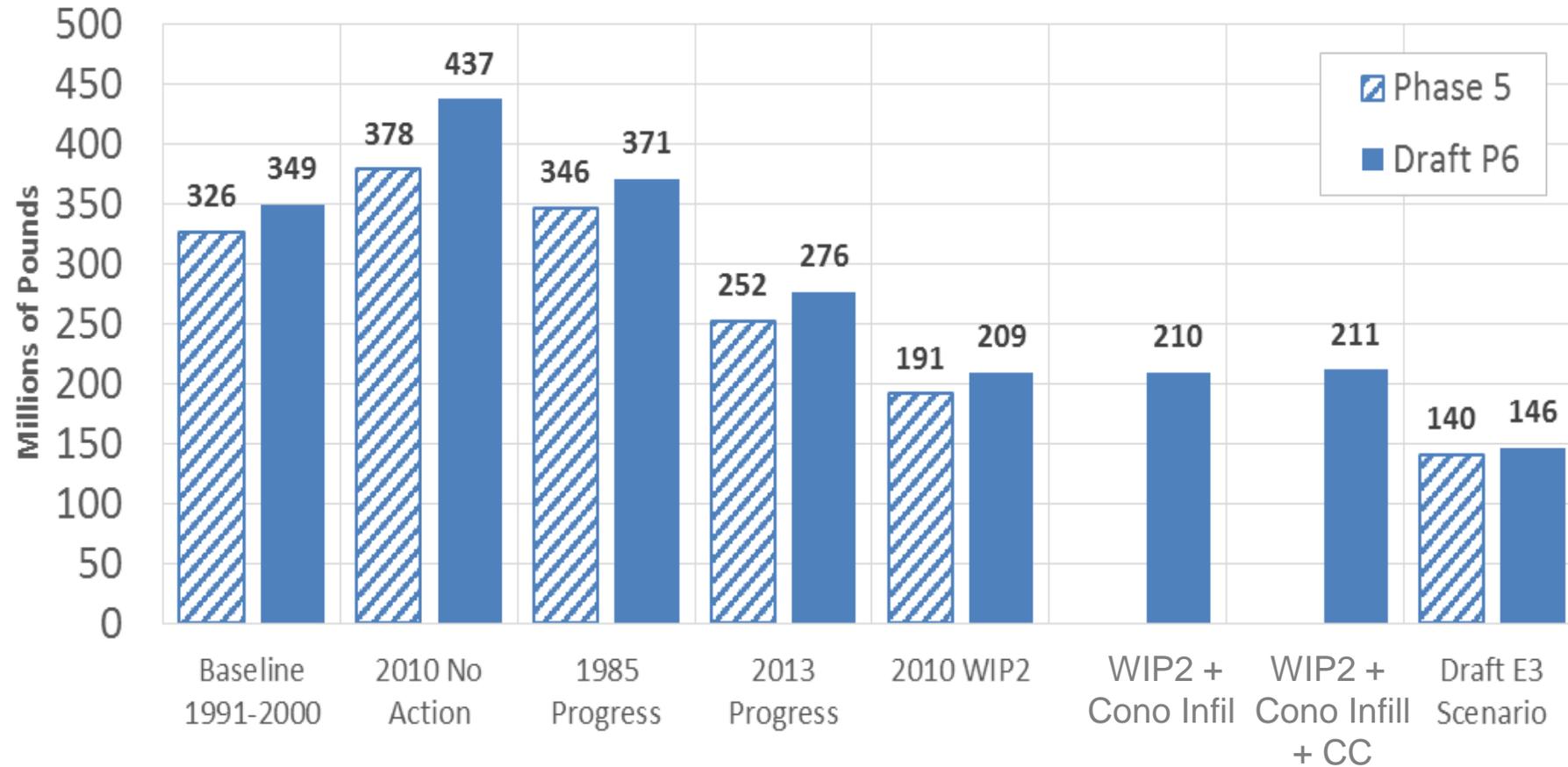
Long range (2100) conditions estimate tidal wetland changes to be on the order of a 40% loss in the Chesapeake which could reduce tidal wetland attenuation on the order of about 10 million pounds nitrogen and 0.6 million pounds phosphorus.

Source: Carl Cerco, CoE ERDC and Lara Harris, UMCES Sea Level Affecting Marshes Model (SLAMM) results.



Phase 6 Nitrogen Loads

Draft Phase 6 September, Total Nitrogen Delivery to the Bay

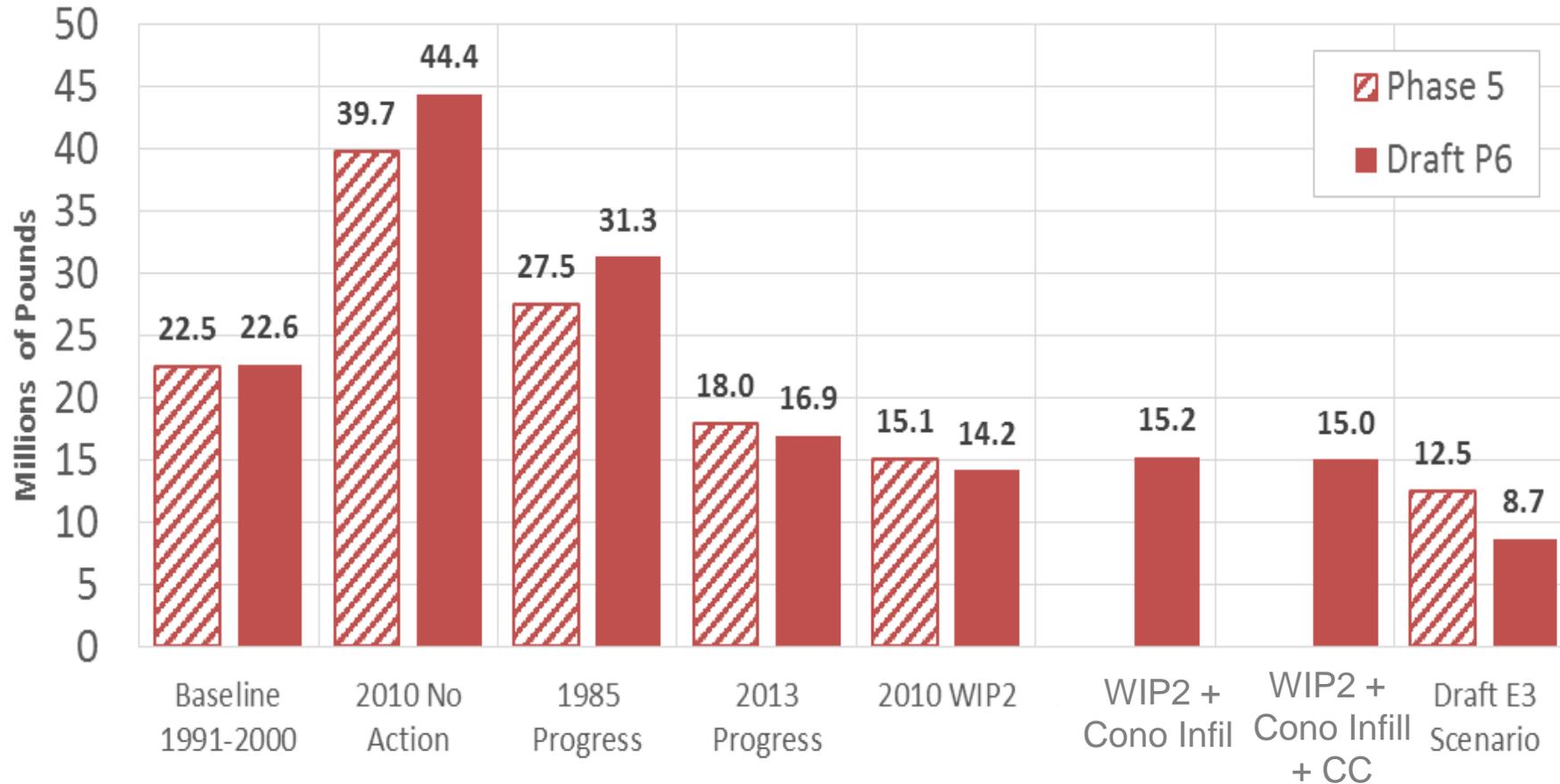


2017 September Draft Phase 6 in solid blue bars. Phase 5.3.2 in stippled bars. Units in millions of pounds.



Phase 6 Phosphorus Loads

Draft Phase 6 September, Total Phosphorus Delivery to the Bay



2017 September Draft Phase 6 in solid blue bars. Phase 5.3.2 in stippled bars. Units in millions of pounds.



The Phase 6 Assessment of Deep Channel DO Standard Achievement

		Base	No Action	1985 Progress	1993 Progress	2013 Progress	WIP2	WIP2 + Cono Infill	WIP2 + Cono + CC	E3	All Forest
Phase 6		349TN	437TN	371TN	279TN	276TN	209TN	210TN	211TN	146TN	40TN
9/25/17		22.6TP	44.4TP	31.3TP	17.9TP	16.9TP	14.2TP	15.2TP	15.0TP	8.7TP	2.1TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	14.9%	10.6%	8.1%	1.6%	0.0%	0.6%	0.7%	0.0%	0.0%
CB4MH	MD	46.0%	56.1%	50.6%	47.2%	31.1%	16.8%	18.9%	19.4%	0.0%	0.0%
CB5MH	MD/VA	14.2%	21.8%	17.4%	15.6%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	MD	37.4%	25.5%	19.8%	17.9%	9.3%	8.8%	11.5%	13.2%	0.6%	0.0%
POTMH	MD/VA	20.2%	23.9%	19.4%	17.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	24.0%	19.5%	17.7%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	27.9%	18.3%	17.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	34.4%	23.1%	19.5%	13.4%	9.8%	14.5%	14.6%	1.1%	0.0%
MD5MH	MD	21.7%	29.2%	24.4%	22.4%	6.8%	0.0%	0.0%	0.1%	0.0%	0.0%
VA5MH	VA	4.5%	11.9%	7.9%	6.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	44.2%	41.2%	28.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

		Base	No Action	1985 Progress	2009 Progress	WIP2	E3	All Forest
Phase 5.3.2		323TN	376TN	344TN	264TN	189TN	138TN	54TN
		20.6TP	37.9TP	25.7TP	18.3TP	13.2TP	10.6TP	2.6TP
		1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995	1993-1995
Cbseg	State	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel	Deep Channel
CB3MH	MD	16.0%	22.0%	19.2%	7.3%	0.2%	0.0%	0.0%
CB4MH	MD	46.0%	52.8%	49.1%	26.4%	2.9%	0.0%	0.0%
CB5MH	MD/VA	14.2%	20.0%	37.4%	0.6%	0.0%	2.3%	0.0%
CHSMH	MD	37.4%	41.5%	22.7%	35.6%	16.6%	0.6%	0.0%
POTMH	MD/VA	20.2%	27.4%	22.7%	0.0%	0.0%	0.0%	0.0%
POMMH	MD	20.4%	27.6%	22.8%	0.0%	0.0%	0.0%	0.0%
RPPMH	VA	19.0%	28.1%	25.1%	0.0%	0.0%	0.0%	0.0%
EASMH	MD	25.4%	35.6%	27.5%	14.0%	1.6%	1.1%	0.0%
MD5MH	MD	21.7%	27.2%	23.8%	3.9%	0.0%	0.0%	0.0%
VA5MH	VA	4.5%	10.7%	7.4%	0.0%	0.0%	0.0%	0.0%
PATMH	MD	24.8%	49.1%	38.2%	11.5%	0.0%	0.0%	0.0%

PSC Decision Points

10

- PSC Decision Point #1: Approve policy approach to guide Jurisdictions' development and implementation of Phase III Watershed Implementation Plans
- PSC Decision Point #2: Establish the “minimum standard” for implementation in Jurisdictions' Phase III WIPs
- PSC Decision Point #3: Establish the level of flexibility among jurisdictions, as well as commitments for CBP programmatic support (e.g., guidance, data, funding, etc.), for implementation of climate change policies that exceed the “minimum standards” of Partnership approved quantitative and/or qualitative policy elements

Briefing Document

11

Chesapeake Bay TMDL 2017 Midpoint Assessment Policy Options and Implementation Considerations for Addressing Climate Change in Jurisdictions' Phase III Watershed Implementation Plans

CBP Climate Resiliency Workgroup
WQGIT Briefing Document
09.06.17

Background:

Informed by the outcomes of the Midpoint Assessment's climate change modeling assessment, the Chesapeake Bay Program (CBP) Partnership is scheduled to decide by October 2017 when and how to incorporate climate change considerations into the jurisdictions' Phase III Watershed Implementation Plans (WIPs). To inform this process, the CBP Climate Resiliency Workgroup (CRWG) was tasked with informing the climate change projections and scenarios for input into the watershed and estuarine modeling efforts; exploring both quantitative and qualitative policy options for addressing climate change in the Phase III WIPs; and, developing policy implementation guidance for the Partnership's consideration. During the fall of 2016, the CRWG responded with a set of recommended Guiding Principles, a comprehensive set of policy options, and implementation guidance to the Partnership.

On December 13, 2016, the CBP Partnership Principals' Staff Committee (PSC) approved the [proposed climate change assessment procedures](#) for determining the projected mid-term (2025) and long-term (2050) impacts on the Chesapeake Bay watershed loads and the Chesapeake Bay water quality; and, the set of Guiding Principles as recommended by the Management Board. The PSC did not reach a decision on how and when to incorporate climate change considerations into the Phase III WIPs but instead agreed to continue to work together between now and the next PSC retreat (October 30-31, 2017) to evaluate how the "Quantitative Policy Option" (#2)² will play out based on additional modeling results as they become available. Additionally, the PSC agreed to consider language proposed by the Chesapeake Bay Commission (CBC) to combine the proposed "Qualitative Policy Options" (#5-7).³

Since the decisions issued by the PSC in December, 2016, the CRWG has continued to support the modeling component of the Midpoint Assessment and to further consideration of the proposed policy options, including the drafting of proposed revisions⁴ to the language offered by the CBC and the development of additional implementation guidance for consideration by the Partnership.

¹ Jurisdictions include the six Bay Watershed states (NY, PA, MD, DE, WV, VA) and the District of Columbia.

² *Quantitative Option #2 (as proposed by CRWG): Factor Climate Change into Phase III WIPs Base Conditions:* Use the 2025 climate projection scenarios as base conditions (informed by CBWM climate modeling results) in the establishment of the jurisdictions' Phase III WIPs. The climate change projection would be an added load that the jurisdictions would need to address in addition to their Phase III WIP planning targets, thereby increasing the level of effort.

³ *Qualitative Options #5-7 (as proposed by CBC: Adaptively Manage Phase III WIPs BMP Implementation:* During each two-year milestone development period, jurisdictions would consider new information on the performance of BMPs and the programs that support them, including the contribution of seasonal, inter-annual climate variability and weather extremes on BMP performance. When there is a detectable impact on the effectiveness of a BMP or programmatic performance, jurisdictions would use this information to re-prioritize their actions to implement in the Phase III WIPs that will better mitigate the anticipated increased in nitrogen, phosphorus or sediment.

The Issue(s):

How to incorporate climate change considerations into Phase III WIPs.

Important Timelines and Process Steps to consider:

- October 30-31, 2017: The PSC [is scheduled](#) to decide on how to incorporate climate change considerations into the jurisdictions' Phase III WIPs. Leading up to this, on:
 - September 11, 2017: The CRWG will present its proposed policy options and implementation guidance to the Water Quality Goal Implementation Team (WQGIT).
 - Sept. 19, 2017: The Modeling Workgroup will present its latest climate change modeling results; and
 - Sept. 25-26: The full WQGIT will consider both the modeling results and policy options at its Sept. 25-26 in-person meeting.

Decisions:

The key decision the Partnership [is requested](#) to make is whether to include both "Quantitative" and "Qualitative" policies for the incorporation of climate change considerations in the Phase III WIPs. The specific decision points [are outlined](#) below:

Decision Point #1: Approve policy approach to guide Jurisdictions' development and implementation of Phase III Watershed Implementation Plans

Quantitative Component (approved for consideration by PSC) - Factor Climate Change into Phase III WIP Base Conditions: Use the 2025 climate projection scenarios as base conditions (informed by CBWM climate modeling results) in the establishment of the jurisdictions' Phase III WIPs. The climate change projection would be an added load that the jurisdictions would need to address in addition to their Phase III WIP planning targets, thereby increasing the level of effort.

Implementation Considerations: The climate change projection would be an added load that jurisdictions would need to address in addition to their Phase III WIP planning targets, thereby potentially increasing the level of effort. Addressing climate change as part of the base conditions does not change the assimilative capacity of the Bay, nor the Phase III WIP planning targets. The Partnership will have modeling output results based on a subset of 2025 and 2050 climate scenarios, but there will be uncertainty. Projections of climate and BMP response will likely change over time. Jurisdictions would assess this information and adjust plans in accordance with Chesapeake Bay TMDL, Section 10: Implementation and Adaptive Management. To offset anticipated changes in loads due to climate change, a greater level of effort (i.e., BMP implementation) [may be needed](#) to meet water quality standards. Jurisdictions would include a narrative describing these decisions in their Phase III WIPs.

Qualitative Component (proposed for consideration by CBC) - Adaptively Manage Phase III WIP BMP Implementation: During each two-year milestone development period, jurisdictions would consider new information on the performance of BMPs and the programs that support them, including the contribution of seasonal, inter-annual climate variability and weather extremes on BMP performance. When there is a detectable impact on the effectiveness of a BMP or programmatic performance, jurisdictions would use this information to adjust and/or re-

Quantitative Policy Component (under consideration)

12

- *Factor Climate Change into Phase III WIP Base Conditions:*
 - Use the 2025 climate projection scenarios as base conditions (informed by CBWM climate modeling results) in the establishment of the jurisdictions' Phase III WIPs.
 - The climate change projection would be an added load that the jurisdictions would need to address in addition to their Phase III WIP planning targets, thereby increasing the level of effort.

Qualitative Policy Component

(under consideration/language proposed by CBC)

13

- ***Adaptively Manage Phase III WIP BMP Implementation:***

- During each two-year milestone development period, jurisdictions would consider new information on the performance of BMPs and the programs that support them, including the contribution of seasonal, inter-annual climate variability and weather extremes on BMP performance.
- When there is a detectable impact on the effectiveness of a BMP or programmatic performance, jurisdictions would use this information to adjust and/or re-prioritize their actions to implement in the Phase III WIPs that will better mitigate the anticipated increases in nitrogen, phosphorus or sediment.

Qualitative Policy Component

(revised language/proposed by CRWG)

- ***Optimize Phase III WIP Development and Adaptively Manage BMP Implementation:***
 - *Element A:* During the development of Phase III WIPs, jurisdictions will consider and prioritize BMPs that are more resilient to future climate impacts over the intended design life of the proposed practices.
 - *Element B:* Within a practical time-period applicable to an individual source sector, initiative or action, the Partnership will consider new information on the performance of BMPs, including the contribution of seasonal, inter-annual climate variability, and weather extremes. Jurisdictions will assess this information and their support programs and adjust plans through the two-year milestone process to implement their Phase III WIPs to better mitigate anticipated increases in nitrogen, phosphorus, or sediment due to climate change.
 - *Element C:* Jurisdictions will provide a narrative consistent with the Guiding Principles that describes their programmatic commitments to address climate change in their Phase III WIPs.

PSC Decision Point #1

15

- **Decision:** Approve policy approach to guide Jurisdictions' development and implementation of Phase III Watershed Implementation Plans
 - Quantitative Component (approved for consideration by PSC) - Factor Climate Change into Phase III WIP' Base Conditions
 - Qualitative Component (language proposed for consideration by CBC) - Adaptively Manage Phase III WIP BMP Implementation
 - Qualitative Component (language proposed for consideration by CRWG) - Optimize Phase III WIP Development and Adaptively Manage BMP Implementation (Elements A-C)
 - ✦ **Implementation Considerations:** The CRWG has compiled informational material, including a "Guidance Example" and "Sample Narrative Template," outlining a potential means and method for implementation of the three elements of the qualitative policy component, as proposed above (Appendix A). Once the Partnership reaches agreement on the approach to consider climate change in Jurisdictions' Phase III WIPs, formal implementation guidance will be developed and approved by the CRWG and WQGIT.

PSC Decision Point #2

16

- Decision: Establish the “minimum standard” for implementation in Jurisdictions’ Phase III WIPs
- Implementation Considerations: The Partnership should not consider the “Quantitative” and “Qualitative” policy components as mutually exclusive: instead, they should be viewed as two separate components (quantitative and qualitative), which could be implemented in tandem, or as a stand-alone. Therefore, the Partnership could decide to require the inclusion of both the Quantitative and/or the Qualitative Components in Phase III WIPs.

PSC Decision Point #3

17

- *Decision:* Establish the level of flexibility among jurisdictions, as well as commitments for CBP programmatic support (e.g., guidance, data, funding, etc.), for implementation of climate change policies that exceed the “minimum standards” of Partnership approved quantitative and/or qualitative policy components.
- *Implementation Considerations:* Upon a decision by the Partnership to address climate change qualitatively, flexibility and CBP programmatic support could be provided to specific jurisdictions that may elect to include a quantitative and or expanded qualitative policy component in their Phase III WIPs.

Decision-Support Materials

18

- [Briefing Document: Policy Options and Implementation Considerations for Addressing Climate Change in Jurisdictions' Phase III Watershed Implementation Plans](#)
- [Appendix A. Guidance Example and Sample Narrative for Qualitative Policy Component](#)
- [Compilation of climate change-related BMP implementation reference documents, tools, and resources.](#)
- [STAC Workshop Report \(under development\): Monitoring and Assessing Impacts of Changes in Weather Patterns and Extreme Events on BMP Siting and Design \(Sept. 7-8 2017\).](#)
- **Fact Sheet (under development): *Climate Resiliency Principles for Phase III WIPs***