

Climate Change & the Mid-Point Assessment: Methods, Process and Key Decisions



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Chesapeake Bay Program
Science. Restoration. Partnership.

WATER QUALITY GOAL IMPLEMENTATION TEAM

2014 Chesapeake Bay Agreement



CLIMATE RESILIENCY

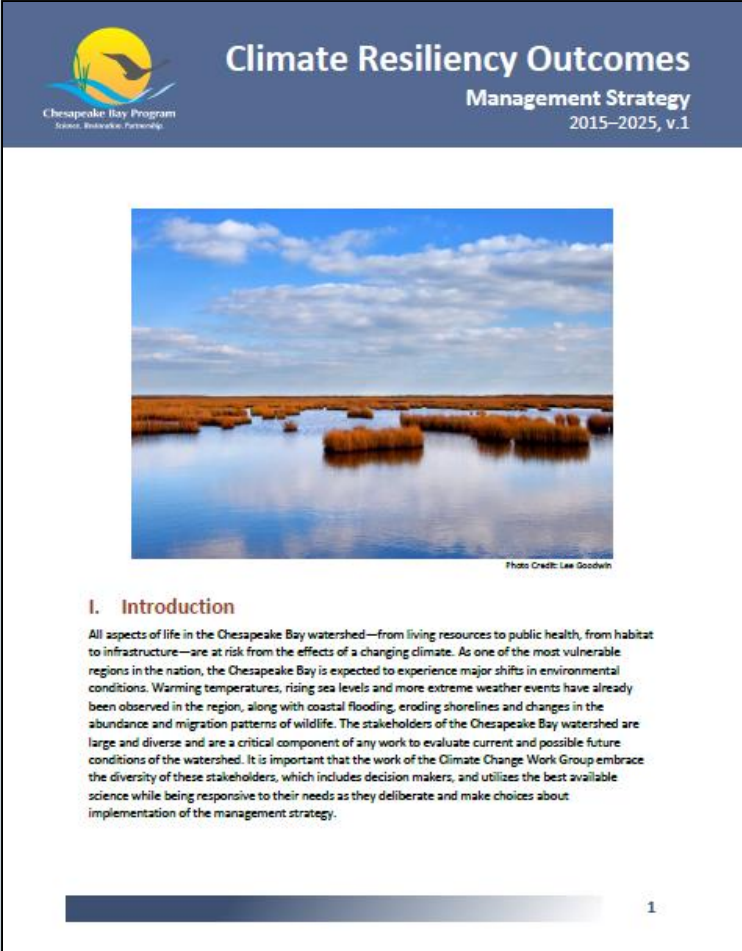
GOAL: Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions.

- **Monitoring and Assessment Outcome:** Continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects.
- **Adaptation Outcome:** Continually pursue, design and construct restoration and protection projects to enhance the resiliency of Bay and aquatic ecosystems from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.

Key Partnership Climate Change-Related Commitments and Recommendations



- *2010 Chesapeake Bay TMDL*
- *2010 Executive Order 13058: Strategy for Protecting and Restoring the Chesapeake Bay Watershed*
- *2014 Chesapeake Bay Watershed Agreement*



Climate Resiliency Outcomes Management Strategy
2015–2025, v.1

I. Introduction

All aspects of life in the Chesapeake Bay watershed—from living resources to public health, from habitat to infrastructure—are at risk from the effects of a changing climate. As one of the most vulnerable regions in the nation, the Chesapeake Bay is expected to experience major shifts in environmental conditions. Warming temperatures, rising sea levels and more extreme weather events have already been observed in the region, along with coastal flooding, eroding shorelines and changes in the abundance and migration patterns of wildlife. The stakeholders of the Chesapeake Bay watershed are large and diverse and are a critical component of any work to evaluate current and possible future conditions of the watershed. It is important that the work of the Climate Change Work Group embrace the diversity of these stakeholders, which includes decision makers, and utilizes the best available science while being responsive to their needs as they deliberate and make choices about implementation of the management strategy.

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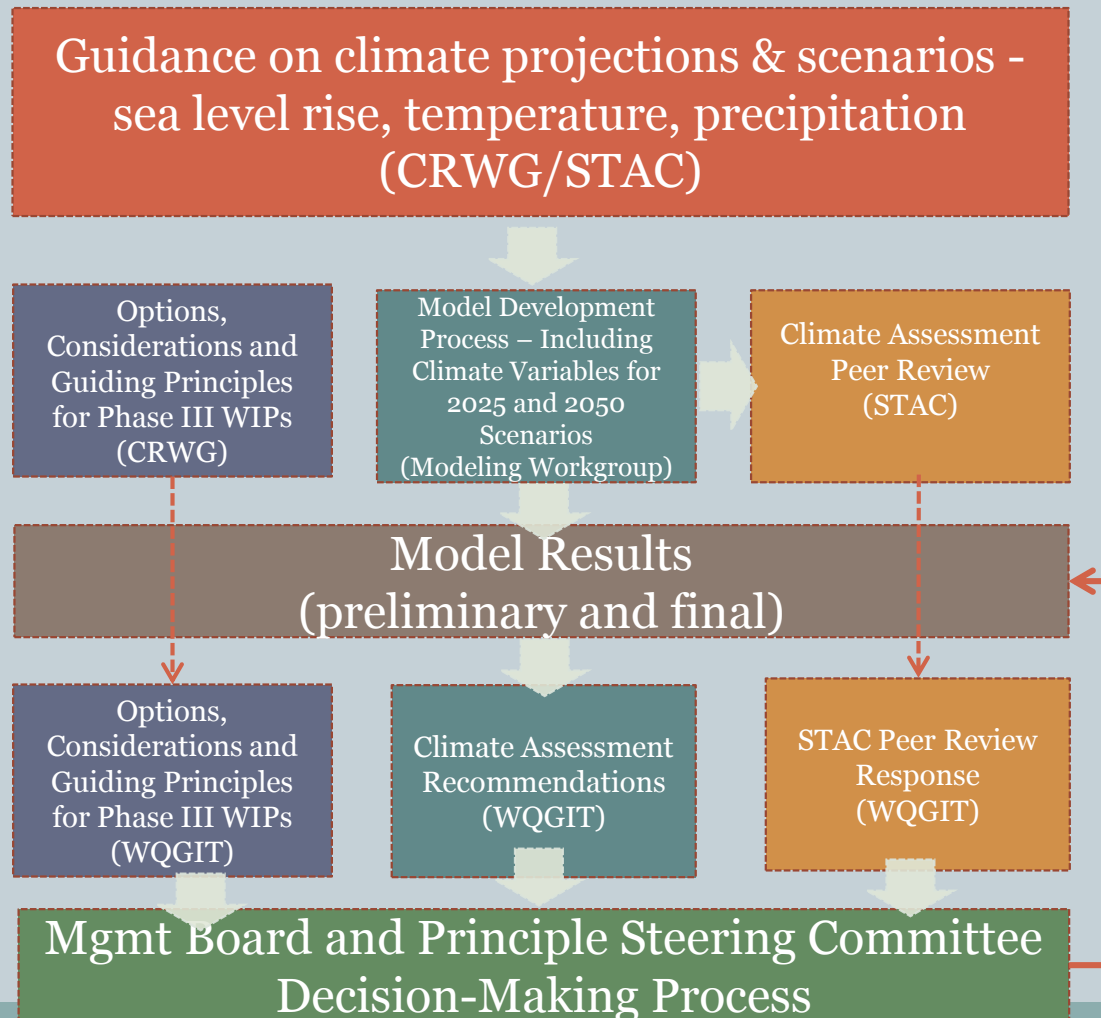
Climate Change & the TMDL

Mid-Point Assessment Considerations



- Assess how climate change may affect current water quality standards (i.e., nutrient and sediment source loads over time)
 - Precipitation change (increased volume and intensity)
 - Temperature increase (air and water)
 - Sea level rise (hydrodynamics and impacts to beneficial resources (i.e., wetlands))
- Evaluate climate impacts on the effectiveness of existing water quality BMPs over time
 - BMP water quality efficiencies
 - “Climate-smart “ siting and design guidance for BMP implementation
- Explore options for if, how and when to address projected climate-related changes in water quality standards
 - Incorporate changes into Phase III WIPS
 - Add an explicit Margin of Safety (MOS)
 - Strategically incorporate into select BMP practices (e.g., wetland restoration, storm water)
 - Seek opportunities to prioritize BMP’s with ancillary “climate resilience” benefits (storm surge and flood attenuation, shore protection)
 - Defer integration but continue to monitor, assess and adaptively manage

Climate Change Decision-Making Process





CBP Climate Change Assessment Components

Increased Estuarine Temperature

- Direct warming of tidal water
- Indirect warming from watershed inputs
- Indirect warming from ocean boundary inputs

Sea Level Rise

- Influence on hydrodynamics
- Influence on tidal wetland loss and associated loss of nutrient attenuation
- Increased organic loading from wetland erosion

Watershed Hydrologic and Loading Changes

- Changes in precipitation volume
- Changes in precipitation intensity
- Changes in land use



CBP Assessment Components *(continued)*

Ecological Changes

- Temperature ranges and optima (*Zostera*)
- Other ecological changes

Changes in Airshed

- Changes in precipitation volume
- Changes in precipitation intensity
- Changes ground level ozone with temperature increases

Additional Inputs to the CBP TMDL Climate Change Decision:

- Historical studies of climate change
- GCM models downscaled for the Chesapeake watershed
- Intercomparison of coastal systems
- Other relevant climate change research, monitoring, and observations

***The Development of Climate
Projections for Use in Chesapeake
Bay Program Assessments***

**Scientific and Technical Advisory Committee
(STAC) Workshop**

March 7-8 2016

STAC Workshop Goals

1. What climate change variables are of most concern to the CBP partners in the consideration of the 2017 Midpoint Assessment decisions and for longer term climate change management decisions?
2. What are the approaches that can be taken to select climate change scenarios for CBP assessments?
3. What characteristics of those climate variables need to be specified, e.g., temporal, spatial, and other relevant characteristics? In what format are scenarios needed to provide the most utility at the regional, state, and local levels?
4. What climate change scenarios meet CBP decision making needs for the 2017 Midpoint Assessment as well as for longer term climate change management decisions and programmatic assessments?

Workshop Recommendation (Draft)

- The Partnership should reach agreement on the utility of an integrated source of climate change projection simulation data that all seven jurisdictions could draw from as well as using the same data for applications from a CBP perspective.
- For the 2017 Midpoint Assessment, use an approach utilizing historical (~100 years) trends to project precipitation to 2025 as opposed to utilizing an ensemble of GCMs. Shorter term climate change projections using GCMs have large uncertainties because climate models are structured to look further out and at much larger scales.
- Looking forward, focus on the 2050 timeframe for selecting and incorporating a suite of global climate scenarios and simulations to provide long-term projections for the management community, and an ongoing adaptive process to incorporate climate change into decision-making as implementation moves forward.
- Beyond the 2017 Midpoint Assessment, use 2050 projections for BMP design, efficiencies, effectiveness, selection, and performance – knowing that many of the BMPs implemented now could be in the ground beyond 2050.

Workshop Recommendation (Draft)

- For 2050, use an ensemble or multiple global climate model approach through a selection of no more than ten models. Use multiple scenarios covering a wide range of projected emissions (RCP 4.5 and 8.5 are a reasonable range to select and are currently being utilized for Fourth National Climate Assessment). Include the 2 °C emissions reduction pathway (RCP 2.6) as well as more "business as usual" assumptions.
- Select an existing system to access GCMs, downscaled scenario data (such as LASSO) in lieu of conducting a tailored statistical climate downscaling process for the CB watershed.
- Carefully consider the representation of evapotranspiration in watershed model calibration and scenarios.

Chesapeake Bay TMDL 2017 Mid-Point Assessment

**Recommendations on Incorporating Climate-Related Data Inputs and Assessments:
Selection of Sea Level Rise Scenarios and Tidal Marsh Change Models**

Climate Resiliency Workgroup

August 5, 2016

Climate Resiliency Workgroup Recommendations - SLR

- The CRWG recommends that the CBP leadership consider the application of the plausible range of sea level rise projections for CBWQSTM modeling efforts, with upper and lower limits, for the years 2025 and 2050.
- In selecting the range of scenarios, the upper bound should be consistent with a higher emissions scenario (but not the extreme upper scenario). This would result in the upper bound corresponding with the 99.5% probability, plus 0.1m to account for interannual variability.
- The lower range value should be within the “likely” range, as presented by Dr. Kopp, consistent with a lower emission scenario (RCP 2.6), but not be the extreme lower scenario which depicts historical tide gauge trend.
- Based on the considerations above, the CRWG recommends that the following range of sea level rise projections for 2025 (.2 - .4 m) and 2050 (.3-.8 m) be applied in the CBWQSTM.

Climate Resiliency Workgroup Recommendations - Wetlands

- Use a multi-model approach, tied to the CRWG's recommended range of sea level rise projections for 2025 and 2050, to gain estimates of current wetland area and projected wetland loss/gain. Use these estimates to inform watershed loads in the CBWQSTM modeling effort.
- To estimate project wetland gain/loss, analyze data results available through the National Wildlife Foundation, Sea Level Affecting Marsh Model v.5 of the Chesapeake Bay (2008) and data available through NOAA's Office for Coastal Management Sea Level Rise Marsh Impacts and Migration Tool.
- In interpreting the data available through these two products, assess whether the sea level rise projections used for the studies were consistent with the 2025 and 2050 SLR projections (as recommended by the CRWG); or, in the case of the NOAA Marsh Tool, whether data runs could be acquired for a different SLR scenario.
- The USGS/CBP GIS Team, which is working to compile the land use/land cover data set for the Midpoint Assessment, should work with the EPA/CBP Modeling Team to ensure there is consistency among the wetland classifications included in the marsh loss modeling outputs (NWF SLAMM (2008) and the NOAA Marsh Tool) to allow for side by side comparison of results.



Status

- The work is coming together including guidance provided by the Climate Change Workgroup and March 2016 STAC Workshop.
- The aim is to have all elements of estimated watershed loads, temperature increases, sea level rise, and tidal marsh loss fully integrated and operational for a 2025 and 2050 assessment by the October 4-5 Modeling Quarterly Review.
- The analysis will be presented at the October 24-25 WQGIT and discussions aimed at deciding if, when, and how to incorporate climate change considerations into the Phase III WIPs will begin.

2017 Mid Point Assessment *Climate Integration Timeline*

<u>Action</u>	<u>Partnership Group</u>	<u>Date</u>
WEBINAR by the STAR Team's Modeling Workgroup and Climate Resiliency Workgroup Co-Chairs and Coordinators on recent climate change analyses for sea level rise projections, projected changes in water column temperatures, estimates for tidal wetland inundation, and the changes in the climatology and hydrology in the watershed..	All Partnership Groups	October 18, 2016 1:00 – 3:00 PM
DECISION to present the proposed climate change assessment procedures, including whether to use a 2025 or 2050 climate change projection to guide the future work of the Climate Resiliency Workgroup, as the WQGIT's recommendations to the Management Board.	WQGIT	October 24-25, 2016
DECISION on the ranges of options for if, when and how to factor climate change considerations into the Phase III WIPs with decisions in spring 2017 informed by the outcomes of the proposed climate change assessment procedures.	WQGIT	October 24-25, 2016
DECISION on the next steps, timeline and upcoming climate change related Partnership decisions.	WQGIT	October 24-25, 2016
DECISION on presenting the WQGIT's proposed climate change assessment procedures to the Principals' Staff Committee at their December 2016 meeting for a final decision.	Mgmt. Board	November 17, 2016
DECISION on presenting the WQGIT's proposed ranges of options for if, when and how to factor climate change considerations into the jurisdictions' Phase III WIPs with final Partnership decisions in spring 2017 informed by the outcomes of the proposed climate change assessment procedures to the Principals' Staff Committee at their December 2016 meeting for a final decision.	Mgmt. Board	November 17, 2016
DECISION on the proposed climate change assessment procedures.	PSC	December TBD 2016
DECISION on the proposed ranges of options for if, when and how to factor climate change considerations into the jurisdictions Phase III WIPs with decisions in spring 2017 informed by the outcomes of the proposed climate change assessment procedures.	PSC	December TBD 2016

2017 Mid Point Assessment Climate Integration Timeline (2017)

<u>Action</u>	<u>Partnership Group</u>	<u>Date</u>
BRIEFING by the STAC Climate Change Peer Review Panel Chair on the Panel's findings and recommendations.	WQGIT	January 9, 2017
DECISION on the responses to the STAC Climate Change Peer Review Panel's findings and recommendations.	WQGIT	January 23, 2017
PRESENTATION by the STAR Climate Resiliency Workgroup Co-Chairs presenting the findings from the full suite of climate change scenarios run following the Partnership approved assessment procedures.	WQGIT	February 13, 2017
WEBINAR by the STAR Climate Resiliency Workgroup Co-Chairs presenting the findings from the full suite of climate change scenarios run following the Partnership approved assessment procedures.	All Partnership Groups	March TBD 2017
DECISION on recommendations for consideration by the Management Board on if, when, and how to incorporate climate change considerations into the Phase III WIPs as the partners work on the draft Phase III WIP planning targets due in June 2017.	WQGIT	March 27, 2017
DECISION on recommendations for consideration by the Principals' Staff Committee on if, when, and how to incorporate climate change considerations into the Phase III WIPs as the partners work on the draft Phase III WIP planning targets due in June 2017.	Mgmt. Board	April 13, 2017
DECISIONS on if, when, and how to incorporate climate change considerations into the Phase III WIPs as the partners work on the draft Phase III WIP planning targets due in June 2017.	PSC	May TBD 2017 Retreat

Climate Resiliency Workgroup – Next Steps



- Continue to review and advise on the climate assessment methodology, including key data inputs.
 - October Webinar (TBD) to present most recent analysis and assessment process.
- Develop a list of options for incorporating climate considerations in Phase III Watershed Implementation Plans.
 - Formation of a small working group to assist with the exploring the list of options and developing guiding principals Phase III WIPs.
 - Please contact me (zoe.johnson@noaa.gov) if you are interested in serving on this small group.
 - September 19, 2016 CRWG In-Person Meeting to focus on this topic.

Questions & Discussion

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