Climate Resiliency Workgroup: BMP Climate Resilience Efforts SRS Discussion Follow-up

Presentation to Management Board

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Presentation Outline

1. Climate Resiliency Workgroup (CRWG) ask to Management Board (MB) & MB follow-up request
1. Watershed BMPs identified by the WQGIT that jurisdictions are using to drive water quality improvements suggesting a need for better understanding of climate change effects on performance
1. Tidal BMPs with habitat and living resource co-benefits identified by NOAA in coordination with U.S. EPA
1. Existing CBP-funded BMP climate resilience assessment efforts
1. Preliminary results from Urban Stormwater BMP climate vulnerability assessment
1. Current CBP-supported BMP performance climate change research
1. Next steps

BMP Climate Resilience Science Need

Data and research needs for impacts of sea level rise, storm surge, increased temperatures, extreme precipitation events and saltwater inundation on BMP climate resilience (i.e., maintenance, shelf life, siting and design, etc.)

- Pressing and ongoing research need of the CBP
- Direct response to a **PSC directive** to the CBP to, "Develop a better understanding of the BMP responses, including new or other emerging BMPs, to climate change conditions."

CRWG Ask and MB Follow-up Request

CRWG Request to MB:

- Assist with identifying options to establish a funding plan to support a research agenda on climate change impacts to BMP performance

MB Follow-Up Request:

- Provide information on existing CBP-funded BMP climate resilience efforts
- Review “Phase III WIP BMP’s: Drivers for Implementation between 2019-2025” to identify which BMPs have the greatest need for climate change research based on workgroup judgement

WQGIT-Identified Watershed BMPs that are Drivers for Implementation in 2019-2025

• Agriculture

- Various cover crops
- Animal waste management systems
- Manure transport
- Soil conservation & WQ plans
- Buffers/filter strip – forest and grass
- Conservation tillage
- Nutrient management
- Tillage management
- Pasture fencing
- Denitrifying ditch bioreactors
- Non-urban stream restoration

• Developed

- Infiltration BMPs (pavement, infiltration trench, bioswale, buffer/ filter strip)
- Dry ponds
- Urban nutrient management
- Wet ponds/constructed wetlands/bioretention/bioswales
- Stormwater performance standard/stormwater management
- Urban tree planting
- Urban stream restoration
- Erosion and sediment permeable controls (regarding construction)

• Other

- Forest harvesting practices
- Wetland restoration
- Stream restoration
- Shoreline management
- Oyster practices (restoration & aquaculture)

Tidal BMPs with Habitat and Living Resource Co-Benefits

- NOAA and U.S. EPA, in coordination with STAR, Habitat GIT, and Fisheries GIT identified the following tidal BMPs with habitat and living resource co-benefits in need of climate resilience assessment:
  - Living shorelines
  - Tidal wetland restoration
  - Oyster practices (restoration and aquaculture)
  - Forest buffers

Ongoing CBP BMP Climate Resilience Assessment Efforts

Literature Review Phase

- STAC and NOAA-funded project awarded to Virginia Tech
  - Assessing existing climate change-related literature on GIT-identified ag, urban, other watershed, and tidal water BMPs to help inform a BMP climate resilience research agenda
  - Point of contacts: Zach Easton and Jeremy Hanson (Virginia Tech), Kurt Stephenson (STAC), Julie Reichert-Nguyen (NOAA)
  - Funding = $125K (STAC-funded), $73K (NOAA-funded)

- Chesapeake Stormwater Network (CSN)-U.S. EPA Cooperative Agreement
  - Assessing existing literature to identify climate vulnerabilities of urban stormwater BMPs
  - Point of contact: David Wood (CSN)
  - Funding = $80K for review; $30K for outreach and training

BMP Performance Research Phase

- Urban Stormwater Workgroup FY19 GIT-funded Intensity Duration Frequency (IDF) curve project
  - Piloting the development of adjusted probabilistic IDF curves under changing precipitation extremes to inform design options for Chesapeake Bay Watershed stormwater practices
  - Point of contact: Michelle Miro (RAND Corp.)
  - Funding = $150K (received special approval to fund above $75K)

STAC and NOAA-Funded Project Awarded to Virginia Tech

- **A Systematic Review of Chesapeake Bay Climate Change Impacts and Uncertainty: Watershed Processes, Pollutant Delivery, and BMP Performance Climate Change and Uncertainty Science Synthesis**
  - Technical synthesis to answer three specific questions by systematically evaluating existing literature for ag, urban, other watershed, and tidal water BMPs
    - How do climate change and variability affect nutrient/sediment cycling in the watershed?
    - How do climate change and variability affect BMP performance? Under what conditions do they fail?
    - Which BMPs appear to be the most robust to climate change and BMP performance uncertainty? Which are the most sensitive?
  - Timeline ~ Jan 2020 – Sep 2021

BMPs under Review by Virginia Tech

Most implemented	Most effective TN	Most Effective TP	NOAA
By units planned implementation/treatment	By reductions	By reduction	
Ag Nutrient Management	AWMS	AWMS	Living shoreline
Tillage Management	Tillage Management	Tillage Management	Tidal wetland restoration
Cover Crops	Nutrient Management	Forest Buffers	Oyster restoration
Urban Nutrient Management	Forest Buffers	Grass Buffers	Oyster aquaculture
Pasture Management	Grass Buffers	Nutrient Management	Forest buffers
Forest Harvesting	Cover Crops	Stream Restoration	
Manure Incorporation		Wet Ponds and Wetlands	
Land Retirement			
Wetland Rehabilitation			
Tree Planting			
Wetland Restoration			
Grass Buffers			
Forest Buffers			
Animal Waste Management Systems (AWMS)			

Summary of BMP implementation and effectiveness from Sekellick et al. 2019 and the Phase 3 WIPs (https://cast.chesapeakebay.net/Documentation/wipbmpcharts). Includes priority BMPs requested by the partnership, in addition to the practices specified by NOAA.

Chesapeake Stormwater Network Cooperative Agreement with U.S. EPA: Urban Stormwater BMPs

- Memo 1: Summary of Stakeholder Concerns, Current Management and Future Needs for Addressing Climate Change Impacts on Stormwater Management
- Memo 2: Review of Current Stormwater Engineering Standards and Criteria for Rainfall and Runoff Modeling in the Chesapeake Bay Watershed
- Memo 3: Synthesis of Precipitation Analyses Used to Derive Intensity-Duration-Frequency (IDF) Curves
- **Memo 4: Vulnerability Analysis of Urban Stormwater BMPs and Restoration Practices**
  - Change in pollutant removal performance due to climate change
  - Best practices to improve resilience (retrofits, sizing, maintenance)
  - Timeline ~ Final Comments Were Due on 3/23/21

Memo 4: Urban Stormwater BMPs under Review by CSN

- **Upland Low-Impact Development (LID) Practices:** bioretention, rain gardens, permeable pavement, green roofs, conservation landscaping, rooftop disconnection, infiltration basins, sand filters, tree pits, manufactured treatment devices)
- **Conveyance Practices:** vegetated swales, dry-channel, open channel, storm drain pipes, roadside ditch retrofits
- **Ponds and Wetlands:** "legacy," wet, and dry ponds, pond retrofits, stormwater wetlands
- **Stream Corridors and Shorelines:** stream restoration, shoreline management
- **Other:** riparian buffers, urban tree canopy, urban forest planting, urban nutrient management, street sweeping, storm drain cleaning, nutrient discharges from gray infrastructure (NDGI)

Memo 4: Summary

- Most **common climate-related vulnerabilities** include:
  - More frequent overflow/bypass of runoff,
  - Loss of treatment capacity due to sedimentation or high groundwater tables,
  - Increased erosion where runoff enters and exits the practices.

- **Not all risks are driven solely by climate change** – projected development and design and maintenance challenges lead to practice failure outside of climate change impacts.

- **Older stormwater practices** are more likely to be **experiencing natural wear and tear**, **increasing their vulnerability to extreme events.**

- **Further work is still needed** to understand climate change impacts and adaptation options on BMP efficiency—limited data on pollutant removal performance.

- The **Chesapeake Bay Program has an opportunity to advance design and resilient adaptation strategies** for a wide range of restoration practices.

BMP Climate Resilience Research

- FY19 GIT-Funded project, “Piloting the Development of Probabilistic Intensity Duration Frequency (IDF) Curves for the Chesapeake Bay Watershed
  - Evaluating downscaling methods and climate model combinations to assess their ability to replicate historical precipitation extremes
  - Downscaling of projected precipitation extremes for future periods
  - Quantifying of climate model uncertainties
  - Development of probabilistic IDF curves for all Chesapeake Bay jurisdictions
  - Development of web-based tools and outreach to make results accessible to stakeholders
  - **Results timeline ~ May 2021**

Next Steps

- Review BMP climate resilience assessment reports from Virginia Tech and CSN and results from IDF curve project
- Cross-workgroup meeting to present and discuss findings from above efforts to identify research needs and, where information exists, possible adaptation strategies
- Work with Management Board to identify options in supporting a BMP climate change research agenda

Discussion

- Thoughts on how to prioritize BMP climate change research
  - Prioritize by most implemented in WIPs? most vulnerable to climate change uncertainty? most water quality benefit? most co-benefits (e.g., habitat, living resources, building climate resilience)?
- Thoughts on funding plan for BMP climate change research
  - Dedicated CBP funding (more control on which BMPs to pursue research on and when)?
  - Rely on partners (less control on which BMPs will be researched and when)
- What role can the Climate Action Team play in getting support for BMP climate change research?