CLIMATE RESILIENCY

Principles for Phase III Watershed Implementation Plans

Restoration to protect people and infrastructure

The Chesapeake Bay Watershed has experienced changes in climate over the last century. On the whole, the Watershed is experiencing stronger storms, an increase in heavy precipitation events, increasing air and water temperatures and a rise in sea level. These trends, which vary both spatially and temporally, are altering the watershed, its ecosystems and the human communities of the Chesapeake Bay and will require changes in programs and projects to successfully achieve restoration and protection goals.

Addressing these risks in conjunction with ongoing restoration efforts will prepare communities for greater variability and may result in cost savings and reduced risks. Considering future impacts during the planning, siting, design and implementation of Best Management Practice (BMP) can reduce the vulnerability of a project to structural failure over its intended design life.

Assessing vulnerability and developing risk reduction strategies at the initial planning stage will increase effectiveness, decrease maintenance costs, and help to ensure you are meeting the U.S. EPA's TMDL requirements.

Best Management Practices with *Resiliency* in Mind

In addition to water quality benefits, several suites of BMPs, including forest buffers, urban tree canopy, stream restoration, shore erosion control and wetland restoration, can aid with hazard (riverine and coastal flood, heat and drought) risk reduction. See the table below for BMPs that have several climate resiliency co-benefits.*

Success Stories

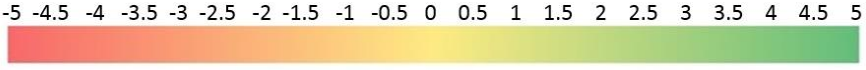
Living shoreline project at Ferry Point, MD (Source: MD DNR)

Forest buffer shading/cooling Brook Trout habitat (Source: CBP)

Best Management Practices	Climate Adaptation	Energy Efficiency	Flood Control/ Mitigation
Urban Shoreline Management	4	0.5	1
Urban Forest Buffers	3.5	4	3.5
Forest Conservation	3.5	3	3.5
Urban Stream Restoration	2.5	2.5	3.5
Ag Forest Buffer	2.5	0.5	3.5
Urban Tree Planting	2	4.5	2
Bioretention, Raingardens, Bioswales	2	3	3.5
Wetland Restoration	2	1	3.5
Ag Shoreline Management	0	0	4
Septic Systems	-0.5	-3.5	0

*Values were taken from a Tetra Tech study evaluating BMP effects on outcomes on a scale of +5 (very beneficial) to -5 (very harmful).

Color Key:



Guiding Principles for Phase III Watershed Implementation Plan

WIP Development

1. *Capitalize on "Co-Benefits"*: maximize BMP selection to increase climate or coastal resiliency, soil health, flood attenuation, habitat restoration, carbon sequestration, or socio-economic and quality of life benefits.
2. *Account for and integrate planning and consideration of existing stressors* – consider existing stressors such as future increase in the area of paved or impervious surface, future population growth, and land-use change in establishing reduction targets or selection/prioritizing BMPs.
3. *Align with existing climate resiliency plans and strategies* – align with implementation of existing greenhouse gas reduction strategies; coastal/climate adaptation strategies; hazard mitigation plans; floodplain management programs; fisheries/habitat restoration programs, etc.
4. *Manage for risk and plan for uncertainty* – employ iterative risk management and develop robust and flexible implementation plans to achieve and maintain the established water quality standards in changing, often difficult-to-predict conditions.
5. *Engage Local Agencies and Leaders* – work cooperatively with agencies, elected officials, and staff at the local level to provide the best available data on local impacts from climate change and facilitate the modification of existing WIPs to account for these impacts.

WIP Implementation

1. *Reduce vulnerability* - use "Climate-Smart" principles to site and design BMP's to reduce future impact of sea level rise, coastal storms, increased temperature, and extreme events on BMP performance over time. Vulnerability should be evaluated based on the factor of risk (i.e. consequence x probability) in combination with determined levels of risk tolerance, over the intended design-life of the proposed practice.
2. *Build in flexibility and adaptability* - allow for adjustments in BMP implementation in order to consider a wider range of potential uncertainties and a richer set of response options (load allocations, BMP selections, BMP redesign). Use existing WIP development, implementation and reporting procedures, as well as monitoring results and local feedback on performance, to guide this process.
3. *Adaptively manage* - Allow for changes in BMP selection or WIP implementation, over-time, as new climate and ecosystem science, research, or data becomes available and the understanding of the impact of how changing seasonal, inter-annual climatic and weather conditions may affect the performance of watershed restoration practices. Consider new science on climate change impacts in future BMP Expert Panels, following the CBP partnership's BMP Expert Panel Protocols.

Tools and Resources

- Resilient BMPs: Planning Tools and Resources –CBP Climate Resiliency Workgroup.
- Chesapeake Bay Program, Climate Smart Framework and Decision Support Tool - *Tetra Tech* - A report detailing recommendations for "Climate Smart" decision-making processes for the Chesapeake Bay Program.
- Best Management Practices: Preserving Clean Water in a Changing Climate - *Maryland DNR* -A fact sheet with information on climate risks and solutions for implementation of water quality related BMPs.
- Climate Data for the Mid Atlantic – *MARISA Climate Data Portal*- Access to the *ChesWx* gridded climate datasets contain daily interpolations of precipitation and temperature observations for the Chesapeake Bay watershed.
- Managing Water Quality in the Face of Uncertainty - *RAND Corporation* -A report describing how to use Robust Decision Making (RDM) when managing future uncertainties such as climate change and evolving land use patterns.
- National Climate Assessment - *U.S. Global Change Research Program* - An interactive, online report on the impact of climate change on the United States, with detailed regional information.
- Climate Resilience Toolkit – *NOAA* - A compilation of tools, resources, data and projections, as well as case studies to help increase understanding of how to address climate risks across many sectors.
- Better Assessment Science Integrating Point & Non-point Sources with Climate Assessment Tool (BASINS CAT) - *EPA*- Combines GIS, national watershed data, and watershed modeling tools to model potential climate change scenarios.
- Tools for Water Related Climate Change Adaptation - *EPA* -A database of climate adaptation tools for communities on water utilities, water quality, and ecosystem protection.

Contacts for More Information

Juris	Website	Lead	Juris	Website	Lead
CBP	http://www.chesapeakebay.net/groups/group/climate_change_workgroup	Zoe.johnson@noaa.gov	**PA**	http://www.dep.pa.gov/business/air/baq/climatechange/pages/default.aspx	gczarnecki@pa.gov
D.C.	http://www.sustainabledc.org/climatereadydc/	katherine.johnson@dc.gov	**VA**	http://www.adaptva.org/	eaandrews@wm.edu
MD	http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/Pages/index.aspx	matthew.rowe@maryland.gov	**WV**	https://statesummaries.ncics.org/sites/default/files/downloads/WV-print.pdf	teresa.m.koon@wv.gov
NY	http://www.dec.ny.gov/energy/44992.html	climatechange@dec.ny.gov	**DE**	http://dnrec.alpha.delaware.gov/energy-climate/climate-change/	jennifer.demooy@state.de.us