Climate Change Adaptation for Maryland Water Utilities

A Message from the Water Supply Program: This brochure was produced by the Maryland Department of Environment's Water Supply Program to assist water utilities to better plan for impacts from climate change. Any water system will be better prepared through an ongoing process of assessing its vulnerabilities and developing and implementing adaptation measures to lessen expected impacts. Many of the recommended measures are "no-regrets" options – measures that strengthen the system's resilience and provide benefits under both current conditions and potential climate change conditions. We encourage utilities to use this brochure as a starting point to evaluate their systems' vulnerability and develop and implement plans to meet this important challenge.

Due to its geography and geology, the Chesapeake Bay region is ranked the third most vulnerable area to sea level rise in the nation, behind Louisiana and Southern Florida. Historic tide records show that sea level increased approximately one foot in the Chesapeake Bay over the last one hundred years. As a continued consequence of climate change, sea level is likely to rise at least twice as fast as it did during the 20th century, resulting in a potential one foot rise by 2050 and between two to three feet of rise by 2100. Temperatures are also expected to increase substantially; Maryland has already experienced a 2° F increase in mean annual temperature from 1977 to 1999. As a result of these climate changes, every area of Maryland could be impacted by increased flooding, more frequent and longer droughts, more intense storms, and/or greater water demand.

In the past, water resource managers – and water utilities – have relied upon predictable variations in climate conditions and water availability. Changes due to climate change, however, may mean that we can no longer rely on previous assumptions. Water utilities need to incorporate climate change expectations into their long-term planning to ensure that they can continue to provide a safe and adequate supply of water to their customers as conditions change.

Climate Change Impacts to Drinking Water

Condition	Potential Impacts
Increased Flooding	• Infrastructure damage • Increased contamination from waste sites (e.g., animal waste) • Increased turbidity – higher treatment levels/costs • Increased potential of wells flooding – bacteriological contamination
Increased Air/Water Temperature	• Increased evaporation rates – less water availability • Algal blooms – toxins and increased disinfection byproducts • Increased raw and finished water temperatures – treatment changes • Increased water demand for irrigation and energy production
Changes in Precipitation and Increased Runoff	• Changes in the seasonality of precipitation – lower stream flow and water availability during peak demand • Increased runoff – results in higher pollutant loads in source waters, increased turbidity of surface waters, and stream bed degradation
Longer Dry Periods and Droughts	• Decreased surface water and groundwater levels • Higher water demand – irrigation, energy, and outdoor water use
Sea Level Rise	• Low lands will experience inundation and flooding • Salt water intrusion in coastal aquifers • Low lying wells more vulnerable to flooding
More Frequent and Intense Tropical Storms	• Damage to utility treatment plants and infrastructure from wind, flooding, and power outages • Post-event water quality impacts – higher sediment and pathogen loads

Climate Change -

Climate change is any significant change in climate indicators (e.g., temperature, precipitation or wind) lasting for an extended period of time (adapted from US EPA).

Adaptation -

Adjustments and changes made in response to climate change and its effects to lessen potential impacts (adapted from Intergovernmental Panel on Climate Change 2007).

Adaptation Measures: Utilities can determine their climate change vulnerabilities based on location and system characteristics. To determine adaptation options, utilities should take the following steps:

1. Evaluate current operating conditions in light of expected climate change impacts;
2. Integrate anticipated conditions under climate change into planning; and
3. Collaborate with other local utilities and/or regional planning agencies as a way to share knowledge and resources.

To adapt to water quality changes...

Acquire and Manage Forested/Vegetated Lands: Acquiring or protecting forested lands near drinking water sources, and requiring vegetative buffers to surface waters, helps to reduce sediments in surface waters, slows and filters stormwater runoff, and reduces the impact of storm surge in coastal areas.

Improve Monitoring: Increasing monitoring capacity helps detect impairments to source water quality, inform operational decisions, and plan for modifications to system facilities to improve water quality (e.g., moving water intake locations).

Increase Treatment Capability: Existing treatment systems may be inadequate to treat higher sediment levels or salt water intrusion.

Green Infrastructure: Managing stormwater using techniques such as rain gardens, porous pavement, and green roofs helps to slow and filter runoff and increases groundwater recharge.

To adapt to changes in water availability...

Manage Demand: Water conservation strategies help to reduce demand on water resources. Strategies include water reuse, increased water storage, rebates for water efficient products in EPA's WaterSense program, adopting a conservation rate structure, identifying and working with high-use water customers, installing water efficient technologies in public buildings, and educating the public and customers about water conservation.

Reduce Leaks/Improve Efficiency: Water losses occur through older infrastructure (e.g., pipes) and through inefficient processes (e.g., filter cleaning). Upgrading infrastructure and processes helps to meet water demand, especially during periods of drought.

Diversify Water Supplies/Sources: Investigate alternate supplies in less stressed watersheds, or explore interconnections with neighboring utilities that may have additional supply/capacity. Evaluate the potential for new technologies such as desalination or aquifer storage and recovery or using reclaimed water for non-potable purposes.

To protect your infrastructure...

Inspect and test the integrity of existing infrastructure: Regular inspection can detect deterioration and identify the necessary repairs or replacements before assets fail.

Upgrade buildings and intake infrastructure to withstand flooding: Flooding may result in damage to buildings, pipes, roads, and treatment facilities. Installing water tight doors and elevating key equipment/ facilities helps to avoid damage.

Increase Energy Efficiency: Reduce operating costs, open up a new avenue of funding for adaptation measures, and reduce greenhouse gas emissions by becoming energy efficient.

Case Studies

Waynesboro, Tennessee Water Treatment Plant

In 2003, the Waynesboro Water Treatment Plant (WWTP) flooded, resulting in damage to the building and its equipment. The plant closed three days for cleanup operations and to dry and repair pumps. The plant flooded again in 2004, and extensive damage caused a four-day shutdown.

In 2005, WWTP received a $148,000 USDA Flood Mitigation Grant. This allowed the plant to relocate laboratory and office space to the second level, remove first level windows, install water tight doors, and raise the raw water intake motors and electrical equipment by four feet. These adaptation measures helped Waynesboro to avoid major damage during the 2010 flood. After this flood, the plant resumed normal operations in only 18 hours.

2003 Flood

Dry

2010 Flood

Spartanburg Water, South Carolina

Spartanburg Water (SW) experienced droughts in 2002, 2003, and from 2005-2009. SW completed a qualitative assessment of potential climate change effects on its infrastructure, operations, and customer needs. The results showed that expected impacts would require increased management of existing vulnerabilities such as increasing water demand and changes in land use patterns affecting water quality. Adaptation measures implemented include:

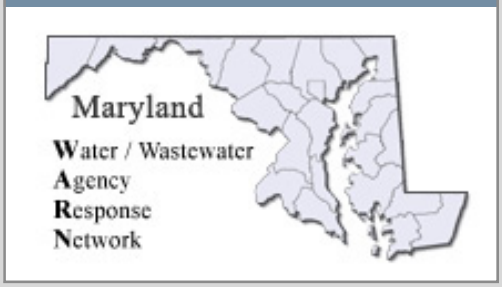
- Raising the Lake Blalock dam ten feet to increase the capacity of the drinking water reservoir from 2.6 to 5.5 billion gallons.
- Joining EPA's WaterSense program to promote water efficient products.
- Using automatic meter reading technology and electronic leak loggers and correlators to reduce water loss.
- Modifying the filter backwash procedure to eliminate excessive filter-to-wastewater loss and extending filter runs to reduce the number of backwash cycles.

Other Resources

- MDE Climate Change Reports http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/legislation/index.aspx
- MDE 2011 Greenhouse Gas Emissions Reduction Draft Plan http://www.mde.state.md.us/programs/Air/ClimateChange/Pages/Air/climatechange/index.aspx
- DNR Fighting Climate Change to Secure a Sustainable Future for Maryland http://www.dnr.state.md.us/climatechange/
- University of Maryland Center for Integrative Environmental Research http://cier.umd.edu/
- EPA Climate Change http://www.epa.gov/climatechange/
- EPA Office of Water Climate Change http://water.epa.gov/scitech/climatechange/index.cfm
- EPA Climate Ready Water Utilities http://water.epa.gov/infrastructure/watersecurity/climate/index.cfm
- EPA Region 3 Climate Change http://www.epa.gov/reg3artd/globclimate/index.html

Maryland Water/Wastewater Agency Response Network (MDWARN)

MDWARN is a network that enables water/wastewater utilities experiencing a natural or man-made disaster to receive emergency aid and assistance from other utilities. More information can be found here: www.mdwarn.org



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