

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

March 2016 Highlights: Sixty-three percent of groundwater levels and 48 percent of streamflow levels were normal at sites monitored by the U.S. Geological Survey across Maryland, Delaware, and the District of Columbia.

Why is it important for the USGS to collect and analyze water-resources data?

USGS water data are valuable to the public, researchers, water managers, planners, and agricultural users, especially during floods and droughts. These data can be used to assess how water resources respond to changes in climate. Scientists at the USGS have measured streamflow and groundwater levels to assess water resources for over 125 years.

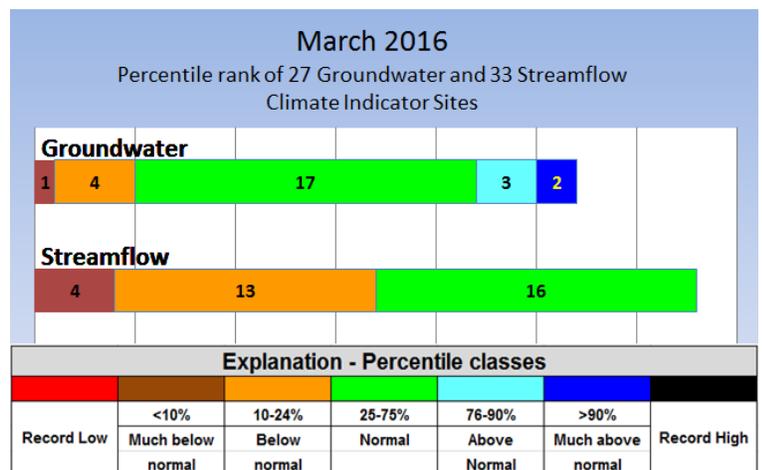
In addition to providing the most extensive set of historical streamflow and groundwater data available to the public, the USGS continues to collect water data and quality-assures the data using standardized techniques across the country. The uniformity of the dataset enables multi-state comparisons and other comparative statistical analyses that better inform policy makers of the possible water-resources conditions they might encounter in the future.

The sites used in this water summary were carefully selected to show the response of streamflow and groundwater levels to weather conditions. Ideally, these sites will show no effects from human influences. The streamflow and groundwater data are ranked in comparison to the historical record and summarized. Precipitation and reservoir data are also presented to give a more complete picture of the region's water resources.

USGS March 2016 Water Conditions Summary

In the Mid-Atlantic region, precipitation was about half of the average monthly precipitation for March and average monthly temperatures were up to 8.8 degrees Fahrenheit above normal. Streamflow responds more quickly than groundwater to climatic conditions, and these weather conditions brought many water levels down from the high February levels that were affected by snowmelt. Monthly mean streamflow dropped at all 33 streamgages used to monitor climatic conditions, and more than half of the sites had below normal monthly mean streamflows.

Although all 33 of the March monthly mean streamflows, and groundwater levels at 19 of the 27 observation wells were less than they were in February, 63 percent (17 of 27) of the groundwater levels and 48 percent (16 of 33) of the monthly mean streamflows were normal (between the 25th and 75th percentiles) at sites used to monitor the response of water resources to changes in climatic conditions in Maryland, Delaware, and the District of Columbia. Groundwater levels were above normal at five wells and below normal at five wells.

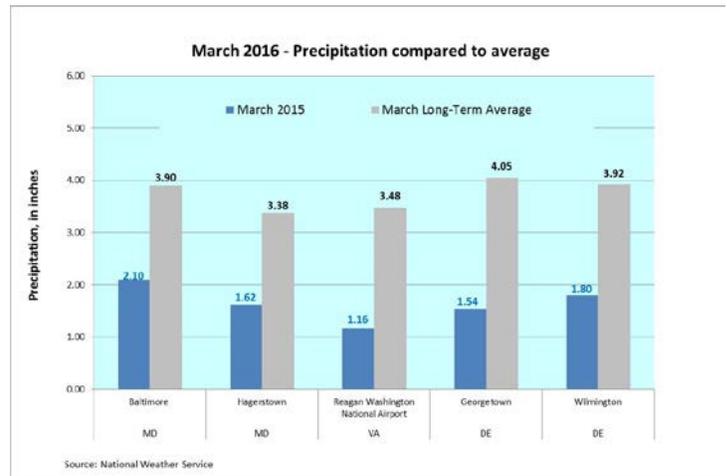


A **percentile** is a value on a scale from 0 to 100 that indicates the percent of a distribution that is equal to or below it. A percentile between 25 and 75 is considered normal. For example, a groundwater level in the 90th percentile is equal to or greater than 90 percent of the values recorded for that month.

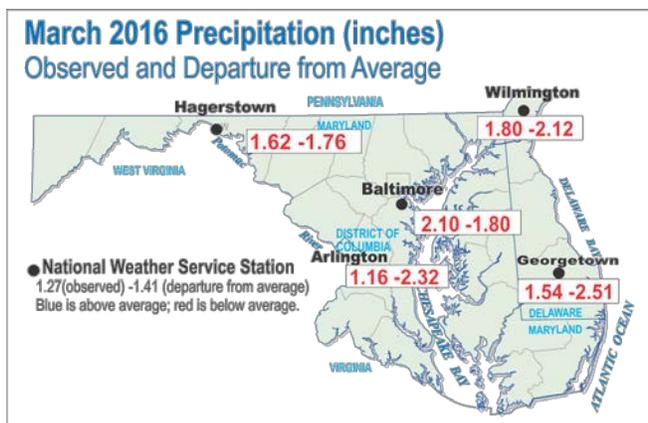
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March 2016 Precipitation and Weather

March precipitation was less than half the long-term average monthly precipitation of about 4 inches at four of the five National Weather Service (NWS) Mid-Atlantic weather stations, and all five sites had below average precipitation. Only the weather station in Baltimore had precipitation that was slightly more than half the normal/long-term monthly precipitation. For the second consecutive month, the Baltimore, Maryland weather station had the highest March precipitation of the five weather stations with 2.10 inches, which was 1.80 inches below the long-term average. There were only 2 days with more than 0.5 inches, but less than 1 inch of rain in Baltimore.



Precipitation at the remaining four Mid-Atlantic weather stations was less than 2 inches in March. At the weather station in Georgetown, Delaware, there were no days with precipitation above 0.5 inches.



National Weather Service Stations

- Baltimore** = Baltimore/Washington International Thurgood Marshall Airport (BWI)
- Georgetown** = Georgetown, Sussex County Airport
- Hagerstown** = Hagerstown Regional Airport
- Arlington** = Ronald Reagan Washington National Airport
- Wilmington** = New Castle Airport

Despite the below normal precipitation in March, the NWS Middle Atlantic River Forecast Center's (MARFC) 365-day precipitation data for Maryland, Delaware, and the District of Columbia showed that precipitation in all counties in Maryland and Delaware was normal to above normal. The highest departure from average was again in Harford County, Maryland, which was 10.5 inches above average for the 365-day period. The lowest precipitation was in Allegany County, Maryland, where it was 2.5 inches below average.

March average temperatures (Fahrenheit) ranged from 5.6 to 8.8 degrees above normal at the five Mid-Atlantic NWS weather stations. In Baltimore, there were 8 days with temperatures greater than 70 degrees and the temperatures ranged from 22 degrees to 82 degrees. The largest departure from average was in Hagerstown, Maryland, where the temperature was 8.8 degrees above normal. The weather station in Arlington, Virginia had the warmest monthly average temperature at 53.5 degrees, which was 6.7 degrees above normal. The lowest temperature was in Wilmington, Delaware at 48.6 degrees, which was 5.6 degrees Fahrenheit above average.

Sources: National Weather Service and Middle Atlantic River Forecast Center (MARFC)
 MD and DC: <http://www.weather.gov/climate/index.php?wfo=lwx>
 DE: <http://www.weather.gov/climate/index.php?wfo=phi>
 MARFC: http://www.weather.gov/marfc/Precipitation_Departures

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

Groundwater

The USGS monitors groundwater levels in unconfined aquifers, providing observations that can be compared to both short-term and long-term changes in climatic conditions. The groundwater wells used for the monthly water summary were selected based on the following criteria:

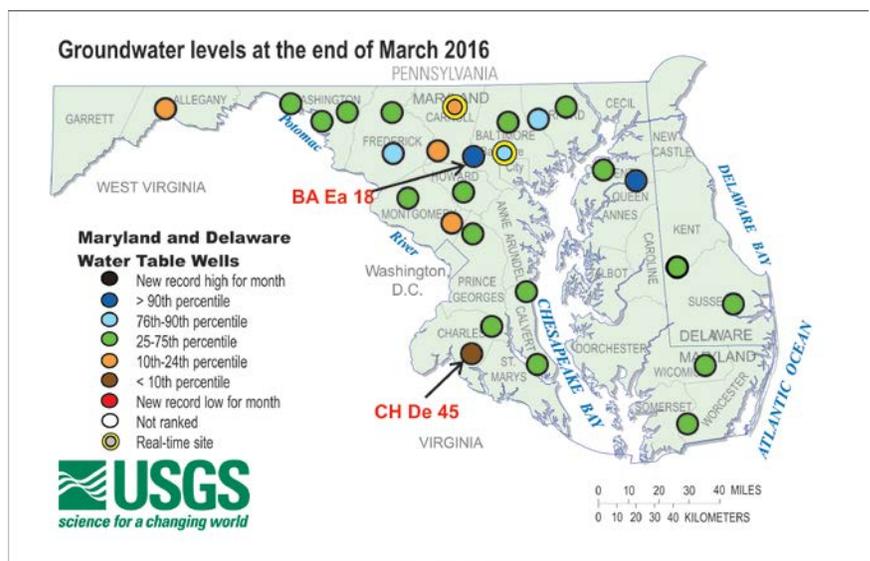
- Located in an unconfined (water-table) aquifer;
- Open to a single, known hydrogeologic unit/aquifer;
- Groundwater hydrograph reflects changes in climatic conditions;
- No indicated nearby pumpage and likely to remain uninfluenced by pumpage, regulated streamflow, or changes related to human activities;
- Minimum period of record is 10 years of continuous/monthly records;
- Minimally affected by irrigation, canals, drains, pipelines, and other potential sources of artificial recharge;
- Well has a casing – dug wells are generally not used;
- Water levels show no apparent hydrologic connection to nearby streams;
- Well has never gone dry; and
- Long-term accessibility likely.

March 2016 Groundwater Levels

Groundwater levels ranged from the lowest 10th percentile to the highest 90th percentile in USGS wells used to monitor climatic conditions in Maryland and Delaware in March. Sixty-three percent (17 of 27 wells) of the groundwater levels were normal (25th-75th percentiles; green on map) in March in Maryland and Delaware. Groundwater levels generally do not respond as quickly as streams to changes in weather conditions.

Groundwater levels were above normal at five USGS observation wells. Wells in Baltimore and Queen Anne's Counties in Maryland were above the 90th percentile (dark blue on map) and the remaining three wells had groundwater levels between the 76th and 90th percentiles (cyan on map).

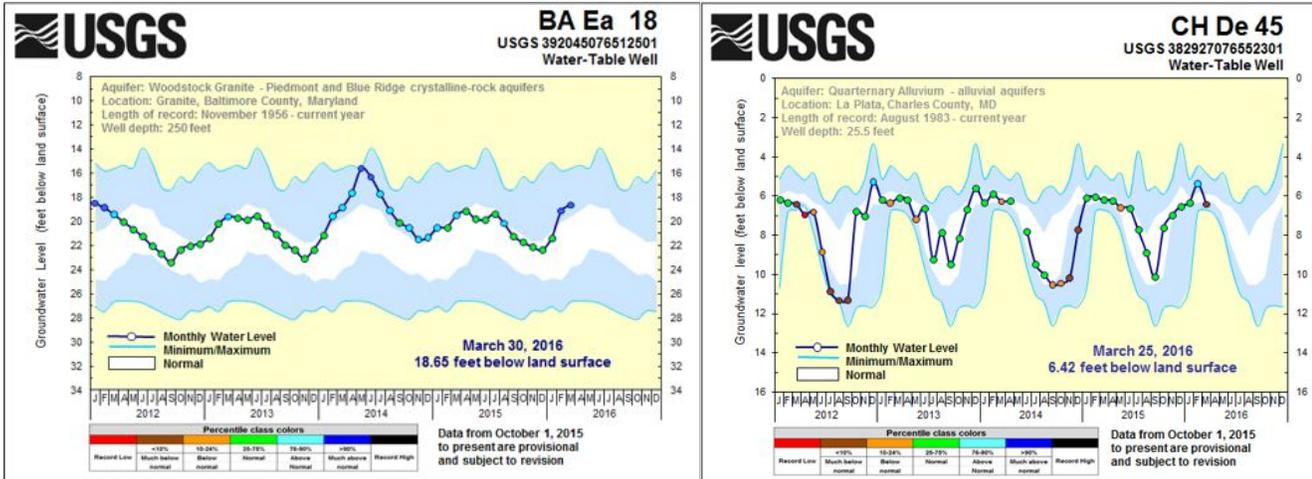
There were five USGS observation wells with groundwater levels below normal. Four wells had groundwater levels between the 10th and 24th percentiles (orange on map) and the USGS observation well in Charles County had a groundwater level below the 10th percentile. These data are provisional and subject to revision.



To access the clickable groundwater map, go to:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties/

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

The groundwater level in USGS observation well BA Ea 18 in Baltimore County, Maryland rose since February and ranked above the 90th percentile for March. In Charles County, Maryland the groundwater level in USGS observation well CH De 45 dropped from above normal in February to below normal in March.



Five-year groundwater hydrographs can be viewed at:
http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties

The 5-year hydrograph shows groundwater levels as a dark blue line, the minimum and maximum monthly values, and the normal range (between the 25th and 75th percentiles) as a white band based on the period of record. The maximum water level is at the top of the upper blue section and the minimum water level is at the bottom of the lower blue section in the graph. Each monthly measurement is colored according to the percentile rank in which it falls for the month.

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Streamflow

Streamflow data are used for many purposes. A few of the most common uses are to assess water supply and the risk of droughts and floods. Streamflow data are also used to calculate loads of chemical constituents and assess how biological communities are affected by hydrologic conditions. The USGS operates the most extensive network of streamgages in the region.

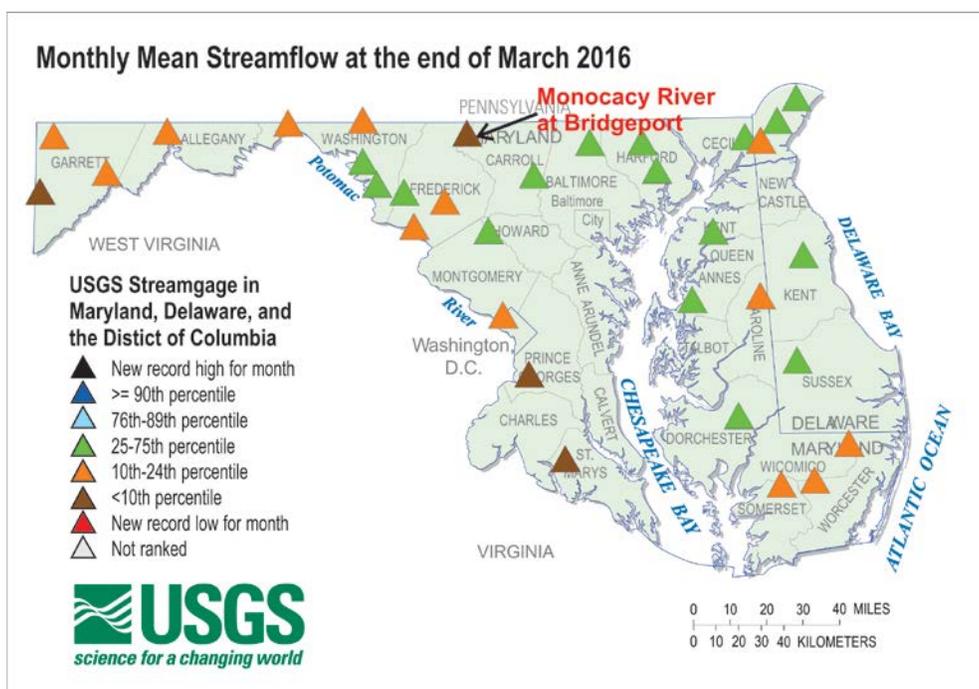
The streamflow locations chosen for the monthly water summary were selected based on the following criteria:

- Minimum period of record is 10 years of continuous data;
- Watershed areas greater than 5 square miles;
- Streamflow is not regulated, or has relatively natural flow;
- Streamflow data reflect climatic conditions; and
- The surrounding area and watershed are not urban.

March 2016 Streamflow

Streamflow respond more quickly than groundwater to a lack of or abundance of precipitation, and March levels provide an example of how streamflow at many sites went from above normal monthly mean streamflow in February to below normal monthly mean streamflow in March.

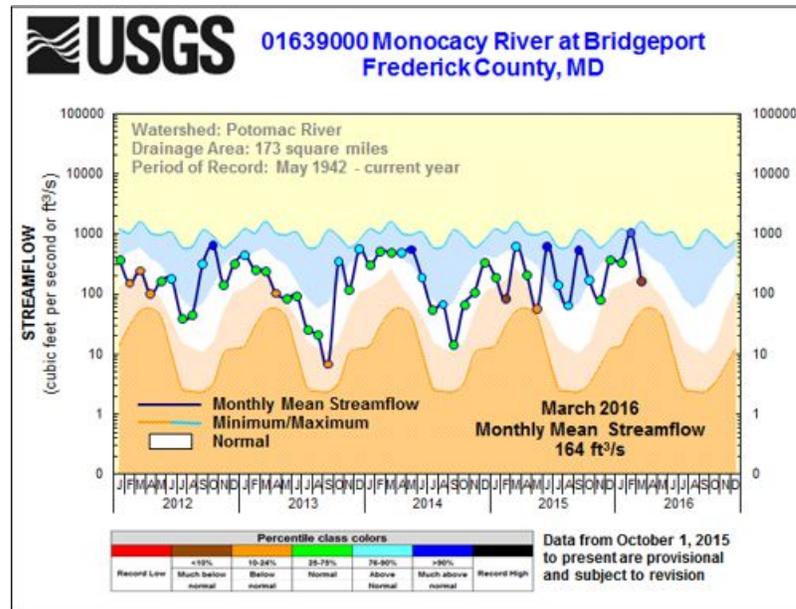
Monthly mean streamflow in March was normal (25th-75th percentiles, green on map) at 48 percent (16 of 33) of streamgages used to monitor climatic response in Maryland, Delaware, and the District of Columbia. Streamflow at the remaining 17 streamgages was below normal with 13 sites in the 10th-24th percentile (orange on map) and 4 sites below the 10th percentile (brown on map).



To access the clickable streamflow map, go to:
<http://md.water.usgs.gov/surfacewater/streamflow/>

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

Monthly mean streamflow on the Monocacy River at Bridgeport in Frederick County, Maryland dropped more sharply than the normal trend in March and it went from above the 90th percentile to below the 10th percentile. The average streamflow typically decreases in volume from March to October when evapotranspiration increases (air temperatures warm and plants take up water through photosynthesis). The weather in Maryland in March was unusually dry and warm. The nearest weather station to the Monocacy River is at Hagerstown, Maryland, which had only 1.62 inches of rain (1.76 below average) and temperatures were 8.8 degrees Fahrenheit above normal in March. Spring rainfall can offset some of the effects of early evapotranspiration.



Five-year hydrographs can be viewed at:
<http://md.water.usgs.gov/surfacewater/streamflow/>

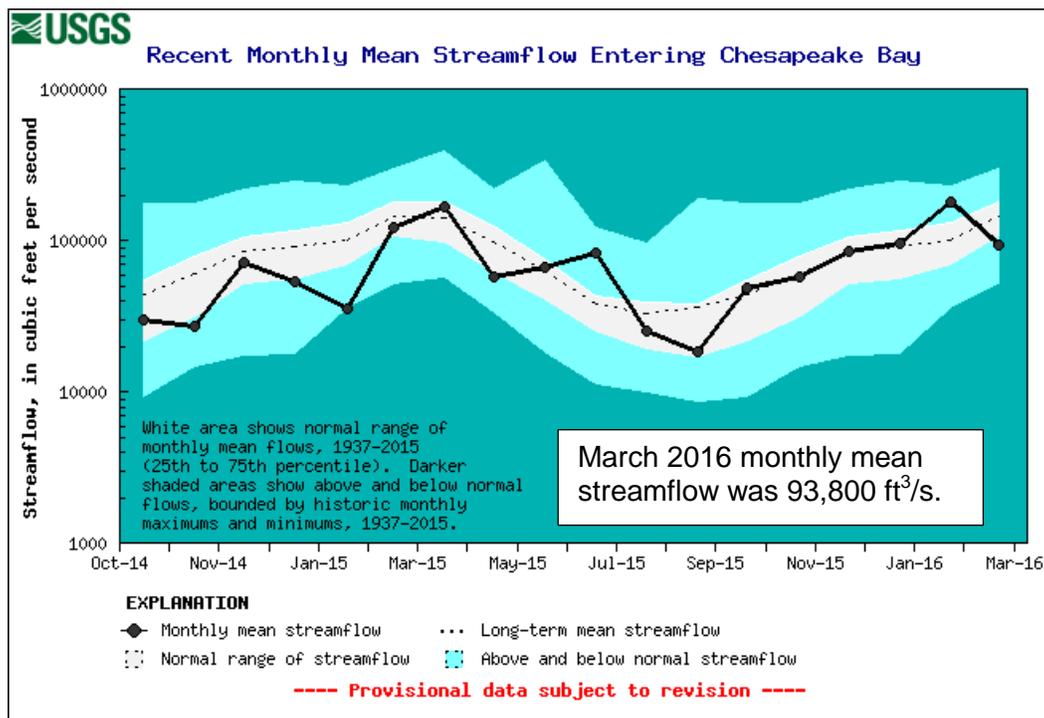
The dark line in the 5-year hydrograph represents the monthly mean streamflow for this period and the white band shows the normal range (25th-75th percentiles) based on the period of record. The maximum monthly mean streamflow is at the top of the blue shaded section, and the lowest monthly mean streamflow is at the top of the dark orange area. Each monthly mean measurement is colored according to the percentile rank in which it falls for the month.

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

Estimated Streamflow to the Chesapeake Bay

The USGS estimates monthly mean freshwater streamflow to the Chesapeake Bay using streamflow measurements from the Susquehanna, Potomac, and James Rivers. In March 2016, the monthly mean freshwater flow to the Chesapeake Bay was 93,800 ft³/s (provisional, and subject to revision), which is below normal. The long-term March average (mean) is 147,000 ft³/s, and the normal range is between 105,000 ft³/s and 182,000 ft³/s, the 25th and 75th percentiles of all March values. These provisional statistics are based on a 79-year period of record.

Runoff in the Chesapeake Bay watershed carries pollutants, such as nutrients and sediment, to rivers and streams that drain to the Bay. The amount of water flowing into the Chesapeake Bay from its tributaries has a direct impact on how much pollution is in the estuary and it also affects the salinity levels that are important for fish, crabs, and oysters. Generally, as river flow increases, it brings more nutrient and sediment pollution to the Bay.



More information on the freshwater flow to the Bay can be found here:
<http://md.water.usgs.gov/waterdata/chesinflow/>

U.S. Geological Survey (USGS) Maryland-Delaware-District of Columbia Monthly Water Conditions Summary

Reservoir Levels

Available reservoir storage at the end of March 2016 in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) was 99.86 percent of available storage capacity, or a total of 75.69 billion gallons of water. The Baltimore City Environmental Services Division manages the Baltimore reservoirs.

Total normal storage in the Triadelphia and Duckett Reservoirs, which serve parts of Howard, Montgomery, and Prince George’s Counties in suburban Maryland around the District of Columbia, was 102.02 percent of normal storage capacity at the end of March 2016 with 10.83 billion gallons of water.

Not all of the water in the Patuxent Reservoirs is usable; for operational purposes, percent of normal storage capacity is used, but this value can exceed 100 percent of the usable storage. In the graph below, 100 percent is the maximum. The Washington Suburban Sanitary Commission (WSSC) manages the Patuxent reservoirs.

March 2016	Percent available/normal storage	Volume (billion gallons)
Baltimore Reservoirs Baltimore City – Environmental Services Division		
Liberty	99.57%	36.64
Loch Raven	100.00%	21.20
Prettyboy	100.00%	17.85
Total	99.86%	75.69
Patuxent Reservoirs Washington Suburban Sanitary Commission (WSSC)		
Triadelphia	102.66%	5.75
Duckett	101.38%	5.08
Total	102.02%	10.83

