

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

**October 2016 Highlights:** Record high groundwater level recorded in Queen Anne's County, Maryland. Forty-three percent of groundwater levels and 52 percent of monthly mean streamflows 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.

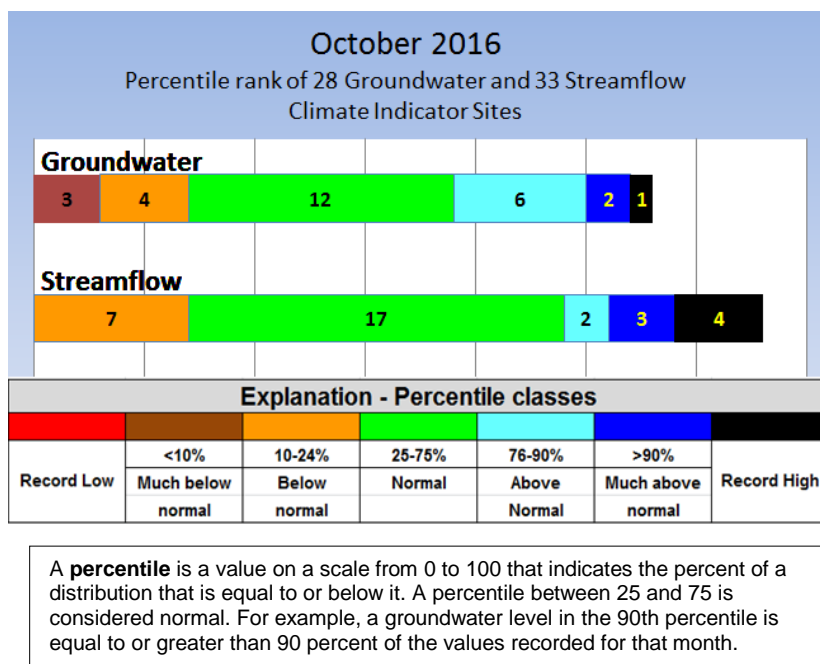
The sites used in this water summary were carefully selected to show the response of streamflow and groundwater levels to weather conditions. Ideally, these sites will show no effects from human influences. The streamflow and groundwater data are ranked in comparison to the historical record and summarized.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

## USGS October 2016 Water Conditions Summary

Forty-three percent of the groundwater levels and 52 percent of monthly mean streamflows were normal (25<sup>th</sup>-75<sup>th</sup> percentiles) in October 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 normal at 12 of the 28 USGS observation wells, and below normal at 7 wells, 3 of which were below the 10<sup>th</sup> percentile. Groundwater levels were at a record high at one observation well and above the 90<sup>th</sup> percentile at two wells.

Monthly mean streamflow was normal at 17 of the 33 streamgages used to monitor climatic conditions. Streamflow was at an October record high at four streamgages, and above normal at another five streamgages. Streamflow was below normal at seven streamgages.

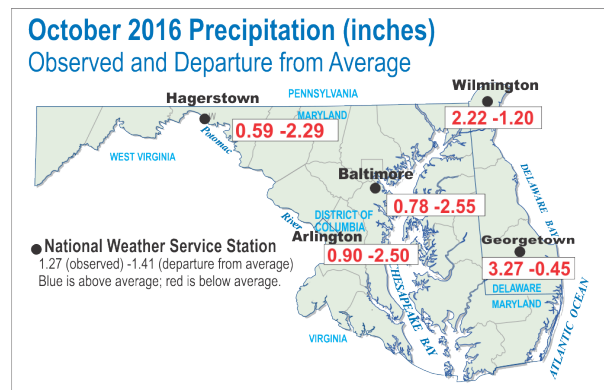
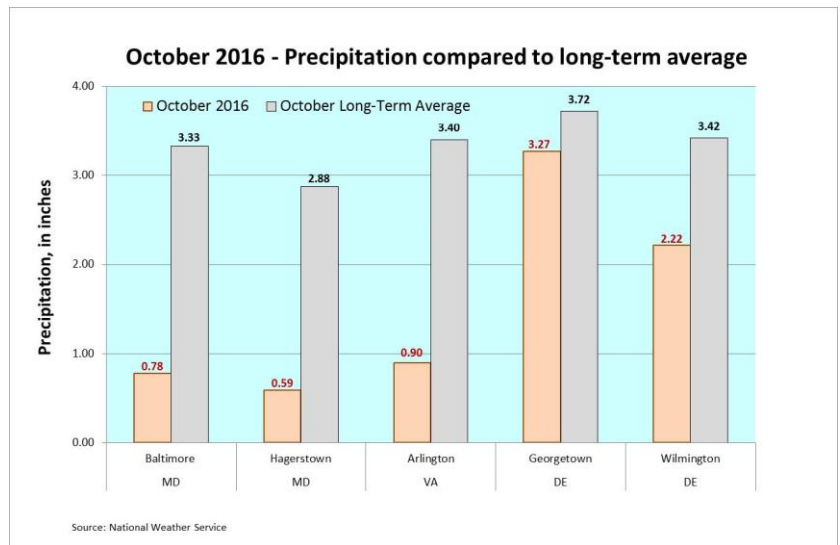


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## October 2016 Precipitation and Weather

October precipitation was below the long-term average (shown as tan bars) at all five National Weather Service (NWS) Mid-Atlantic stations. Total October precipitation at the Arlington, Virginia, and Baltimore and Hagerstown, Maryland weather stations was below 1 inch, which is one-third the average monthly precipitation, and there were no days with more than 0.50 inches of rainfall.

Although October precipitation at Georgetown, Delaware was below average, September precipitation had been nearly 3 times the long-term average September value. Therefore, the September rainfall contributed to the high and record-setting streamflow on the Maryland Eastern Shore in October.



### 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

The Middle Atlantic River Forecast Center's (MARFC) 365-day precipitation totals for the District of Columbia and all counties in Maryland and Delaware were average to above average. West of the Chesapeake Bay, all counties except for Calvert County, Maryland were within 10 percent of the 50<sup>th</sup> percentile. The Eastern Shore of Maryland and counties on the Delmarva Peninsula had precipitation ranging from 5.2 to 20.4 inches above average.

October temperatures were 2.8 degrees Fahrenheit to 4.5 degrees above average at the five Mid-Atlantic NWS stations. The largest departure from average for the fourth consecutive month was at the weather station in Hagerstown, Maryland, where the average temperature was 59.3 degrees, or 4.5 degrees above average. The average temperature at the weather station in Wilmington, Delaware was the lowest of the five weather stations at 59.0 degrees. The highest average temperature was 63.1 degrees in Arlington, Virginia.

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

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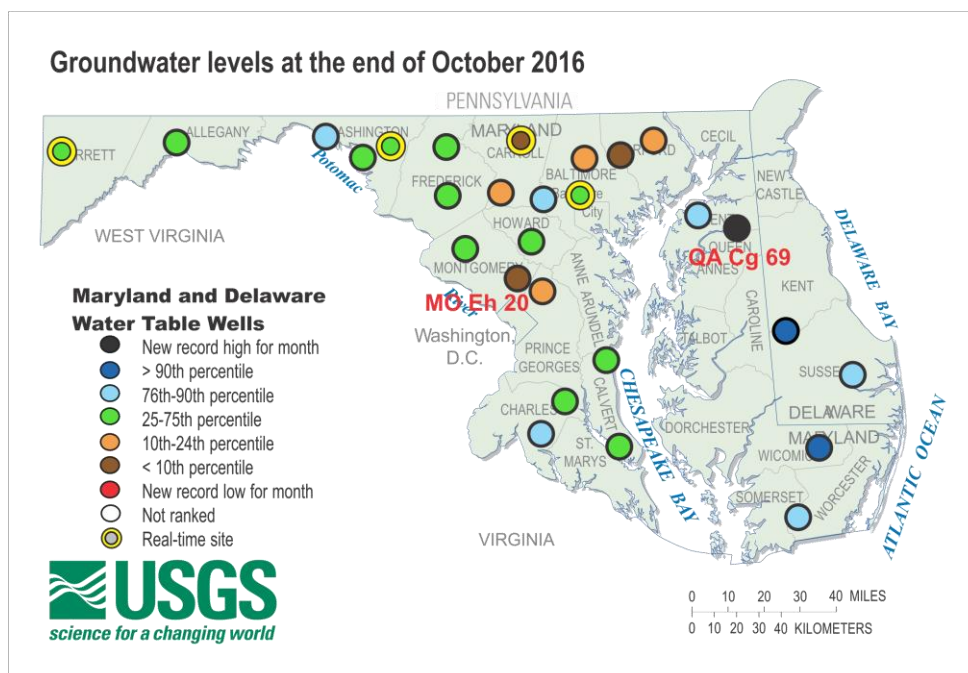
## Groundwater

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.

## October 2016 Groundwater Levels

Forty-three percent (12 of 28 wells) of the groundwater levels were in the normal range (25<sup>th</sup>-75<sup>th</sup> percentiles). There was a record high October groundwater level in Queen Anne's County, Maryland. Groundwater levels in USGS observation wells were greater than the 90<sup>th</sup> percentile at two wells on the Delmarva Peninsula. In contrast, there were three wells with groundwater levels below the 10<sup>th</sup> percentile in central Maryland.



To access the clickable groundwater map, go to:

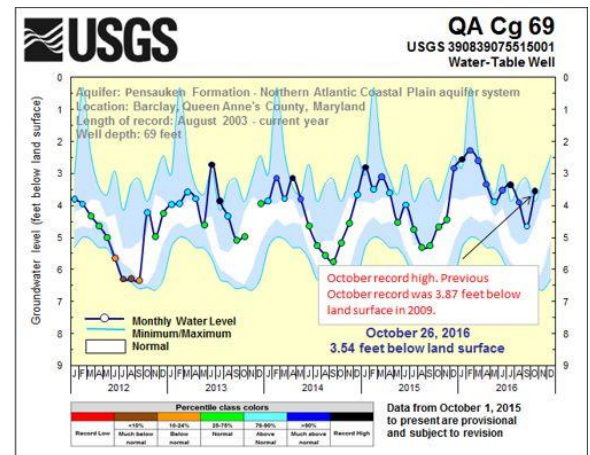
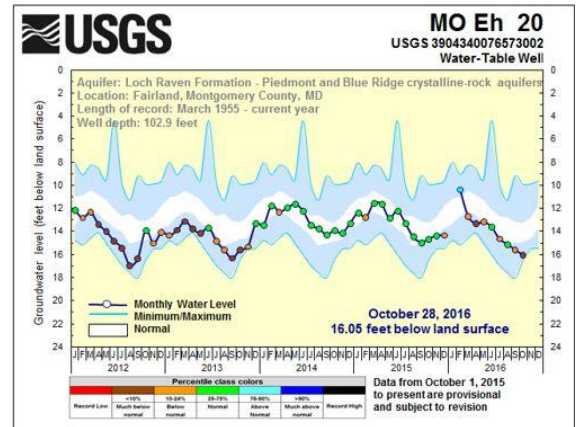
[http://md.water.usgs.gov/groundwater/web\\_wells/current/water\\_table/counties/](http://md.water.usgs.gov/groundwater/web_wells/current/water_table/counties/)

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

The groundwater level in USGS observation well MO Eh 20 in Montgomery County, Maryland was 16.05 feet below land surface in October, which was close to a record October low.

The 5-year hydrograph shows groundwater levels as a dark blue line, the minimum and maximum monthly values, and the normal range (between the 25<sup>th</sup> and 75<sup>th</sup> 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. These data are provisional and subject to revision.

The groundwater level in USGS observation well QA Cg 69 in Queen Anne's County, Maryland was 3.54 feet below land surface in October, which was a record October high, and exceeded the previous record of 3.87 feet below land surface set in 2009.



Five-year groundwater hydrographs can be viewed at:  
[http://md.water.usgs.gov/groundwater/web\\_wells/current/water\\_table/counties](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

## 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.

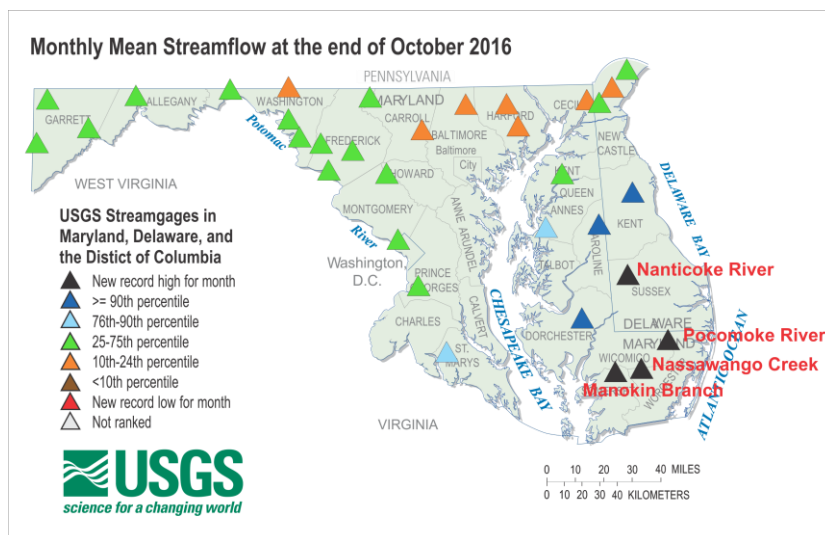
The streamflow locations chosen for the monthly water summary were selected based on the following criteria:

- 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.

## October 2016 Streamflow

Monthly mean streamflow ranged from below normal to record highs in October at USGS streamgages used to monitor climatic conditions in Maryland, Delaware, and the District of Columbia. Streamflow was at record highs on Manokin Branch, Nassawango Creek, and the Pocomoke River, in Maryland, and the Nanticoke River in Delaware. Streamflow was above normal at an additional five streamgages, including three above the 90<sup>th</sup> percentile, all on the Delmarva Peninsula. Much of high flows were driven by a storm event from September 29 through October 1, 2016.

Fifty-two percent (17 of 33) of the monthly mean streamflows were in the normal range (25<sup>th</sup>-75<sup>th</sup> percentiles) in October. Streamflow was below normal (between the 10<sup>th</sup> and 24<sup>th</sup> percentiles) at seven streamgages in Maryland and the Delaware.



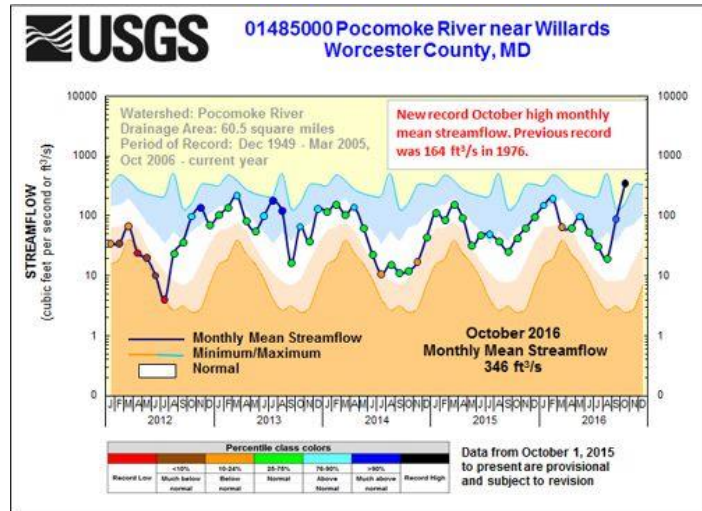
To access the clickable streamflow map, go to:  
<http://md.water.usgs.gov/surfacewater/streamflow/>



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

Monthly mean streamflow on the Pocomoke River near Willards in Worcester County, Maryland was at a record high of 346 cubic feet per second (ft<sup>3</sup>/s) in October, breaking the previous record of 164 ft<sup>3</sup>/s set in 1976. Similar rises in streamflow were seen at stations on the Eastern Shore because of the more than 12 inches of rainfall at the end of September.

The dark line in the 5-year hydrograph represents the monthly mean streamflow for this period and the white band shows the normal range (25<sup>th</sup>-75<sup>th</sup> 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.

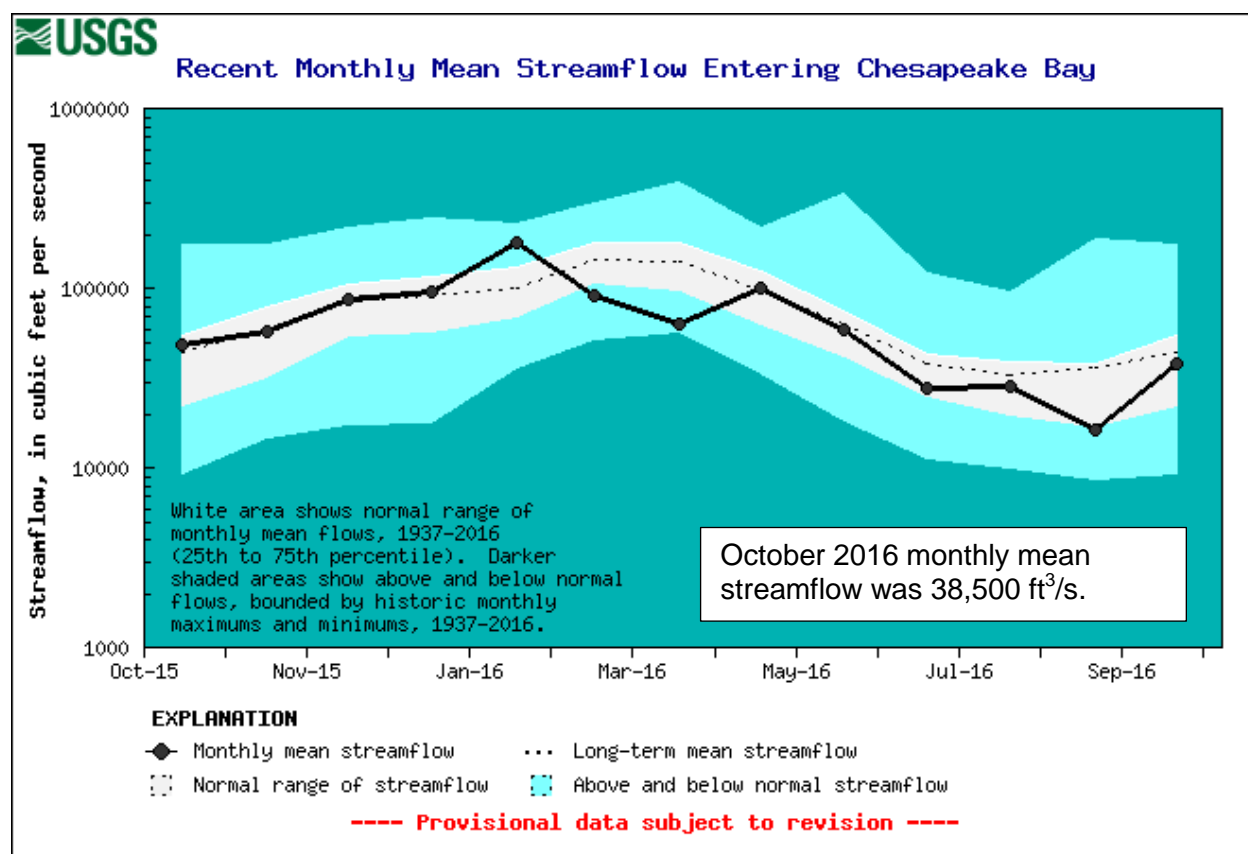


Five-year hydrographs can be viewed at:  
<http://md.water.usgs.gov/surfacewater/streamflow/>

# 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 October 2016, the monthly mean freshwater flow to the Chesapeake Bay was 38,500 ft<sup>3</sup>/s (provisional, and subject to revision), which is in the normal range. The long-term September average (mean) is 44,700 ft<sup>3</sup>/s, and the normal range is between 22,100 ft<sup>3</sup>/s and 55,700 ft<sup>3</sup>/s, the 25<sup>th</sup> and 75<sup>th</sup> percentiles of all October values. These provisional statistics are based on a 80-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 freshwater flow to the Bay can be found here:  
<http://md.water.usgs.gov/waterdata/chesinflow/>

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## Baltimore and Patuxent Reservoir Levels

Available reservoir storage at the end of October 2016 in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) was 90.85 percent of available storage capacity, or a total of 68.52 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 66.53 percent of normal storage capacity at the end of October 2016, with 7.08 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.

October 2016	Percent available/normal storage	Volume (billion gallons)
<b>Baltimore Reservoirs</b>		
<b>Baltimore City – Environmental Services Division</b>		
Liberty	87.91%	32.35
Loch Raven	95.85%	20.32
Prettyboy	88.80%	15.85
<b>Total</b>	<b>90.85%</b>	<b>68.52</b>
<b>Patuxent Reservoirs</b>		
<b>Washington Suburban Sanitary Commission (WSSC)</b>		
Triadelphia	69.99%	3.92
Duckett	63.06%	3.16
<b>Total</b>	<b>66.53%</b>	<b>7.08</b>

## Baltimore and Patuxent Reservoirs - Percent Full

