

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

October 2012 – Rain from “Superstorm Sandy” leads to high streamflows and drought recovery

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

USGS water data is 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 in wells to assess water resources for over 125 years.

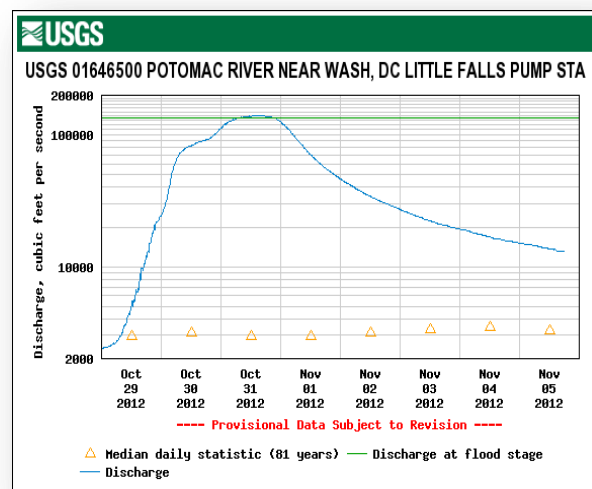
In addition to providing the most extensive set of historical streamflow and groundwater data available to the public, the USGS collects water data and quality-assures the data by employing standardized techniques across the country. The uniformity of the dataset allows for multi-state comparisons and other comparative statistical analyses that better inform policy makers of the possible water resource 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 October 2012 Water Conditions Summary

What began as Hurricane Sandy in the Caribbean developed into an enormous storm, referred to as “Superstorm Sandy.” It was the largest Atlantic Hurricane on record with a diameter of nearly 1,000 miles, and although it was no longer a hurricane when it made landfall, the effects were widespread. Superstorm Sandy was a combination hurricane/Nor’easter/winter storm unlike anything that had been experienced before. Parts of New York City, New Jersey, and many of the nearby areas of the eastern United States were devastated by storm surge and flooding, high wind, power outages, and fires.

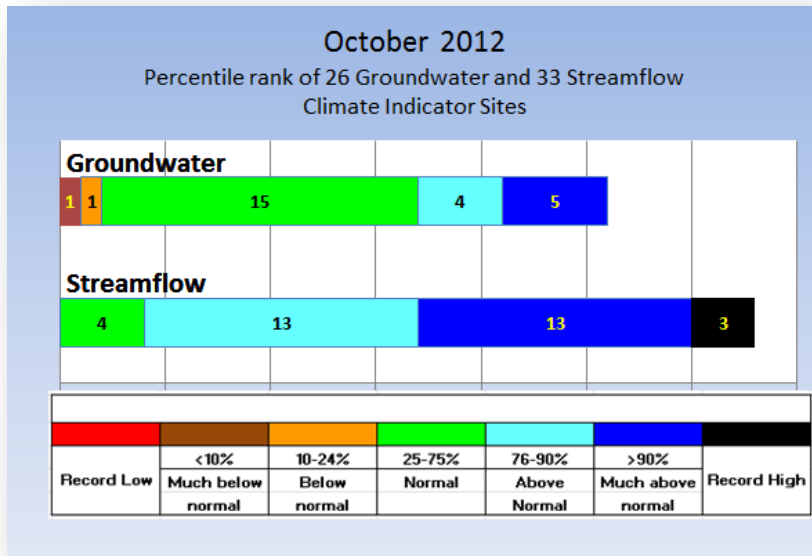
The Maryland, Delaware, and District of Columbia region was also affected by Superstorm Sandy, but the damage was much less severe. The equivalent of 1-2 months’ rainfall (3-6 inches) fell east of the mountains during the event, while 1-2 feet of snow fell in western Maryland. Many leaves were still on the trees; combined with the excessive precipitation and winds, this led to widespread power outages in the area. There are no longer any areas designated in drought status in Maryland, Delaware, or the District of Columbia as of the end of October.



In response to the storm, streamflow and groundwater levels rose significantly--the Potomac River near the District of Columbia reached flood stage (shown as a green line in the graphic).

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Record high monthly mean streamflow was recorded at three streams in Maryland in October. There were no streams with below normal monthly mean streamflow, and streamflow at 29 of the 33 streamflow-gaging stations in Maryland, Delaware, and the District of Columbia was above normal.



Groundwater levels were normal in 15 of the 26 USGS monitoring wells. Groundwater levels measured shortly after Superstorm Sandy were below normal at two wells, which may indicate a delayed response to recharge from the storm. Groundwater levels were above normal at 9 observation 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.

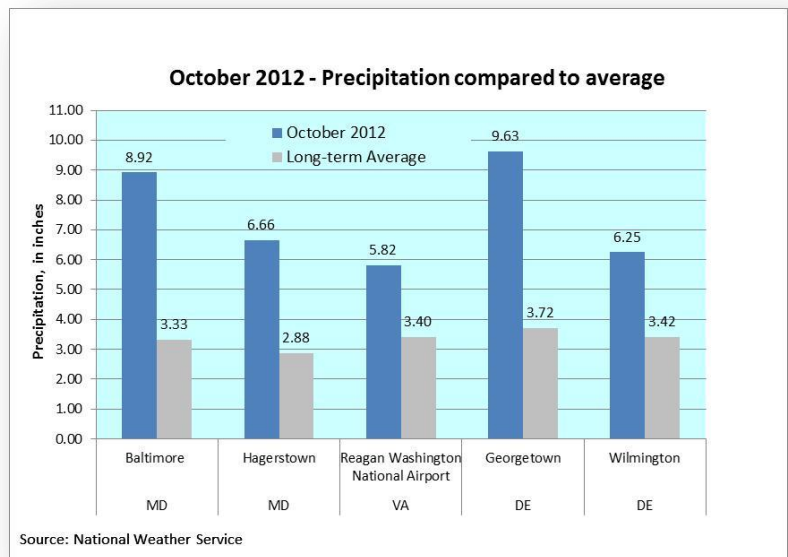
For example, a groundwater level in the 90th percentile is equal to or greater than 90 percent of the values recorded for that month.

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October 2012 Precipitation and Weather

Precipitation was above the long-term average for the climate normal period at the five National Weather Service (NWS) stations in the Maryland, Delaware, and District of Columbia region in October. As a result of Superstorm Sandy, the Mid-Atlantic region experienced high winds and high precipitation, which was rain in the eastern part of the state and 1-2 feet of snow in western Maryland.

Rainfall at three weather stations was over twice the normal monthly average. The highest rainfall among these stations was in Georgetown, Delaware with 9.63 inches, or 5.91 inches above the average rainfall for October. The second highest was in Baltimore, Maryland with 8.92 inches, or 5.59 inches above the average rainfall. Over the 3-day period from October 28 to October 30, 6.67 inches of rain fell in Baltimore, which is close to double the monthly average. Although some flooding occurred, it was not as bad as expected.



The least amount of rainfall was at Ronald Reagan Washington National Airport, near the District of Columbia, with 5.82 inches; the average rainfall for October is 3.40 inches. Average monthly temperatures were just above the long-term average at all five weather stations.

The Middle Atlantic River Forecast Center web site shows that for the last 365 days, precipitation fell within the normal range for all of Maryland and Delaware. For October 2012, every county in Maryland and Delaware was ranked "greater than 75 percent above" (normal), except for Garrett and Allegany Counties, which received snowfall instead of rain.

Sources:

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

Drought Status

The long-term rainfall deficit disappeared after the above normal rainfall associated with Superstorm Sandy across the region. The U.S. Drought Monitor web site map (http://droughtmonitor.unl.edu/DM_northeast.htm) issued on November 1, 2012 showed no drought status for Maryland, Delaware, or the District of Columbia.

Maryland and Delaware had both had some level of drought designation since January 2012, mostly on the Eastern Shore, in southern Maryland, and on the Delmarva Peninsula. There had been areas of drought in 2011, but they were eliminated during the fall by the record rainfall associated with Hurricane Irene and Tropical Storm Lee in August and September 2011, respectively.

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Streamflow

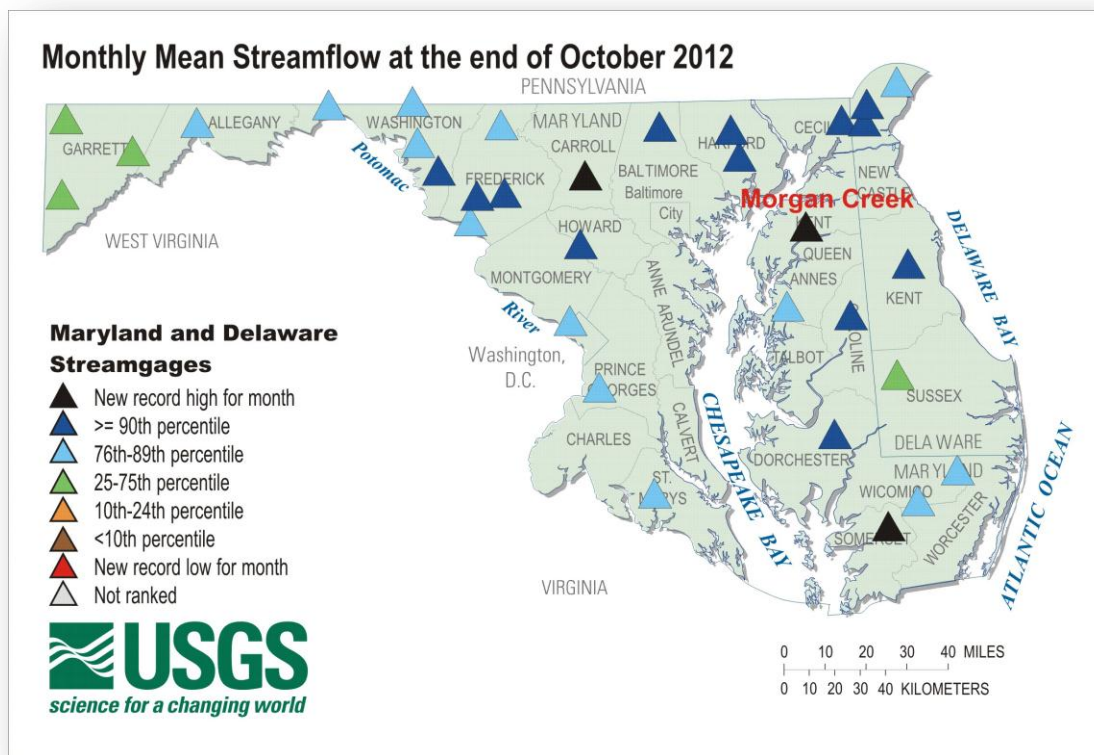
Streamflow data are used for many purposes. A few of the most obvious uses are to assess water supply and the risk of droughts and floods. Streamflow data are also used to calculate loads of chemical constituents and to assess how biological communities are affected by hydrologic conditions. The USGS operates the most extensive network of streamflow gages 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 2012 Streamflow

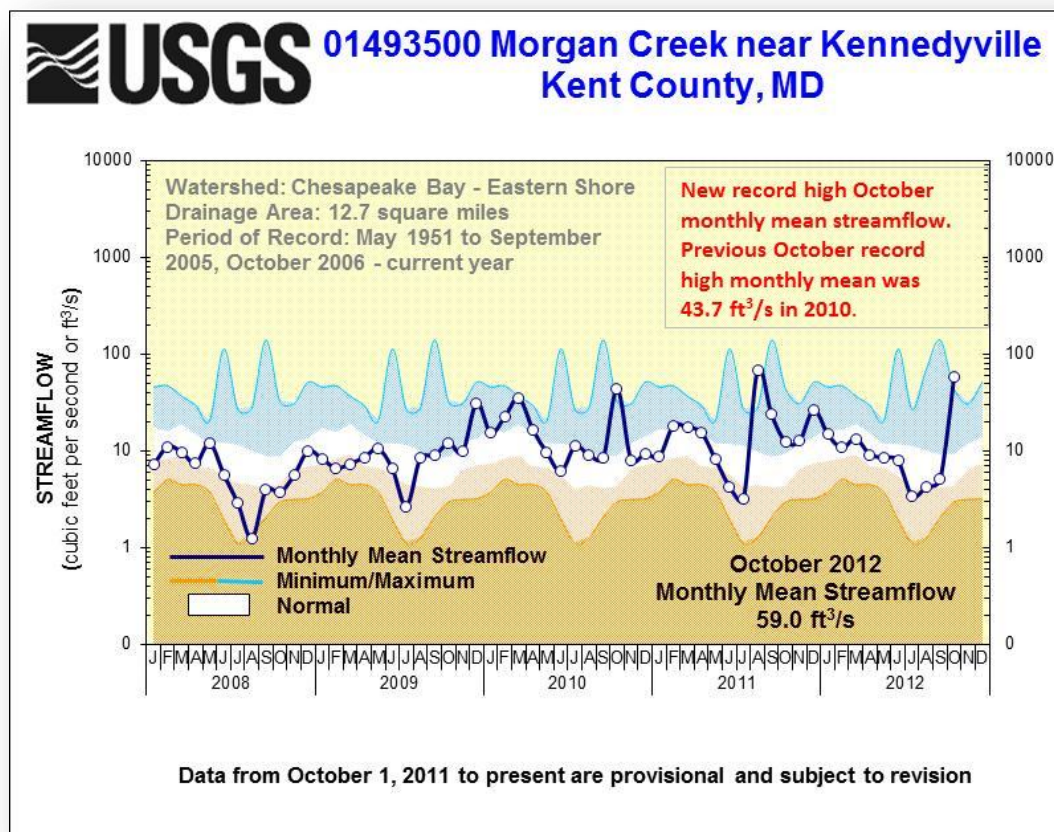
Monthly mean streamflow was normal to above normal at all 33 USGS streamflow-gaging stations used to monitor climatic response in Maryland, Delaware, and the District of Columbia. Normal is considered to be between the 25th and 75th percentiles. There were three record high monthly mean streamflows at streams in Carroll, Kent, and Somerset Counties in Maryland. Streamflow levels rose at all stations except for one, the Monocacy River at Bridgeport, and several of these were also near a monthly record high.



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

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Monthly mean streamflow on Morgan Creek in Kent County, Maryland set a record high for October 2012 at 59.0 cubic feet per second (ft³/s). The previous record high, set 2 years ago in October 2010 was 43.7 ft³/s. There was also a record high monthly mean streamflow at this station in August 2011. Record-keeping began at this station in May 1951.



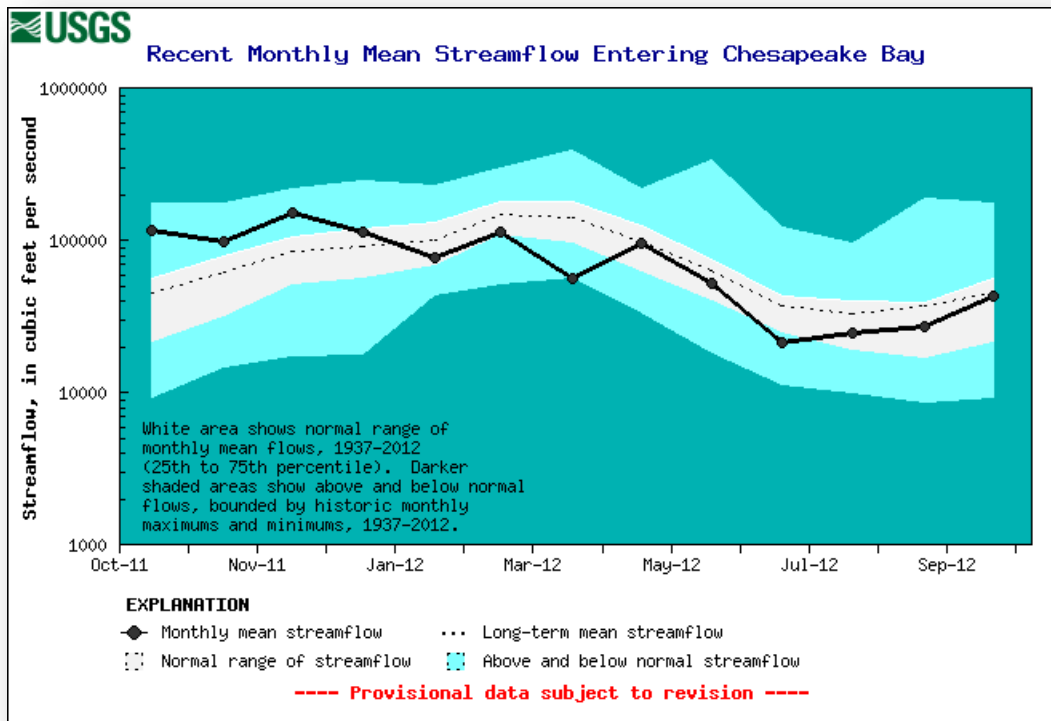
Five-year hydrographs can be viewed at:
<http://md.water.usgs.gov/surfacewater/streamflow/>

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 to 75th percentile) 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.

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Estimated Streamflow to the Chesapeake Bay

The estimated monthly mean freshwater streamflow to Chesapeake Bay remained in the normal range in October 2012, at 43,700 cubic feet per second (ft³/s; provisional and subject to revision). The normal range for average (mean) monthly streamflow for September is between 21,600 ft³/s and 56,600 ft³/s, the 25th and 75th percentiles, respectively, of all October values. These statistics are based on a 76-year period of record.



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

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Groundwater

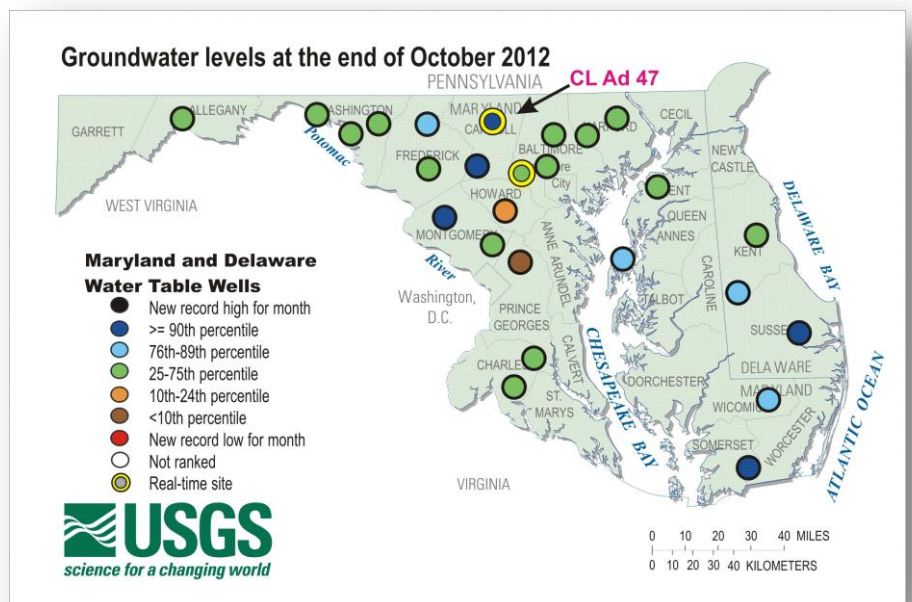
The USGS monitors groundwater levels in unconfined aquifers, providing observations that can be compared to both short-term and long-term changes in climatic conditions. Twenty-six groundwater wells were selected based on the following criteria:

- 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 casing--dug wells not used;
- Water levels show no apparent hydrologic connection to nearby streams;
- Well has never gone dry; and
- Long-term accessibility likely.

October 2012 Groundwater Levels

Groundwater levels used to monitor climatic conditions in Maryland and Delaware were normal or above normal in 24 of 26 wells. Normal is considered to be between the 25th and 75th percentiles. All but two of the wells are measured by hand by hydrologists on a monthly basis and are therefore not all measured simultaneously. Some wells were measured in the middle of the month and did not include the rainfall from Superstorm Sandy, making comparisons more difficult. The groundwater levels in the wells in western Maryland may have risen from their current “normal” status to above normal levels after Superstorm Sandy.

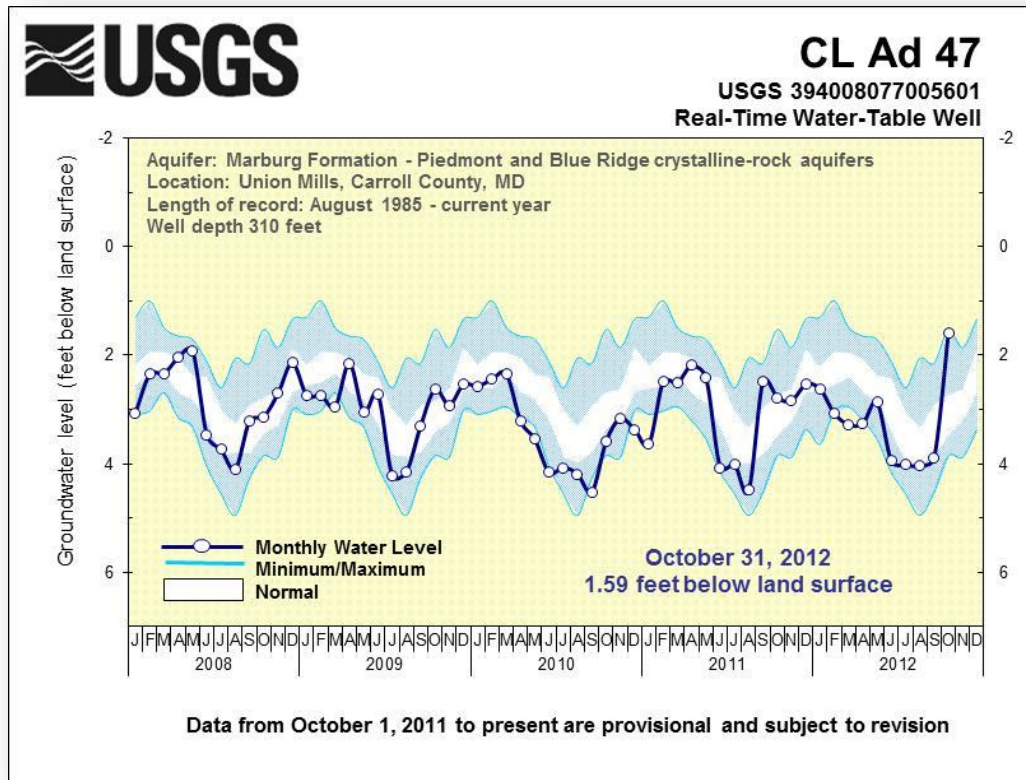
Two wells, in Howard and Prince George’s Counties, had groundwater levels below normal. These wells were measured shortly after Superstorm Sandy, and the lack of response may indicate that recharge from the event had not yet reached the water table.



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

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The groundwater level in observation well CL Ad 47 in Carroll County, Maryland rose to a nearly record-setting high level in October in response to the rainfall from Superstorm Sandy. The previous October record high was set in 2003 at 1.53 feet below land surface.



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 blue section and the minimum water level is at the bottom of the blue section in the graph.

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Reservoir Levels

Rain associated with Superstorm Sandy caused the reservoir storage at the end of October in the Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) to increase 1 percent to 97 percent of available storage capacity, with a total of 73.65 billion gallons of water.

Storage in the Triadelphia and Duckett Reservoirs, which serve parts of Howard, Montgomery, and Prince George’s Counties in suburban areas around the District of Columbia, rose from 66 percent of normal storage capacity at the end of September to 97 percent at the end of October 2012, with 10.33 billion gallons.

October 2012	Percent available/normal storage	Volume (billion gallons)	Source
Baltimore Reservoirs			Baltimore City – Environmental Services Division
Liberty	94%	34.60	
Loch Raven	100%	21.20	
Prettyboy	100%	17.85	
Total	97%	73.65	
Patuxent Reservoirs			Washington Suburban Sanitary Commission (WSSC)
Triadelphia	100%	5.62	
Duckett	94%	4.71	
Total	97%	10.33	