News Release

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Highest September Flow to the Chesapeake Bay Since 1937

Rainfall associated with several hurricanes in the Mid-Atlantic States resulted in record high September streamflow to the Chesapeake Bay, according to hydrologists at the U.S. Geological Survey (USGS). This is the highest September flow to the Bay since record-keeping began in 1937. High flows in September continue a 3-month sequence of high flows, which brings high amounts of nutrients and sediment to the Bay. The record flow caused scouring of sediment from the Susquehanna River at Conowingo Dam; the last time this occurred was in 1996. Most of this flow was from flooding in Pennsylvania, where the upper part of the Chesapeake Bay watershed is located (see more details in the Chesapeake Bay section below).

Photo taken by Wendy S. McPherson on September 21, 2004 at Conowingo Dam showing the sediment loaded Susquehanna River.

September streamflow at the mouth of the Susquehanna River was the highest monthly flow in 67 years, with 113,800 cubic feet per second (cfs). September flow was 72 percent higher than the previous record (81,700 cfs), set in 1975. The Susquehanna River typically contributes half the flow to the Chesapeake Bay, but during the last 3 months, the contribution has been much higher. The high flows brought higher than usual amounts of sediment and nutrients. The sediment is visible in the photo at Conowingo Dam.

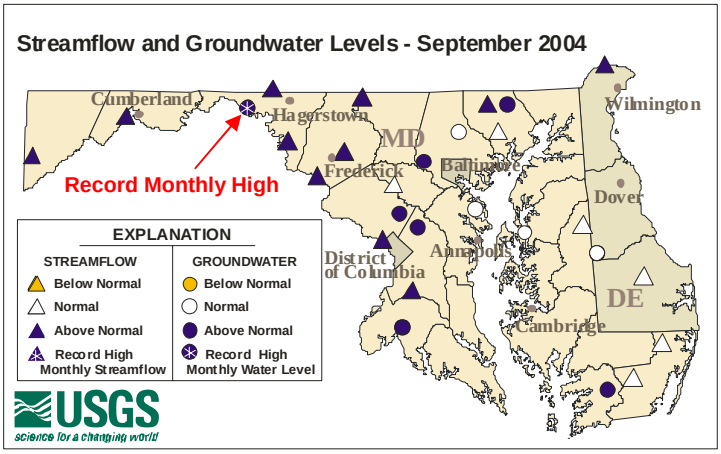
The high flow and nutrient and sediment loads in September will have some short-term impact on conditions in Chesapeake Bay in 2004 and may impact conditions in spring 2005. Since the high flows occurred late in the summer of 2004, the impacts to the Bay may be fairly small this year.

Streamflow levels in central and western Maryland were above normal, which includes the Potomac River. In southern and eastern Maryland and most of Delaware, September water levels were normal, except for northern Delaware, which was above normal. An observation well in Washington County, Maryland was at its highest September level since 1996, which reflects the more than 7 inches of rain the region received. Groundwater levels in other parts of Maryland and Delaware were normal to above normal; however, some wells were measured before the hurricanes crossed the region.

Precipitation

Rainfall totals in September varied widely across Maryland, Delaware, and Washington, D.C. and were dependent on the paths of hurricanes. Remnants of Hurricanes Ivan and Jeanne brought more than 7 inches of rainfall to western Maryland in September. Rainfall was also above normal in northern Maryland and northern Delaware. In Delaware, rainfall at Wilmington was 9.31 inches, or 5.30 inches above normal, while rainfall further south in Georgetown was 1.87 inches below normal, according to preliminary rainfall data from the National Weather Service. September rainfall and temperatures were near normal in Baltimore and Washington, D.C., southern and eastern Maryland, and southern Delaware. However, the National Weather Service reported that a record rainfall of 2.46 inches was set on September 28 at Washington National Airport, which broke the old record of 1.69 set in 1907.

These September storms, including Hurricane Frances, dropped higher than normal rainfall to the west and north of Maryland, which caused major flooding in western Maryland and along the lower Susquehanna River. Rainfall was also high in the Potomac River Basin, leading to high flows on the river and contributing to the highest September flow to the Chesapeake Bay.

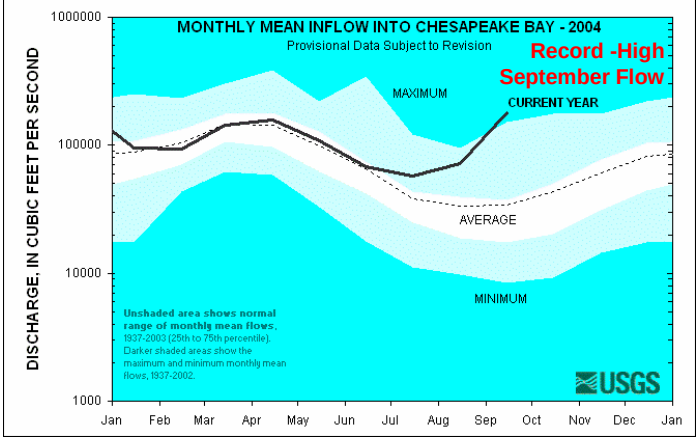


Status of Streams and Wells

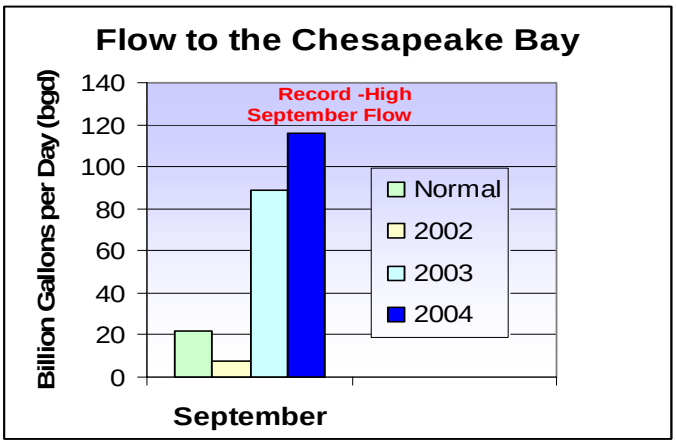
The map to the left shows the location of the wells and streams used by the USGS to monitor water conditions in Maryland, Delaware, and Washington, D.C. Water levels were influenced by the path of the hurricanes, which crossed central and western Maryland. The result was a new monthly high for an observation well in Washington County (see starred symbol on map), and river levels rose to above normal levels. In eastern Maryland, rainfall was near normal, as were water levels in this region.

Chesapeake Bay

Monthly mean streamflow into the Chesapeake Bay during September averaged 116.2 bgd (billion gallons per day), which is 430 percent above normal. This is the highest September flow since 1937. Flow to the Bay has been in the normal range since January, but has been far above normal for the last 2 months (see graphs below).



Flow was normal until July 2004, and has been above normal since then because of several hurricanes. See graph at http://md.water.usgs.gov/monthly/bay.html.



This graph shows how the September 2004 flow compares to normal flow, and September flow in 2003 (also a high flow year), and 2002 (a drought year).

High flow during the last 3 months has contributed to the third highest water year* flow (74.9 bgd) to the Bay. Flow during the 2003 water year was also high and ranked as the second highest since record-keeping began. Normal flow to the Bay is 50.5 bgd, and flow during the dry water year 2003 was only 8.27 bgd.

Rank	Year	Billion gallons per day (bgd)
1	1972	78.2
2	2003	76.2
3	**2004**	**74.9**
4	1996	74.0
Normal		50.5
Drought year	2002	8.27

*The water year (WY) is the natural, annual water cycle from October through September that is used by hydrologists. Streamflow and groundwater levels are generally at their lowest levels at the end of September and the recharge cycle begins again in October when water levels begin to rise because there is less demand for water from plants and people.

The Susquehanna, Potomac, and James Rivers are the largest rivers in the Chesapeake Bay watershed and usually contribute about 85 percent of the freshwater streamflow to the Bay. In an average year, approximately 50 percent of the freshwater flow comes from the Susquehanna River, 20 percent from the Potomac River, and 15 percent from the James River. The remaining 15 percent comes from surrounding tributaries and smaller streams.

This September, more freshwater entered the Bay from the Susquehanna River (63 percent) than normal, and the flow at the mouth of the river was the highest September flow on record. While the Potomac and James Rivers contributed proportionately less water than normal, 14 percent and 9 percent respectively, the Potomac River had the fifth highest flow, and the James River had the seventh highest flow. The remaining 14 percent was from other sources in September. More information about USGS studies to help with the protection and restoration of the Chesapeake Bay and its watershed can be found at http://chesapeake.usgs.gov.

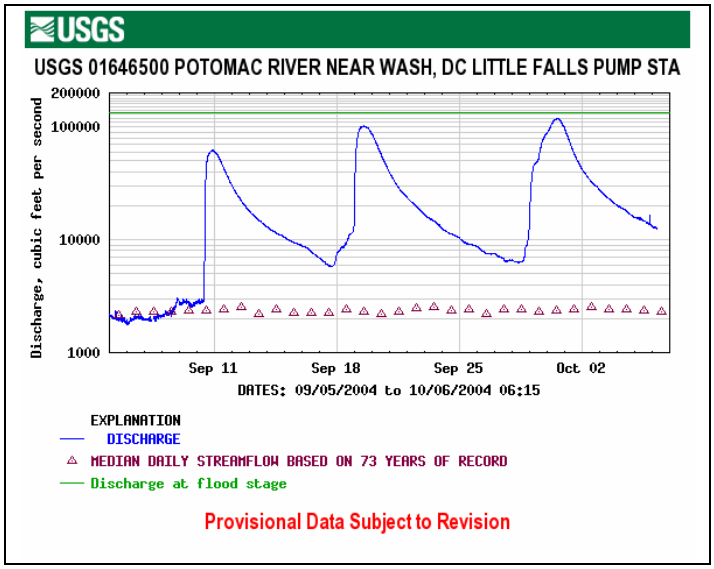
According to scientists, the increased nutrient and sediment loads will probably only have short-term impacts on the Bay in 2004. The increased sediment will result in less light in the Bay waters, which could impact the growth of submerged aquatic vegetation (SAV). However, since it is late in the growing season for SAV, this impact may be minimal. SAV is important in the Bay because it provides oxygen and habitat for fish and crabs, and food for waterfowl.

The increased nutrient loads could also contribute to algal blooms which result in low dissolved-oxygen levels in the Bay, especially during the summer. The low dissolved oxygen can cause loss of fish, crabs, and oysters. However, the higher nutrient loads in September are occurring when Bay waters are beginning to cool, so there is less likelihood for impacts on dissolved oxygen. The high nutrient loads delivered this fall may cause worse than normal algal blooms and dissolved oxygen levels next spring as the waters warm.

Streamflow

Streamflow in Maryland and Delaware ranged from normal to above normal in September. Rainfall in western Maryland was twice the normal amount for September, which resulted in high flows and some new daily record highs. Streams in the central Maryland Piedmont region, on the Eastern shore, and in most of Delaware were flowing at normal to above normal levels. Current and historical streamflow data can be monitored on the web at: http://waterdata.usgs.gov/. Monthly streamflow has been at normal to above normal levels since September 2002 at the Brandywine River in Delaware and the following streams in Maryland: Antietam Creek, Choptank River, Conococheague Creek, Deer Creek, Monocacy River, Patuxent River, Piscataway River, Potomac River, Youghiogheny River, and Winters Run. Five-year monthly streamflow hydrographs from the USGS stream-gaging network can be viewed on the USGS website at: http://md.water.usgs.gov/surfacewater/streamflow/

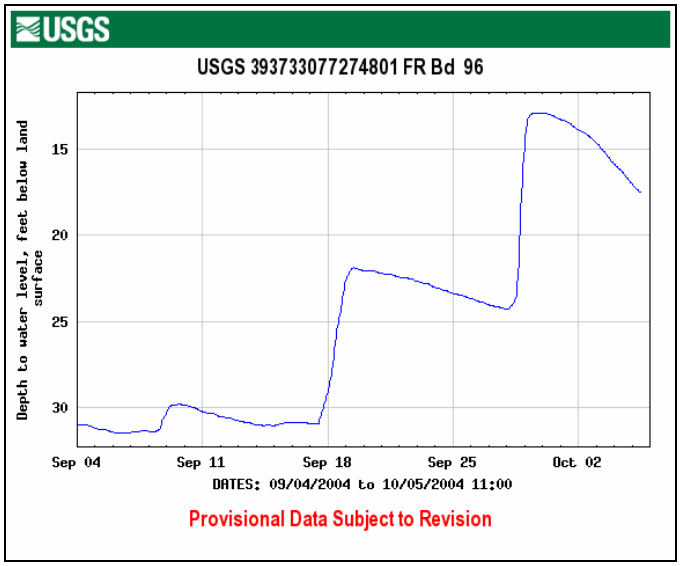
Daily streamflow on the Potomac River near Washington, D.C. averaged 13.4 bgd in September, which is 520 percent above normal for the month of September. Flow at the mouth of the Potomac River entering the Chesapeake Bay during September was the fifth highest on record. Flow in 2003 was the second highest. Streamflow on the Potomac River during water year 2004 was 12.0 bgd, or 46 percent above normal. More information on the Potomac River is available at: http://md.water.usgs.gov/monthly/poto.html.



Streamflow, also called discharge, approached flood stage (shown as a green line) three times in September on the Potomac River near Washington, D.C. Flow was normal (triangles) at the beginning of September and the three rises were related to rainfall associated with hurricanes in the Potomac River Basin. Note that although the river receded, it remained above normal before the next rainfall event and each peak was a little higher than the previous. For real-time streamflow and gage height data, visit: http://waterdata.usgs.gov/.

Groundwater-Unconfined or Shallow Aquifers

Groundwater levels were normal to above normal during September in wells used by the USGS to monitor unconfined or shallow aquifer response to climatic conditions in the Maryland, Delaware, and Washington, D.C. region. Rainfall associated with hurricanes caused some groundwater levels to rise and the observation well in Washington County reached the highest September level since 1996. For 5-year hydrographs of groundwater levels for the climatic indicator wells, visit: http://md.water.usgs.gov/groundwater/.



Groundwater levels for this well in Frederick County, Maryland show a response to rainfall associated with September hurricanes. Groundwater levels are shown as depth below land surface. A rise on the hydrographs means that the groundwater level is closer to land surface. Note that the water level climbed nearly 15 feet since the beginning of September. For real-time groundwater data, visit: http://waterdata.usgs.gov/.

Groundwater-Confined or Deep Aquifers

Water levels in the deep confined aquifers continue to decline because the wells are pumped at higher rates than the rate at which deep groundwater is recharged. Because confined aquifers are deep, water levels in confined aquifers respond slowly to climatic conditions. The network of confined aquifer wells has been reduced because of diminishing funds. Several wells will no longer be measured on a monthly basis, and the web pages will be updated when data is collected. Limited data for confined aquifer wells can be viewed at: http://md.water.usgs.gov/groundwater. Real-time water-level data can be viewed at: http://waterdata.usgs.gov/md/nwis/gw

Reservoir Storage

Storage of the Baltimore reservoir system rose 1 percent, to 97 percent of capacity in September. The Baltimore reservoirs (Loch Raven, Liberty, and Prettyboy) have been nearly full since May 2003. Storage in the Triadelphia and Duckett Reservoirs on the Patuxent River, which serve Montgomery and Prince Georges Counties, dropped 4 percent to 85 percent of capacity in September.

Water Monitoring

The USGS has been collecting National streamflow data for 120 years, since 1884. Streamflow monitoring began in Maryland on the Potomac River at Point of Rocks, Maryland in 1895 and continues today. Streamflow and groundwater levels are used to assess current water conditions and can be used to predict the potential for flooding and drought conditions. These USGS data have been provided to State and local water resource managers and are critical for making appropriate decisions on water regulation. For more information on streamflow and groundwater levels in Maryland, Delaware, and the District of Columbia, visit Water Watch at: http://md.water.usgs.gov/waterwatch/.

The real-time streamflow stations used in this analysis are operated in cooperation with the Maryland and Delaware Geological Surveys, the Maryland State Highway Administration, the U.S. Army Corps of Engineers, the Maryland Department of Natural Resources, the Maryland Department of the Environment, Baltimore County, Baltimore City, and other agencies. The long-term observation wells used in this analysis are operated in cooperation with the Maryland and Delaware Geological Surveys and the Interstate Commission on the Potomac River Basin. The real-time wells are operated in cooperation with the Maryland and Delaware Geological Surveys, the Interstate Commission on the Potomac River Basin, and Calvert County, Maryland. The USGS publishes data for 137 streamflow stations, 393 observation wells, and 4 springs across Delaware, Maryland, and the District of Columbia.

The USGS, a Bureau within the Department of the Interior, has served the Nation and the world for 125 years by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; to make important decisions and enhance and protect our quality of life.

Recently Released USGS Report: Streamflow statistics for 15 streams in Delaware

A new Open-File Report that contains low-flow statistics for 15 streamgaging stations in Delaware has been released by the Maryland-Delaware-District of Columbia District of the U.S. Geological Survey. The statistics contained in the report, OFR 2004-1313, can be used by engineers, planners, land and water-resource managers, biologists, and many others to help in the design and management of water-related infrastructure and protection of habitat for aquatic plants and animals. The report, written by hydrologist Kernell Ries, contains low-flow frequency statistics, such as the 7-day, 10-year low flow, and flow-duration statistics, such as the 95-percent duration flow. The average flow over a 7-day period is less than the 7-day, 10-year flow, on average, once in 10 years. The 95-percent duration flow is the flow that is equaled or exceeded 95 percent of the time. In addition to these flow statistics, the report contains several other low-flow frequency and flow-duration statistics. The report is available online only at http://md.water.usgs.gov/publications/ofr-2004-1313/.

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