

Virginia's Surface-Water Resources, Monitoring Network, and Studies, 2007

Surface-Water Resources

Surface water is a valuable resource in Virginia, providing 1,091 million gallons per day, or 78 percent, of the total freshwater used in the State (excluding thermoelectric use). The major river basins in the State include the Big Sandy, Chowan, James, Kanawha, Potomac, Rappahannock, Roanoke, Tennessee, and York (fig. 1).

Surface-Water Monitoring Network

The Virginia Water Science Center (WSC), in cooperation with the Virginia Department of Environmental Quality, administers and maintains 188 stream-gaging stations, which are distributed throughout the major river basins of the state (fig. 1). At each station, Virginia WSC personnel calculate the discharge of the river at that point, using a variety of methods. One long-used method to make a discharge measurement is by wading the river with a wading rod and current meter to measure depth and velocity. A newer method that shows promise of being more accurate and efficient in some cases is the use of **hydroacoustics**, which uses Doppler measurements of reflected sound waves to determine flow velocities. Associated flow depths are measured directly by sound-wave reflection from the channel bottom.

Hydroacoustic instruments commonly are used for the measurement of streamflow, water velocity, and hydrographic surveying. Research is being conducted on the use of this technology for other applications such as quantifying sediment loads. The addition of acoustic measurement equipment to existing gaging techniques allows Virginia WSC personnel to work more efficiently at some gages and to make measurements at locations that otherwise would be difficult, if not impossible, to measure accurately with traditional equipment. Such cases include sites with bi-directional flow (tidally influenced) and high or rapidly changing flows, where flood conditions make it unsafe to place a person in the water.

USGS stream-gaging data are essential for the following purposes:

- Planning, designing, operating, and maintaining the nation's multipurpose water management systems;
- Issuing flood warnings to protect lives and reduce property damage;
- Designing highways and bridges;
- Mapping floodplains;

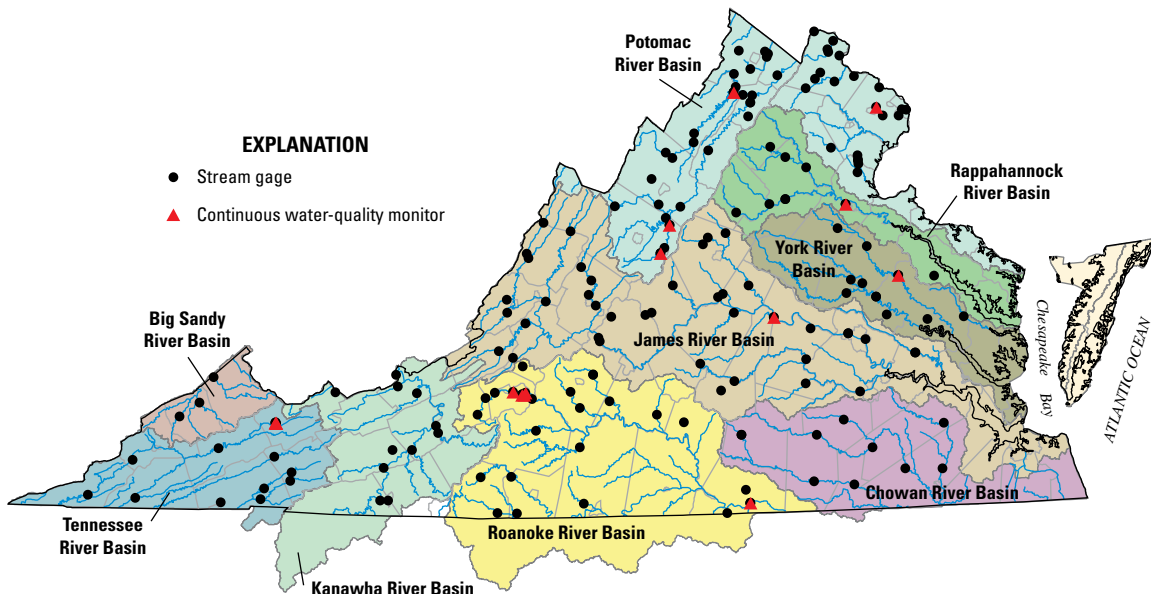


Figure 1. Location of monitoring stations in Virginia. For current real-time streamflow and water-quality data, see <http://waterdata.usgs.gov/va/nwis/rt>.

Water-quality data collected along with discharge data are essential to conduct any surface-water study.

- Monitoring environmental conditions and protecting aquatic habitats;
- Protecting water quality and regulating pollutant discharges;
- Managing water rights and transboundary water issues;
- Education and research; and
- Recreational uses.

In addition to collecting stream-gaging data, the Virginia WSC also collects water-quality samples at over 100 locations throughout the state. Stream-water samples may be analyzed for routine water-quality parameters such as temperature, pH, specific conductance, dissolved oxygen, and turbidity, or for specialized parameters such as concentration of mercury, nutrients, pesticides, or person wastewater products.

Stream-water samples for water-quality analyses are collected as either discrete samples, where a person collects the sample for later analysis, or as continuous samples, where automated equipment, which is placed in and left in the stream, monitors and records the water quality electronically.

Surface-Water Studies

The Virginia WSC conducts studies in cooperation with State, local, and other Federal agencies. Continuously collected water-quality data (temperature, pH, specific conductance, and turbidity) are used to:

- Quantify the influence of best-management practices (BMPs) on instream water-quality;
- Serve as a “real-time” warning system for changing water-quality conditions as a result of stream-channel modification activities related to construction or releases from reservoirs;
- Serve as a surrogate for predicting targeted water-quality constituent concentrations and loads; and
- Enhance hydrograph separation techniques.

The Virginia WSC also conducts studies that utilize discrete (as opposed to continuous) water-quality sampling. These studies typically focus on:

- Quantification of long-term water-quality trends in rivers throughout the state;
- Fate and transport of a variety of water-quality constituents, including nutrients, sediment, metals, pesticides, and enteric bacteria and viruses;
- “Emerging” contaminants, such as endocrine disrupting compounds;
- Channel geomorphology;
- Ecological flows and minimum in-stream flow analyses;
- Total Maximum Daily Load development for enteric bacteria, pH, and mercury; and
- Development of models for assessment of complex hydrologic systems.

For information about water resources in Virginia, see <http://va.water.usgs.gov> or contact Mark Bennett, Director, USGS Virginia Water Science Center, 1730 East Parham Rd., Richmond, VA 23228; 804-261-2643 (dc_va@usgs.gov).

