

In 1991, the U.S. Geological Survey (USGS) began a National Water-Quality Assessment (NAWQA) Program to (1) document the quality of a large, representative part of the Nation's water resources, (2) define water-quality trends, and (3) identify major factors that affect water quality. In addressing these goals, the program produces water-quality information useful to National, State, and local policy-makers and managers.

Studies of 60 hydrologic systems that include parts of most major river basins and aquifer systems are the building blocks of NAWQA. Study units range from less than 1,000 to more than 60,000 square miles (mi²) and represent about

two thirds of the Nation's water use and population served by public water supply. Twenty study units started in 1991, 20 more in 1994, and the final 20 are planned for 1997. Assessment of the Kanawha–New River Basin began in 1994.

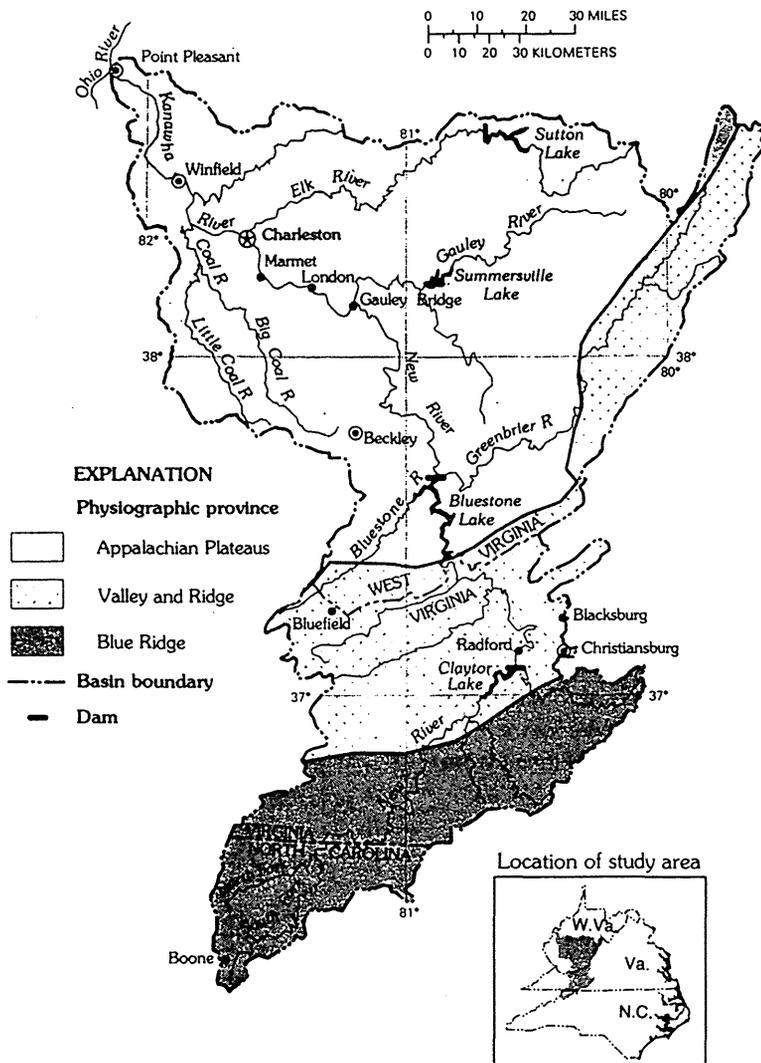
DESCRIPTION OF THE BASIN

The Kanawha–New River Basin encompasses 12,233 mi² and includes parts of West Virginia (8,424 mi²), Virginia (3,044 mi²), and North Carolina (765 mi²). In 1990, about 870,000 people lived in the basin, of whom about 25 percent lived in the Charleston, W.Va., metropolitan area. Other communities with a

population of greater than 10,000 include Beckley and Bluefield, W.Va.; Blacksburg, Radford, and Christiansburg, Va.; and Boone, N.C. Since 1940, the population of the basin has fluctuated within 7 percent of the 1990 population. Major industries include chemical manufacturing, coal mining, forestry, agriculture, and recreation.

Three physiographic provinces are included in the Kanawha–New River Basin—the Appalachian Plateaus, the Valley and Ridge, and the Blue Ridge. Steep slopes (greater than 20 percent) are characteristic throughout the basin, and flat areas are limited to valley bottoms and ridgetops. Forests are the dominant land use and occupy about 71 percent of the basin. About 23 percent is used for crops and pastures, and only about 3 percent is urban or industrial. The climate is continental; minimum winter temperatures in the northeastern part of the basin average about 20 degrees Fahrenheit (°F), and maximum summer temperatures in the western part average about 85°F. Average annual precipitation ranges from 36 inches (in.) in the central part of the basin to 56 in. near Boone, N.C., and 60 in. at the headwaters of the Elk River. Average annual runoff in most of the basin ranges from 15 to 30 in., of which from 45 to 65 percent is ground-water discharge. For the entire basin, average annual runoff is 20.5 in. compared with average annual precipitation of 43.5 in.; the difference of 23 in. is an estimate of evapotranspiration.

The New River begins in North Carolina at the confluence of the North and South Forks and flows generally north for 250 miles (mi) to Gauley Bridge, W.Va., where it joins the Gauley River to form the Kanawha River. The Kanawha River flows 97 mi northwest to the Ohio River at Point Pleasant, W.Va. During 1940–1993, the average flow of the Kanawha River at Charleston, W.Va., was 9,700 million gallons per day (Mgal/d); maximum flow was 140,000 Mgal/d on August 15, 1940, and minimum flow was less than 670 Mgal/d during October 1–5, 1953. Major tributaries of the Kanawha



and New Rivers are the Greenbrier, Elk, Gauley, Coal, and Bluestone Rivers.

The Kanawha River is navigable by barges for 91 mi upstream from the Ohio; dams with locks are at Winfield, Marmet, and London, W. Va. Streamflow in much of the basin is controlled by four major reservoirs, but their capacity is only about 14 percent of the average annual flow at Charleston. The reservoirs provide flood control, recreation, and hydropower; during periods of low flow, they maintain navigation and water quality, principally dissolved oxygen. Hydroelectric power is generated at Claytor Lake, at two large run-of-river plants on the New River, and at the three navigation dams. The New River downstream from Bluestone Lake and the Gauley River downstream from Summersville Lake are used for commercial whitewater rafting. The New River Gorge National River includes most of the New River downstream from Bluestone Lake. Recreational fishing and boating are common throughout the basin.

Rocks in the Appalachian Plateaus and the Valley and Ridge Provinces are sedimentary (sandstone, shale, limestone, coal). The Blue Ridge Province is underlain mostly by crystalline rocks. The bedrock is blanketed by weathered material, or regolith, typically less than 20 ft thick. Unconsolidated sediments are less than 70 ft thick along the Kanawha River and generally less than 30 ft thick in other river valleys. Soils on steep slopes generally are shallow and have low fertility and high erosion potential. Soils in limestone areas of the Valley and Ridge and over unconsolidated sediments are commonly deeper and more fertile.

Ground water occurs primarily in fractures in the sedimentary and crystalline rocks of the basin and in the pore spaces of the unconsolidated sediments and regolith. Natural fractures are most common near the land surface, along valley sides and bottoms, and near the crest of upward folds in the rocks. More water is withdrawn from Lower Pennsylvanian aquifers in the Appalachian Plateaus than from any other unit in the basin.

In 1990, water withdrawn from streams and aquifers in the Kanawha–New River Basin averaged 1,680 Mgal/d, over 80 percent of which was surface water.

About 56 percent of the total was withdrawn from surface water for thermoelectric-power production; 20 percent, from surface water for industrial use; and 12 percent, from ground water for mining uses. Public water systems withdrew 78 Mgal/d, and individual domestic users withdrew 24 Mgal/d. Ground water provides the domestic water supply of almost all rural residents in the basin. In addition to the withdrawals, nearly 22,000 Mgal/d was used to generate hydroelectric power.

COORDINATION

Coordination between USGS and water-management or scientific organizations is essential to NAWQA. A study-unit liaison committee has been organized, consisting of representatives from nine Federal or Interstate agencies, ten State agencies, four universities, and two private organizations who have water-resource responsibilities. Committee activities include defining water-quality issues, sharing water-quality and other data, assisting in design of the study, and review of project plans, findings, interpretations, and reports. The liaison committee for the Kanawha–New River Basin study held its first meeting on April 12, 1994.

MAJOR WATER-QUALITY ISSUES

State and local agencies in the Kanawha–New River Basin recognize three important aspects of water-quality assessment. First is understanding the effects of water quality on human use of water resources, including effects from bioaccumulation of toxic substances through aquatic food webs. Second is the lack of basic scientific knowledge of the occurrence, distribution, fate, and biological effects of many contaminants. Third is measurement of the improvement in water quality expected to result from pollution-control regulations. NAWQA investigations will contribute new knowledge in each aspect of water-quality assessment. The study unit liaison committee identified the following major issues in the Kanawha–New River Basin:

- *Toxic contamination from organic compounds and trace elements.* West Virginia has warned citizens against

eating fish from some areas in the lower Kanawha River because of contaminants. Acidic water that contains large concentrations of dissolved metals drains from some coal-mining sites. Organic and inorganic chemicals have reached rivers and ground water through operating accidents, leakage from disposal sites, and permitted discharges from chemical processing and other industries along the Kanawha River, as well as along the New River in Virginia. Effects of pesticides and herbicides used in agricultural, forest, and other land management can extend beyond the intended targets.

- *Sanitation practices.* Elevated fecal bacteria counts are a concern throughout the study area, particularly in the New River Gorge National River during low flows and in the Kanawha River during summer storms. Floods or shallow ground water can release untreated sewage from septic systems in areas where rural home sites are close to streams.

- *Interactions of hydrology and water quality.* Understanding the flow of water is basic to understanding water quality. Contaminants in ground water flowing through cavernous limestone, for example, react differently than those moving slowly through granular sediments. Land disturbance during coal mining, forest harvesting, and road construction can increase sediment loads in streams. Underground coal-mining operations generally increase fracturing of overlying rock layers, permit increased recharge from precipitation, and can either increase or decrease base flow of nearby streams. Acidic precipitation affects poorly buffered small streams in high-elevation areas and in the Blue Ridge Province.

—James H. Eychaner, 1994

Information on technical reports and hydrologic data related to NAWQA can be obtained from:

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