WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM
The Kanawha–New River Basin

In 1991, the U. S. Geological Survey began a National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status of, and trends in, the quality of a large, representative part of the Nation's surface- and ground-water resources and to identify the major natural and human factors that affect the quality of these resources. In addressing these goals, the program will produce a wealth of water-quality information that will be useful to policy makers and managers at the National, State, and local levels.

The NAWQA program emphasis is on regional-scale water-quality problems. The program will not diminish the need for monitoring and smaller-scale studies already conducted by local, State, and Federal agencies to meet their individual needs. The NAWQA program, however, will provide a framework for conducting many other activities and an understanding about regional and national water-quality conditions that cannot be acquired from individual, small-scale programs.

Studies of 60 hydrologic systems that include parts of most major river basins and aquifer systems (study-unit investigations) are the building blocks of the national assessment. The 60 study units range in size from less than 1,000 mi^2 (square miles) to more than 60,000 mi^2 and represent 60 to 70 percent of the Nation's water use and population served by public water supplies. Twenty study-unit investigations were started in 1991, 20 are starting in 1994, and 20 more are planned to start in 1997. The Kanawha-New River basin was selected to begin assessment activities as a NAWQA study unit in 1994. The study team will work under the West Virginia District office of the U.S. Geological Survey in Charleston, West Virginia.

DESCRIPTION OF KANAWHA– NEW RIVER BASIN

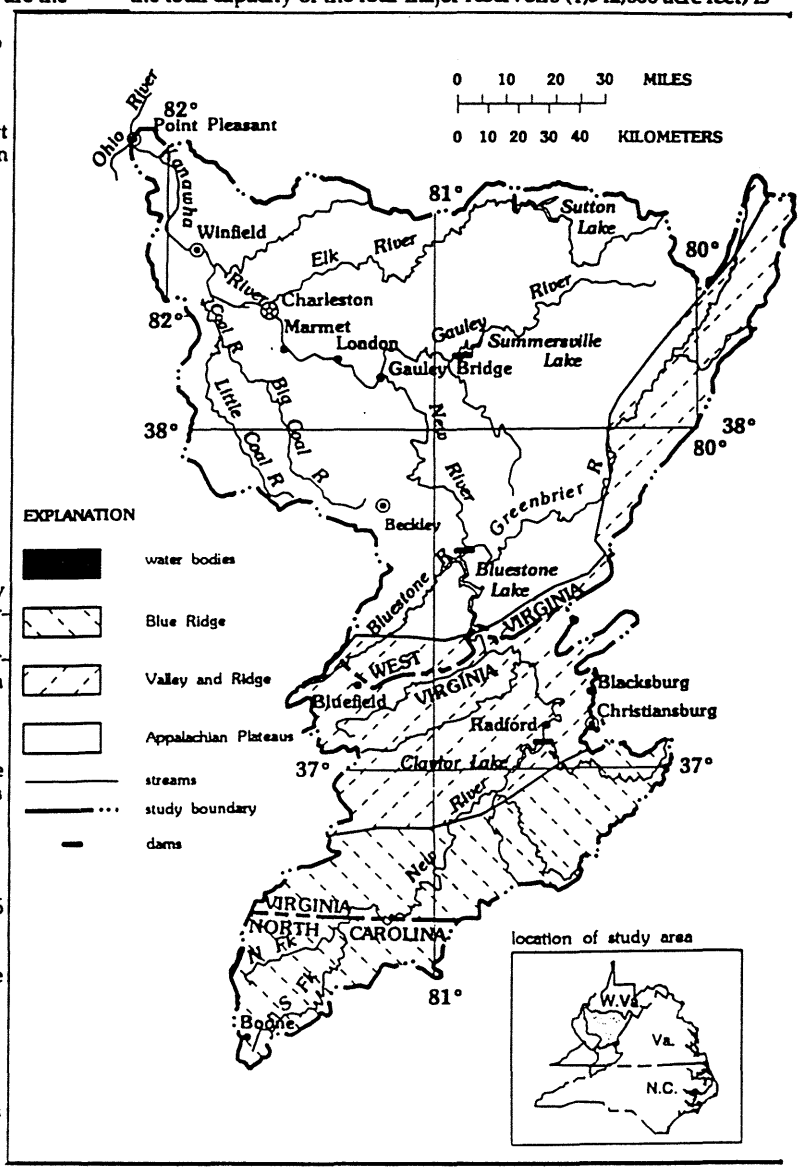
The Kanawha-New River basin encompasses 12,233 mi^2 and includes parts of West Virginia (8,424 mi^2), Virginia (3,044 mi^2), and North Carolina (765 mi^2). In 1990, approximately 870,000 people lived in the Kanawha-New River basin, including about 25 percent in the Charleston, W.Va., metropolitan area. Other communities with population greater than 10,000 include Beckley and Bluefield, W.Va.; Blacksburg, Radford, and Christiansburg, Va.; and Boone, N.C. Since 1940, population of the basin has fluctuated within 7 percent of the 1990 population. Major industries include chemical manufacturing, coal mining, forestry, agriculture, and outdoor recreation.

Three physiographic provinces are included in the Kanawha-New River basin: the Appalachian Plateaus, Valley and Ridge, and Blue Ridge. Steep slopes (greater than 20 percent) are characteristic throughout the basin, and flat areas are limited to valley bottoms and ridge tops. Flat areas generally are smaller in the Appalachian Plateaus province than in the other provinces except along the lower Kanawha River. Forests are the dominant land use. In 1970, 71 percent of the basin was forested, 23 percent was used for crops and pastures, and only 3 percent was urban or industrial. The climate is continental; minimum temperatures in mountainous areas in the northeastern part of the basin average about 20 °F (degrees Fahrenheit) during the winter, and maximum temperatures average about 85 °F during the summer at lower elevations in the western part. Average annual precipitation ranges from 36 in (inches) in the central part of the basin to 56 in near Boone, N.C., and 60 in at the headwaters of the Elk River.

The New River begins in North Carolina at the confluence of the North and South Forks, just south of the Virginia border. The New River flows generally north for 250 mi (miles) to Gauley Bridge, West Virginia, where it joins with the Gauley River to form the Kanawha River. The Kanawha River flows 97 mi northwest and discharges into the Ohio River at Point Pleasant, West Virginia. The Kanawha River is navigable by barges for 91 mi upstream from the Ohio; locks and dams at Winfield, Marmet, and London, W.Va., maintain a minimum depth of 9 ft (feet) in the barge channel. 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, which is managed by the National Park Service, includes most of the New River downstream from Bluestone Lake. Recreational fishing and boating is common throughout the study unit.

The average flow of the Kanawha River at Charleston, W.Va., was 9,700 Mgal/d (million gallons per day) for the period 1940-92. The maximum flow during that period was 140,000 Mgal/d on August 15, 1940; the minimum flow was less than 670 Mgal/d during October 1-5, 1953. The major tributaries of the Kanawha and New Rivers are the Greenbrier, Elk, Gauley, Coal, and Bluestone Rivers. The Kanawha River contributes 23 percent of the average flow of the Ohio River at Point Pleasant, W.Va., where it includes the same proportion of the total drainage area.

Streamflow in much of the basin is controlled by reservoirs, but the total capacity of the four major reservoirs (1,542,000 acre feet) is



only about 14 percent of the average annual flow at Charleston. The reservoirs are used for flood control, recreation, and hydropower; during periods of low flow, they are used to maintain navigation and water quality, principally dissolved oxygen. Hydroelectric power is generated at the three navigation dams on the Kanawha, at two large run-of-river plants on the New River, and at Claytor Lake.

Average annual runoff in most of the basin ranges from 15 to 30 in, of which 45 to 65 percent is ground-water discharge. The fraction of precipitation that ultimately becomes runoff ranges from 30 to 50 percent and is larger for the Appalachian Plateaus province and for areas of higher precipitation. For the entire basin, average annual runoff is 20.5 in, compared to average annual precipitation of 43.5 in. The difference of 23 in is an estimate of average annual evapotranspiration.

The Kanawha - New River basin is underlain by many different types of rocks. The rocks in the Appalachian Plateaus and Valley and Ridge provinces are sedimentary (sandstone, shale, limestone, and coal). The Blue Ridge province is underlain mostly by crystalline rocks. The bedrock in all three of these provinces is blanketed by a layer of weathered rock material, or regolith, which is typically less than 20 feet thick. Unconsolidated sediments that occur in river valleys are less than 70 feet thick along the Kanawha River and generally less than 30 feet thick elsewhere. Soils in areas of steep slope generally are shallow, weakly developed, and poorly drained and have low fertility and high erosion potential. Soils on gentler slopes in limestone areas of the Valley and Ridge province and over unconsolidated sediments are commonly deeper, better-developed, well-drained, and fertile.

Ground water is present primarily in fractures in the sedimentary and crystalline rocks of the basin, in the pore spaces of the overlying regolith mantle, and in unconsolidated sediments. 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 ground water is withdrawn from the Lower Pennsylvanian aquifers in the Appalachian Plateaus province 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 were used to generate hydroelectric power.

MAJOR WATER-QUALITY ISSUES

State and local agencies in the Kanawha - New River basin recognize two important aspects of water-quality assessment. First is understanding the effects of water quality on human use of water resources, including impacts from bioaccumulation of toxic substances through aquatic food webs. Second is measurement of the improvement in water quality expected to result from pollution-control regulations. Perceived water-quality problems have occurred historically and are still occurring in parts of the basin, but basic scientific knowledge of the occurrence, distribution, fate, and biological effects of many contaminants is lacking. NAWQA investigations in the Kanawha - New River study unit will contribute new knowledge in both aspects of water-quality assessment. The following high-priority regional-scale issues have been identified in coordination with the study unit liaison committee.

- *Toxic contamination from organic compounds and trace elements.* Organic and inorganic chemicals related to the extensive chemical processing industries along the Kanawha River have been released to the river and to ground water through operating accidents, leakage from disposal sites, and permitted discharges. Other industries along the Kanawha River and along the New River in Virginia also have released toxic materials. Major highway and rail corridors follow many rivers in the basin, so that toxic or hazardous materials released in transportation accidents can move quickly into flowing streams. Acidic water with large concentrations of dissolved metals drains from some coal-mining sites. In the lower Kanawha River, toxic contaminants have been detected in sediments and fish tissue, and the State of West Virginia has warned citizens against eating fish from affected areas. Effects of pesticides and herbicides used in agricultural, forest, and other land management can extend beyond the intended targets.
- *Land-disturbing activities.* Coal mining, forest harvesting, and road construction can contribute increased sediment loads to streams. Forest harvesting can increase nutrient runoff. Underground coal-mining operations generally increase fracturing of overlying rock layers and permit increased recharge from precipitation. Greater water movement through these rocks can increase solute concentrations as well as either increase or decrease baseflow of nearby streams. Surface mining, which generally disturbs naturally-fractured materials, has less direct effect on ground-water quality, but water that percolates through mine spoil piles generally is more mineralized than native ground water. Most coal in the basin has a low sulfur content; after mining, affected waters are generally not highly acidic.
- *Waste-disposal practices.* Landfills that receive solid and hazardous wastes and sewage sludge are possible sources of contaminants to both ground water and streams. Wastewater discharges from industries and mines may contain regulated contaminants. Elevated fecal bacteria counts are a concern through the New River Gorge National River during low flows and in the Kanawha River during summer storms. In areas where rural home sites are close to streams, floods or shallow ground water can release untreated sewage from septic systems. The navigation pools of the Kanawha River receive large amounts of treated municipal sewage and function somewhat like a series of lakes during typical low summer discharge; the sewage is a rich source of nutrients and metals as well as bacteria.
- *Other topics.* Acidic precipitation affects poorly buffered streams in high-elevation areas and in the Blue Ridge province. Salty water underlies fresh ground water at some depth in most of the Appalachian Plateaus province. Natural discharge of saline water to streams occurs locally in the northwestern part of the basin, and some old or deteriorated wells may allow deep brines to move up into zones of fresh ground water.

COMMUNICATION AND COORDINATION

Communication and coordination between the Geological Survey and water-management or other related scientific organizations are critical components of the NAWQA program. Study-unit liaison committees have proven highly effective in this process and consist of representatives who have water-resources responsibilities from Federal, State, and local agencies, universities, and the private sector. Specific activities of each liaison committee include—

- Exchange of information on and prioritization of water-quality issues of regional or local interest.
- Identification of sources of water-quality data and other information, such as land use, demographics, soils, land management practices, and pesticide use.
- Assisting in the design and scope of project elements.
- Review of project planning activities, findings, and interpretations, including reports.

The liaison committee for the Kanawha-New River basin study held its first meeting on April 12, 1994. The committee includes representatives from eight Federal or Interstate agencies; five State agencies from West Virginia, four from Virginia, and one from North Carolina; four universities; and two private organizations.

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

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