WATER RESOURCES DATA - VIRGINIA, 2002

VOLUME 1. SURFACE-WATER-DISCHARGE AND SURFACE-WATER-QUALITY RECORDS

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Virginia each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Virginia."

This report series includes records of stage, discharge, and water quality of streams and stage, contents, and water quality of lakes and reservoirs. This volume contains records for water discharge at 170 gaging stations; stage only at 3 gaging station; stage and contents at 10 lakes and reservoirs; and water quality at 18 gaging stations. Also included are data for 51 crest-stage partial-record stations. Locations of these sites are shown on figures 4 and 5. Miscellaneous hydrologic data were collected at 192 measuring sites and 8 water-quality sampling sites not involved in the systematic data-collection program. The data in this report represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia.

This series of annual reports for Virginia began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the l975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels. Beginning with the 1990 water year, the report format was changed to two volumes. Volume 1 contains surface-water-discharge and surface-water-quality data and Volume 2 contains ground-water-level and ground-water-quality data.

Prior to the introduction of this series and for several water years concurrent with it, water-resources data for Virginia were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Parts 6A and 6B." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from the U.S. Geological Survey, Branch of Information Services, Federal Center, Bldg. 41, Box 25286, Denver, Colorado 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report VA-01-1." For archiving and general distribution, the reports for l971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Office at the address given on the back of the title page or by telephone (804) 261-2600.

Water resources data, including those provided in water data reports, are available through the World Wide Web on the Internet. The Universal Resource Location (URL) to the Virginia District’s home page is:

http://va.water.usgs.gov

COOPERATION

The U.S. Geological Survey and agencies of the State of Virginia have had joint-funding agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through joint-funding agreements with the Survey are:

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY, Robert G. Burnley, Executive Director.

VIRGINIA DEPARTMENT OF TRANSPORTATION, Charles D. Nottingham, Commissioner.

CITY OF ALEXANDRIA, Vola Lawson, City Manager.

CITY OF DANVILLE, Barry Dunkley, Director, Water and Wastewater.

CITY OF NEWPORT NEWS, Brian Ramaley, Director, Department of Public Utilities.

CITY OF ROANOKE, Kit B. Kiser, Director, Utilities and Operations.

NORTHERN VIRGINIA REGIONAL COMMISSION, G. Mark Gibb, Executive Director.

WEST PIEDMONT PLANNING DISTRICT COMMISSION, Robert W. Dowd, Executive Director.

CITY OF NORFOLK, Regina V. K. Williams, City Manager.

HAMPTON ROADS PLANNING DISTRICT COMMISSION, Arthur L. Collins, Executive Director.

WASHINGTON COUNTY SERVICE AUTHORITY, David S. Dawson, General Manager.

Assistance with funds or services was given by the U.S. Army Corps of Engineers in collecting records for gaging stations and water-quality stations throughout the State.

Under a cooperative agreement covering the Tennessee River Basin, the Tennessee Valley Authority provided financial assistance for the operation of gaging stations, the records for which are published herein. Similar financial assistance for water-quality studies was provided by the U.S. Marine Corps Base, Quantico, VA, for the Quantico, Cannon, and Aquia Creek Basins. Other cooperators that provided funds for the collection of records are the American Electric Power, Virginia Power, City of Danville, City of Radford, City of Bedford, Multitrade of Pittsylvania County, LG & E, Synergics Incorporated, and Georgia Pacific Corporation.

Organizations that provided data are acknowledged in station descriptions.

RECORDS COLLECTED BY THE STATE OF VIRGINIA

In addition to data collected by the U.S. Geological Survey, there are included herein records for 67 gaging stations operated by the Virginia Department of Environmental Quality. These records are published as provided and are acknowledged in the "COOPERATION" paragraph of each individual station. The Virginia Department of Environmental Quality is under the direction of Robert G. Burnley, director. Published material for the gaging-station records is supplied through the Division of Water Resource Management, Larry G. Lawson, P.E., director.

SUMMARY OF HYDROLOGIC CONDITIONS

Surface-Water Discharge

Annual mean discharges for the 2002 water year were below the normal range of flow (below the 25th percentile of annual mean flows) throughout most of the State based on streamflow data at the farthest downstream gaged locations in the Shenandoah, Potomac, Rappahannock, York, James, Roanoke, Kanawha, and portions of the Tennessee River Basins. Annual mean discharges were in the normal range of flow (between the 25th and 75th percentile of annual mean flows) in the Big Sandy River Basin (southwestern portion of the State) based on streamflow data at the Pound River below Flannagan Dam, near Haysi, Va., stream-gaging station, and in one sub-basin of the Tennessee River Basin based on the Powell River near Jonesville, Va., stream-gaging station. Annual mean discharges were not above the normal range of flow (above the 75th percentile of annual mean flows) in any of the major river basins in the State based on stream-gaging stations. Figure 1 shows annual mean discharges with the long-term mean discharges at four selected stations throughout the State.

Statewide, streamflows (based on monthly mean streamflow statistics) were below the normal range of flow during the entire year. Only in the far southwestern portion of the State (Big Sandy and Tennessee River Basins) were streamflows in the normal range of flow. Figure 2 shows the distribution of monthly and annual mean discharges for four selected stations throughout the State.

During the summer of 2002, the entire State, except for the far southwestern area, experienced a severe hydrologic and water-supply drought. There have been five major statewide droughts since the early 1900's. During the drought of 1930-32, one of the most severe droughts recorded in the State, recurrence intervals ranged from 30 years to greater than 80 years. The droughts of 1938-42 and 1962-71 were less severe; however, the cumulative streamflow deficit was the largest ever recorded during the 1962-71 drought because of its duration. The drought of 1980-82 was the least severe and had the shortest duration, and recurrence intervals ranged from 15 years across most of the State to greater than 80 years in the James River Basin. No recurrence intervals have been assigned to the most recent drought of 1998-2002; however, drought conditions during the summer of 2002 were at least as severe as the 1962-71 drought and approached the severity of the 1930-32 drought.

Hydrologic drought conditions during 2002 resulted from precipitation patterns over the previous several years. The 2002 statewide drought began in the summer of 1997. Precipitation was well below normal during the summer and fall of 1997, allowing streamflow to decline to below the normal range. Precipitation was well above normal during the winter of 1998, increasing ground–water storage and streamflows to above the normal range. During the summer and fall of 1998, precipitation again was well below normal, causing a significant agricultural drought; however, streamflows never declined to below normal until late fall because of the unusually high ground-water storage. Ground-water storage was not replenished significantly during the winter of 1999, and new record minimums were recorded during the summer of that year. Hurricanes Dennis and Floyd brought significant precipitation during the fall of 1999, which boosted ground-water storage in the eastern half of the State. During the winters of 2000, 2001, and 2002, precipitation did not replenish the ground-water storage to the extent normally expected, and well levels continued to decline.

Since the winter of 1998, water-table ground-water levels have declined steadily throughout the State. Below-normal precipitation during the winter months has allowed only minimal recharge to the ground-water system. Precipitation during the summer months is seldom recharged to the ground-water system because most of the moisture remains in the soil and is taken up by evaporation and transpiration. Streamflows in the summer normally are maintained by ground-water storage (highest in early spring) and then decline as ground-water levels decline to their lowest levels in the fall. Streamflows were near normal during the summers of 2000 and 2001 because of runoff from storm events crossing the State every seven to ten days. This pattern of storms, however, was unusual for Virginia where summer precipitation is usually from thunderstorms and precipitation amounts are highly variable across the State. Precipitation patterns returned to normal during the summer of 2002. Because of the shift in precipitation pattern and below-normal precipitation amounts, streamflows declined rapidly to rates that could be supported by depressed ground-water levels.

Record minimum flows for the period of record were observed at stream gages in the Shenandoah, Rappahannock, York, James, Chowan, and Roanoke River Basins. While most basins in the State had low streamflows because of the lack of precipitation and low ground-water storage, smaller tributary basins in central and eastern Virginia were indicating the worst conditions statistically.

Some of the record minimum flows may be due to natural conditions; however, withdrawals for water supply and irrigation probably significantly impacted the streamflows. The town of Orange, Va., initiated strict rationing and conservation measures to maintain water supply. The town's only water supply is from the Rapidan River. The Rapidan River near Ruckersville, Va., stream gage had a minimum daily-mean flow rate of 0.45 cubic feet per second (previous minimum daily-mean flow rate was 0.90 cubic feet per second, set in 1966). The town of Farmville, Va., also had water supply problems. The town's intake is upstream of the Appomattox River at Farmville, Va., stream gage, which had a minimum daily-mean flow rate of 0.07 cubic feet per second (previous minimum daily-mean flow rate was 6.3 cubic feet per second, set in 1941). Agricultural irrigation may the reason for the record low flows in the Meherrin River. The Meherrin River near Lawrenceville, Va., stream gage had an minimum daily-mean flow rate of 2.2 cubic feet per second (previous minimum daily-mean flow rate was 4.2 cubic feet per second, set in 1954). Table 1 lists the new annual minimum instantaneous discharges recorded at 42 stream-gaging stations in the State.

Flow at stream-gaging stations on rivers that have augmented flow (releases from dams) was low, but would have been much lower without the augmentation. Two rivers in this category are the Pamunkey and James Rivers. The Pamunkey River near Hanover, Va., stream gage had a minimum daily-mean flow rate of 24 cubic feet per second (previous minimum daily-mean flow rate was 47 cubic feet per second, set in 1991). Flows in the Pamunkey River are augmented by releases of 20 to 40 cubic feet per second from Lake Anna. The James River at Cartersville, Va., stream gage had a minimum daily-mean flow rate of 447 cubic feet per second (previous minimum daily-mean flow rate was 330 cubic feet per second, set in 1966). Flows in the James River were augmented by releases of 265 cubic feet per second during the summer from Lake Moomaw.

Table 1: Minimum, period of record, instantaneous discharges recorded during 2002 water year

Gaging Station	Minimum instantaneous discharge, in cubic feet per second	Length of record, in years
Muddy Run near Mt Clinton, Va.	0.27	9
Cameron Run at Alexandria, Va.	1.0	47
Hazel River at Rixeyville, Va.	0.70	51
Rapidan River near Ruckersville, Va.	0.21	58
Rapidan River near Culpeper, Va.	1.2	73
North Anna River at Hart Corner near Doswell, Va.	25	24
Little River near Doswell, Va.	0.04	42
Totopotomoy Creek near Studley, Va.	0.00	25
Po River near Spotsylvania, Va.	0.00	41
Mattaponi River near Beulahville, Va.	0.22	60
Jackson River near Bacova, Va.	12	28
Johns Creek at New Castle, Va.	5.1	77
Catawba Creek near Catawba, Va.	0.24	60
Piney River at Piney River, Va.	0.29	54
Rockfish River near Greenfield, Va.	0.07	60
Hardware River below Briery Run, near Scottsville, Va.	0.00	65
Mechums River near White Hall, Va.	0.00	34
North Fork Rivanna River near Earlysville, Va.	0.25	10
Fine Creek at Fine Creek Mills, Va.	0.00	59
Holiday Creek near Andersonville, Va.	0.02	37
Buffalo Creek near Hampden Sydney, Va.	0.09	57
Appomattox River at Farmville, Va.	0.07	77
Appomattox River at Mattoax, Va.	2.4	83
Deep Creek near Mannboro, Va.	0.00	54
Appomattox River at Matoaca, Va.	a17	34
Chickahominy River near Providence Forge, Va.	0.04	61
Nottoway River near Stony Creek, Va.	1.3	74
Meherrin River near Lawrenceville, Va.	2.0	74
Meherrin River at Emporia, Va.	a3.2	52
South Fork Roanoke River at Shawsville, Va.	6.3	43
Roanoke River at Glenvar, Va.	15	12
Back Creek near Dundee, Va.	0.24	29
Blackwater River near Rocky Mount, Va.	3.2	26
Pigg River near Sandy Level, Va.	17	40
Big Otter River near Evington, Va.	0.63	67
Falling River near Naruna, Va.	b1.0	69
Cub Creek at Phenix, Va.	0.00	52
South Mayo River near Nettleridge, Va.	8.3	40
North Mayo River near Spencer, Va.	5.6	74
Smith River at Smith River Church near Woolwine, Va.	2.7	8
Dan River at STP near Danville, Va.	a83	7
Dan River at Paces, Va.	a129	52

a Result of regulation.
b Estimated daily discharge, minimum instantaneous discharge not determined.

Despite the drought conditions observed throughout the State, flood events took place in the southwestern portion of the State in October, March, and May. During all three events, local flooding affected portions of the Tennessee, Kanawha, and Big Sandy River Basins in Tazwell and Buchanan Counties. Major floods were not recorded at USGS stream gages except for at the North Fork Holston River near Saltville, Va., where the March flood had a recurrence interval of 100 years. Table 2 lists the only new annual maximum instantaneous discharge recorded at stream-gaging stations in the State.

Table 2: Maximum, period of record, instantaneous peak discharges recorded during 2002 water year

Gaging Station	Maximum instantaneous discharge, in cubic feet per second	Recurrence interval, in years	Length of record, in years
North Fork Holston River near Saltville, Va.	18,900	100	85

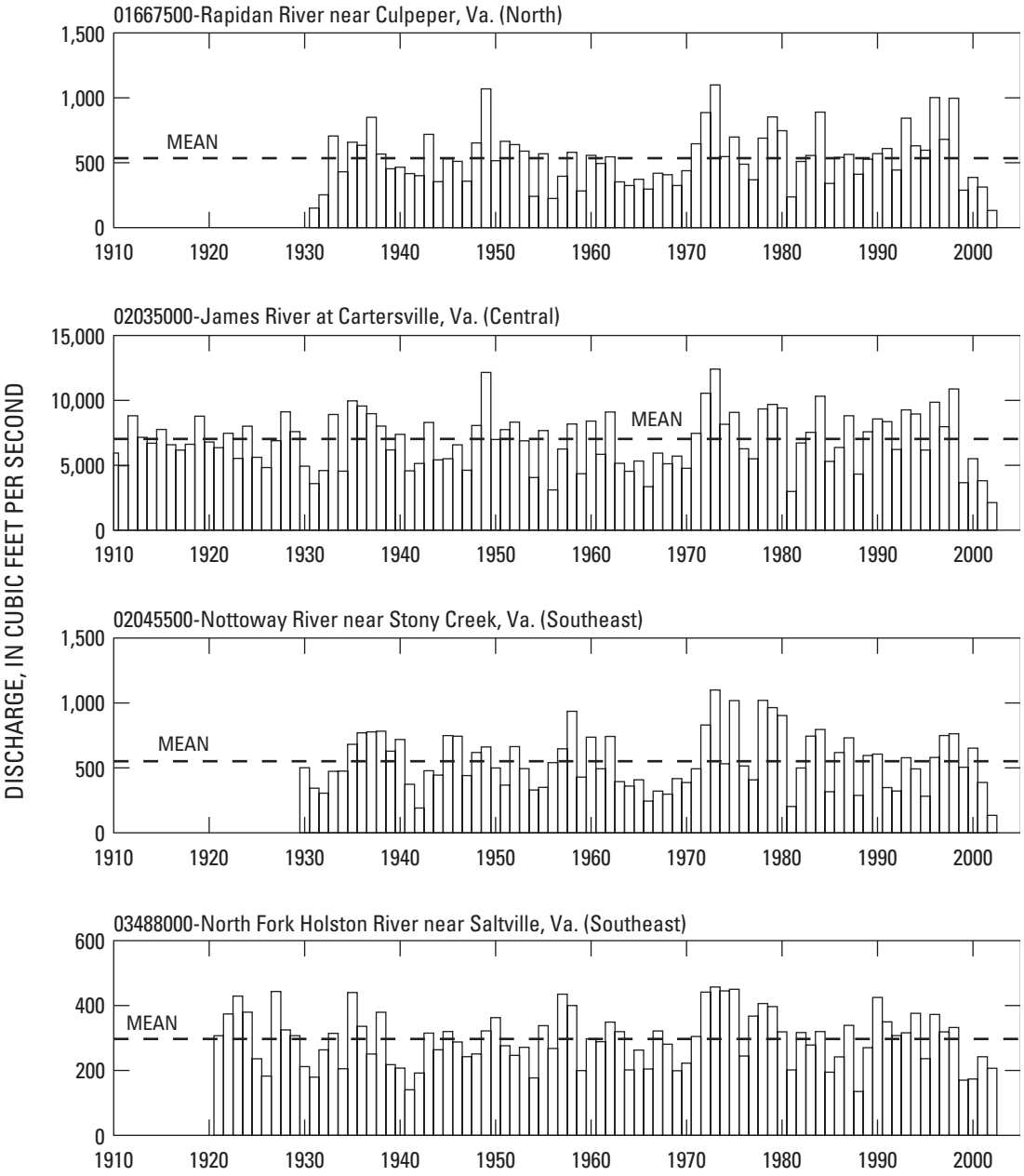

Figure1. Annual mean discharge at four selected stream-gaging stations

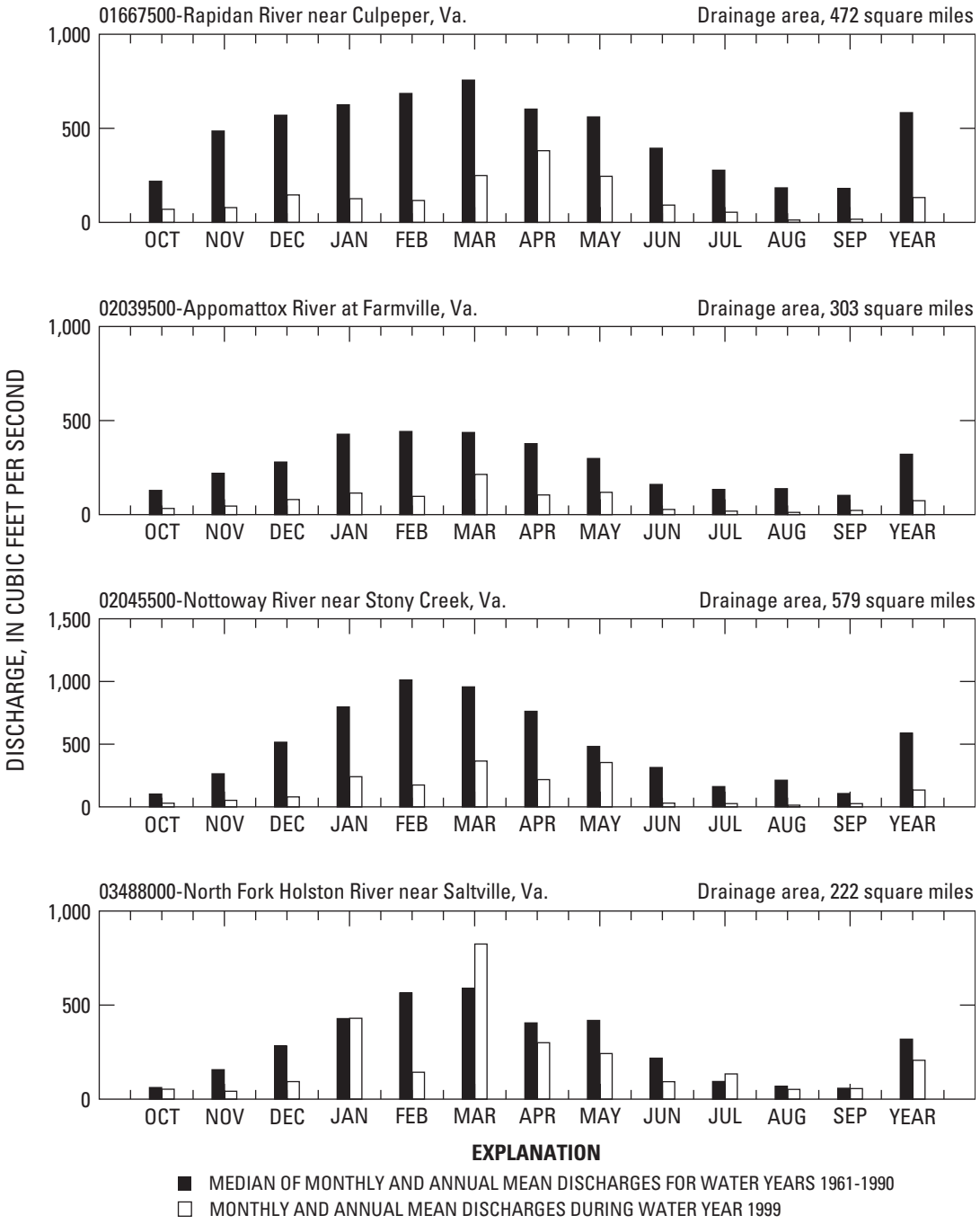

Figure 2. Monthly and annual mean discharges during 2002 water year and median of monthly and annual mean discharges for 1971-2000 water years at four representative stream-gaging stations